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Abstract

This paper analyses inflation dynamics in the Central African Economic and Monetary Community (CEMAC) using a constructed dataset for country-specific commodity price indices and panel cointegrated vector autoregressive (VAR) models. Imported commodity price shocks are significant in explaining inflation in the region. Governments are another driving force of inflation dynamics mainly through controlled prices and the role of capital expenditure in domestic activity. In most CEMAC countries, the largest effect of global food and fuel prices occurs after four or five quarters in noncore inflation and then decays substantially over time. Second-round effects are significant only in Cameroon and to a lesser extent in the Republic of Congo.

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Contents

I. INTRODUCTION

The current spike in commodity prices, owing to a combination of external and idiosyncratic shocks, has led to high inflation in the developing world. The upside pressure on, especially, food prices is likely to have a significant adverse impact on the purchasing power of the poor and on macroeconomic stability in those countries.[2] This is particularly relevant for low-income countries (LICs) where food price inflation is not only more volatile and on average higher than nonfood inflation but also, in many cases, more persistent than nonfood inflation (Walsh, 2011).

Inflation pressures have also started to rise in some of the Central African Economic and Monetary Community (CEMAC) countries. This is due to their economic structure, in which oil is the largest export sector and a big share of consumed food is imported. In particular, certain members (the Republic of Congo, Cameroon) have registered a flare up in noncore inflation (food, energy), even though it remains low for the region as a whole (Figure 1). It is important, therefore, for countries' policymakers to understand, first, what are the main drivers of inflation across the region; and second, how their policies could affect macroeconomic stability in a currency union.

This paper, therefore, investigates inflation dynamics in four CEMAC members (Cameroon, the Central African Republic, Gabon, the Republic of Congo) and in the CEMAC-4 region as a whole.[3] It aims to analyze overall inflation, and to disentangle the dynamics and interactions between the core (all items in the basket excluding food and energy) and noncore components of inflation in the region.

Our analysis is based on an innovative dataset including country-specific energy and food commodity indices. First, we estimate a cointegrated vector autoregressive (VAR) model investigating the effect of energy prices (in particular, global crude oil prices) and food prices on the noncore component of inflation.[4] Second, we estimate the pass-through from noncore inflation into core inflation (overall CPI excluding its food and energy components) and the impact of domestic activity on the latter for each country and the region as a whole. The robustness of the results is checked via panel cointegration tests following Pedroni (1999, 2001, 2004).

Empirical research in inflation dynamics in the CEMAC region is limited, although recent studies provide some useful insights for the region. Analyzing the determinants of inflation in the CEMAC as a whole, Portillo (2009) finds that fiscal shocks have been an important source of inflation volatility in the region. Coleman (2010) focuses on inflation persistence in the Franc zone and provides robust evidence of some asymmetry in inflation dynamics across the countries. He also finds that inflation is persistent in Chad. Kinda (2010) provides empirical evidence that supply constraints, public spending, and external factors (such as rain patterns) drive inflation in Chad.

Fernandez, Gerling and Valdovinos (2011) focus on inflation in the West African Economic and Monetary Union (WAEMU). They highlight the importance of keeping inflation low to reduce

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[2] Easterly and Fisher (2000) have provided some empirical evidence on the negative effect of inflation on the well-being of the poor.

[3] Equatorial Guinea and Chad are excluded from our analysis because data on components of price indices are unavailable.

[4] See Johansen and Juselius (1990, 1992) for details.

inflation uncertainty and relative price variability, which could lead to resource misallocation in the context of a currency union. Baldini and Poplawski-Ribeiro (2011), in turn, analyze the fiscal and monetary determinants of inflation for a sample of Sub-Saharan African (SSA) countries. These authors find that countries within the CFA franc arrangement (including CEMAC countries) were more successful in achieving price stability and single-digit inflation in 1980–2005.[5]

Overall, our analysis suggests that inflation in the region is driven mainly by global commodity prices and government policies. Government is an important driving force of inflation dynamics in the CEMAC countries mainly through two channels: (i) controlled prices, which hinder the pass-through from international market prices into domestic prices; (ii) and the predominant role of government expenditure in driving domestic activity, which seems to affect prices in some members in a significant manner. In addition, our tests suggest that the monetary policy conducted by the central bank of the currency union is weak in explaining inflation dynamics both for individual countries and for the region as a whole.[6]

This paper is organized as follows: Section II introduces some background information on CEMAC. The dataset used and the estimation methodology are presented in the Section III. In turn, Section IV focuses on the estimation results. Finally, Section V assesses the main findings and discusses their policy implications, and Section VI concludes the paper.

II. BACKGROUND

A. The Economic and Monetary Community of Central Africa

The Economic and Monetary Community of Central Africa (CEMAC) was established in 1994 by Cameroon (CMR), the Central African Republic (CAR), Chad (TCD), the Republic of Congo (COG), Equatorial Guinea (EQG), and Gabon (GAB) to promote economic integration among members of the currency union.[7]

CEMAC countries are very heterogeneous in terms of size, economic structure, and price controls (see Table 1a, Table 1b and the Appendix). Cameroon dominates the CEMAC region accounting for almost 50 percent of the population and 31.5 percent of its GDP. Equatorial Guinea is the smallest, but also the richest, member of the currency union owing to its large reserves of oil and natural gas. The sectoral composition of CEMAC's economy is rather skewed, and the micro structure of the food basket varies among countries (with the poorest having usually the largest

[5] Cameroon, in particular, followed a monetary policy characterized by monetary dominance, instead of fiscal dominance, in this period. This helped the country to maintain lower inflation rates than other SSA countries.

[6] Money supply is not found to have statistically significant effects on consumer price inflation (and its main subcomponents) in the CEMAC countries. This variable is thus excluded from the models and results presented hereafter.

[7] In June 1959, the "Union Douanière Équatoriale" (UDE, Equatorial Customs Union) was created by the Central African Republic, the Congo, Gabon, and Chad. Cameroon joined the UDE in 1961. On December 8, 1964, the five countries created in Brazzaville (Congo) the "Union Douanière et Économique de l'Afrique Centrale" (UDEAC, Customs and Economic Union of Central Africa); Equatorial Guinea joined in 1983. On March 16, 1994, in N'Djamena (Chad), the UDEAC was transformed into the (CEMAC).

share of the food). For example, the Congo and Equatorial Guinea are highly reliant on oil exports whereas Cameroon and Gabon have a more diversified economic base. The Central African Republic is the poorest member, and also the only oil importer of the region. The widespread poverty that characterizes the region also is striking, amid the high income per capita in some of the member countries (e.g., the Republic of Congo, Equatorial Guinea). This combination of unfavorable economic structure and high levels of poverty make those countries particularly vulnerable to the recent surge in commodity prices.

B. The Central Bank

The monetary policy in the CEMAC region is conducted by the supranational central bank for CEMAC, the *Banque des Etats d'Afrique Centrale* (BEAC). The BEAC operates in close cooperation with the French Treasury as part of the CFA franc zone arrangement.[8] Main objectives of BEAC's monetary policy are to maintain price stability and an appropriate level of foreign reserves in the pooled foreign exchange reserves of the members. The French Treasury holds 50 percent of CEMAC countries' foreign reserves and guarantees the convertibility of the CFAF into euros at a fixed exchange rate.[9]

As a supranational institution, the BEAC could be considered more independent and able to limit the net credit to government compared with the situation where each CEMAC country would have pursued an independent monetary policy (see also Baldini and Poplawski-Ribeiro, 2011). Moreover, to facilitate the conduct of the monetary policy and to achieve price stability, two monetary policy rules are incorporated in its statues: (i) the BEAC limits the stock of total advances to governments to 20 percent of the previous year's fiscal revenues; (ii) the BEAC is designed to keep gross foreign reserves for each central bank above 20 percent of sight liabilities. In addition to those rules, the BEAC has made use of quantitative limits on credit to governments and private sector to limit monetization of their deficits.

Besides monetary rules, the governments of member countries tend to contain inflation through controlling prices of a wide range of products, including food and energy items (see Table 1b). Given the significant macroeconomic differences among members and weaknesses on the monetary transmission mechanism (Mishra, Montiel, and Spilimbergo, 2010), conducting a single monetary policy suitable for each country's (macroeconomic) dynamics is challenging for the BEAC.

III. Data and Estimation Methodology

A. Construction of the Dataset

Data on inflation is calculated from the CEMAC countries' monthly domestic consumer price indices taken from the IMF's International Financial Statistics from 1996 to 2010. To construct the core and noncore price indices, we use countries' monthly data and weights for different subcomponents of a cross-country comparable consumer price index (CPI), provided by the

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[8] Article 1 of the BEAC statutes (1973) and Article 21 of the Treaty on Central African Monetary Union (1994) at www.beac.int.

[9] After a 50 percent devaluation in 1994, the CFAF is currently pegged against the euro at 655.96 CFAF per euro.

authorities. Food items dominate the basket in all CEMAC countries with weights ranging from 21.7 percent in Cameroon to 70.1 percent in the Central African Republic, whereas the energy subcomponent accounts for about 4 percent in all countries.

With that information, a quarterly dataset is constructed from 1996 to 2010 with a minimum of 55 observations per country in our sample. For the CEMAC region as a whole, we aggregate the data for each country by using the country's correspondent share of personal consumption expenditure (PCE) in the total value of the CEMAC's PCE for each year.

Moreover, in our first econometric model, three innovative import price-based indices are constructed for energy, food, and metals. For that, we retrieve data on total imports in US dollars by product label for each country in the sample between 2005 and 2009. This data is obtained from the dataset *Trade Map* from the International Trade Centre.[10] The data is aggregated and the share of each product in the total value of imports computed for each year in the available sample (2005–2009). These shares for each product are then averaged through that sample period.

The second step in the construction of the import price indices is the selection of the imported products relevant for each of the three categories in analysis (energy, food, metals). Each imported item is then classified as belonging to one of those three categories or excluded from the sample. After this classification, each of the items remaining in one of the categories is rebased, reflecting its relative importance in the respective category.

Figure 2 shows the three quarterly import price indices between 1996:1 and 2010:4. These indices are finally calculated by multiplying the relative average weights of each item within a category by the price index of a particular commodity or basket of commodities that best characterizes the price of the imported product. The commodity (or basket of commodities) price indices are obtained from the IMF World Economic Outlook (WEO) database (IMF, 2011a) on a quarterly basis from 1996 to 2010. These average weights are used for 1996:1–2004:4. Then for each quarter between 2005 and 2009, we use the weight relative to the imports in the corresponding year. For 2010, we use the imported product weights of 2009.

In Figure 2 the prices of the three categories have a close, but not exactly the same, pattern. All of them show a peak in 2008, evincing the commodity price boom in the period just before the financial crisis. Yet, variation among these indices within and between countries is also observed. For example, the peak of imported food prices in 2008 was higher in Cameroon and the Central African Republic than in Gabon and the Congo. Moreover, the index level of imported metals in the most recent period after 2008 is lower than in the other countries.

Our second econometric model, in turn, uses real GDP as a measure of output gap or aggregated demand. For most of the countries in the region, real GDP data is only available on an annual basis. Therefore, the quarterly series used in this paper are obtained by interpolating the annual series. Adjustments are made to ensure that—in each year—the sum of the quarterly GDP matches the annual figure.[11] This is done in order to increase the overall number of observations usable in our

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[10] That data is available at www.trademap.org

[11] First, the annual GDP figure divided by 4 is allocated to the second quarter of each year, and the other three quarters are then linearly interpolated; yielding a first quarterly series. Hence, the same method is repeated, but this time allocating the annual GDP figure divided by 4 to the third quarter of each year; providing a second quarterly series. The

(continued…)

empirical analysis, because all other variables are available at a quarterly frequency. By construction, these quarterly GDP series do not present any seasonality. For CEMAC as a whole, the real GDP series are obtained by adding the series for the individual countries (using a common base year).

We also perform tests using M2 in our second model. For CEMAC as a whole, the M2 series is simply obtained by aggregating the individual country series. As mentioned earlier, this variable is not found to have statistically significant effects on the main components of inflation in the CEMAC countries. Money multipliers have remained broadly stable over the last decade in the region, which may explain the weak statistical relationship between the money and inflation cycles.

B. Methodology and Estimation Model

Two dynamic models are estimated to analyze the pass-through dynamics of inflation in CEMAC. For this purpose, we use the cointegrated vector autoregressive (VAR) methodology (see Johansen and Juselius, 1990, 1992) to estimate the short and long-term relationships between the main component of inflation in CEMAC and their main drivers, namely global commodity prices and economic activity.[12] Supply shocks or disruptions—for instance, the closure of a major rail link—are also likely to play an important role in explaining the behavior of consumer prices in CEMAC. However, these are difficult to quantify analytically given the relatively limited data available in these areas.

First, we assess the effect global food and energy commodity prices on the noncore component of inflation. This model determines the existence of a (long-run) cointegration relationship between the noncore CPI index and the constructed price indices for food (FCI) and energy (ECI) commodity imports for each country in our sample.

The regression model can be described as follows:

$$\Delta X_t = \Pi X_{t-1} + \sum_{j}^{k} \Gamma_j \Delta X_{t-j} + \mu + \varepsilon_t \tag{1}$$

where X_t represents a $(p \times 1)$ vector containing the variables of interest for a particular country or for the CEMAC region as a whole, namely (i) the log of the noncore CPI index, (ii) the log of the energy commodity price index, and (iii) the log of the food commodity price index;[13] μ is a $(p \times 1)$

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final quarterly GDP series used in this study is then obtained as a weighted average of the previous two quarterly series. The weights (whose sum equals one) are determined so that these minimize the distance between the annual GDP figures and the sum of the four quarters (for each year), so that the quarterly data matches the annual data. This interpolation allows us to preserve important information embedded in higher frequency data (see also Caceres, 2008; and Caceres, Guzzo, and Segoviano, 2010).

[12] Exchange rate movements have important consequences in the dynamics of consumer price inflation. Most of this effect is through import prices. In this analysis, we consider the euro-denominated indices of commodity prices. The observed variations in the latter embed variations in both the exchange rate and US dollar denominated commodity prices.

[13] In this particular case $p = 3$.

vector of deterministic terms (e.g., constant, linear trend, seasonal dummies, etc);[14] Π and the Γ_j is a $(p \times p)$ matrix of coefficients; and ε_t is a $(p \times 1)$ vector of random shocks with mean zero and variance Ω. Δ denotes the lag operator, such that $\Delta X_t = X_t - X_{t-1}$. Again, this model is estimated for each of the CEMAC countries, and then for the aggregated series for CEMAC as a whole (CEMAC-4).

When the matrix Π is of reduced rank r $(r < p)$, it can be written as $\Pi = \alpha\beta'$, where α and β are two matrices of dimension $(p \times r)$. If the series in X_t are $I(1)$,[15] then the $(r \times 1)$ vector $\beta' X_t$ is $I(0)$. In other words, there exist r "cointegrating relationships" between (some of) the variables in X_t. Therefore, $\beta' X_t$ represent linear combinations of these variables, which are themselves stationary. The matrices α and β can be estimated using maximum likelihood estimation (Johansen, 1996).

We impose and statistically test the validity of some restrictions on the matrices α and β. In particular, we are interested in determining whether some of these variables are (weakly) exogenous. Indeed, in our first model the indices of food and energy commodity prices appear to be exogenous. This confirms our expectations that global food and energy prices are likely to have an impact on the inflation dynamics in CEMAC, while developments in the countries of that region are not likely to have a significant impact on global developments. A similar model including an index of metal-based commodity prices is also considered, but the latter is not found to have any (statistically) significant impact on CEMAC's consumer prices. It is, therefore, omitted from the final model.

The analysis above is also repeated in a panel-VAR setting. That is, instead of looking at the different countries individually and independently, we mesh their time series together in a panel. In this setting, the vector X_t in equation (1) is replaced by the vector $X_{i,t}$, where the subscript *i* denotes a given country in CEMAC-4. This enables us to make use of the variation in the data across time and also across countries.[16] A panel cointegration residual-based test is performed under the null hypothesis of no cointegration using the CEMAC-4 sample. This test as well as its long-run coefficient estimations allow for dynamic panels in which both the short-run dynamics and the long-run slope coefficients are heterogeneous across the countries forming the panel. The tests also account for country heterogeneous fixed effects, and use both pooled within dimension as well as group mean between dimensions tests. As a robustness check, these results are compared to those obtained using the standard cointegrated VAR models described earlier.

[14] Specific time dummies are included in the model when the residual for that particular period is found to exceed three standard deviations (in the distribution of the residuals).

[15] $I(1)$ denotes 'integrated of order 1,' that is, the underlying series include a unit root. The first difference of a $I(1)$ process is stationary and is denoted $I(0)$.

[16] See Pedroni (1999, 2001, 2004) for more details on dynamic panel cointegration methods.

Our second empirical test analyzes the pass-through from noncore into core inflation, while at the same time, controlling for domestic demand. This test checks for the existence of a cointegration relationship between the core CPI index and the noncore CPI index (food, energy).[17] Real GDP is included as a proxy for economic activity, to test for inflationary pressures arising from spare capacity in the economy and those stemming from the noncore components of inflation—the so called "second-round" effects. Further, we test the exogeneity of noncore inflation in this model, because one would expect the latter to have an effect on core inflation, but not the other way around.

The regression model is written as follows:

$$\Delta Y_t = \Pi Y_{t-1} + \sum_j^k \Gamma_j \Delta Y_{t-j} + \mu + \varepsilon_t \qquad (2)$$

where Y_t represents a $(p \times 1)$ vector containing the variables, for an individual country or for the CEMAC-4 region as a whole, namely (i) the log of the noncore CPI index, (ii) the log of the core CPI index, and (iii) the log of the real GDP series.[18] All other variables are defined as in Model (1).

Once again, one of our main interests is to determine the existence of cointegrating relationships between these series. Furthermore, this model enables us to disentangle the short- and long-run dynamics between the different variables of interest. For this purpose, the matrices (and restrictions imposed on these matrices) are estimated and tested following the standard cointegrated VAR methodology presented in Johansen and Juselius (1990, 1992).[19]

The analysis is also repeated in a panel setting, where the vector Y_t in equation (2) is replaced by $Y_{i,t}$ and where the subscript *i* denotes each of the countries in CEMAC-4. Moreover, robustness checks for the Model (2) estimation are once again performed using Pedroni's (1999, 2001, 2004) dynamic panel cointegration techniques.

IV. Empirical Results

As mentioned in the estimation methodology, we test two cointegrating VAR models in this paper. The first tests whether the noncore CPI index cointegrates (i.e., whether there exists a stationary

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[17] In some countries, separate indices for the energy component in the CPI basket were not available. In such cases, we constructed the core CPI index as the weighted average of the "food" and "transport" components.

[18] In this particular case, again $p = 3$. As mentioned earlier, a similar model is also estimated including a measure of money supply in the CEMAC countries; in that case, p is equal to 4.

[19] Fiscal policy also tends to play an important role in driving the economic cycle in the CEMAC region (see, for example, Lledó and Poplawski-Ribeiro, 2011; Lledó, Yackovlev, and Gadenne, 2011; and Mpatswe, Tapsoba, and York, 2011). Yet, the effect of fiscal policy on inflation is captured here only implicitly through the effect of real output on the main components of inflation. For a more detailed analysis of the effects of fiscal policy on inflation in the CEMAC region, see Portillo (2009); and in the SSA region, see Baldini and Poplawski-Ribeiro (2011).

linear combination of these variables) with the constructed price indicies for food (FCI) and energy (ECI) imports for each country in the sample.

The second model analyzes whether the core CPI index cointegrates with the noncore CPI index (noncore) and real output (RGDP). This model assesses the existence of a relationship and quantifies the second-round effects from noncore inflation onto the core component of inflation. At the same time, it controls for the effect of economic activity on domestic inflation. Having explained our empirical strategy in the previous section, we present empirical results provided by our two models.

A. The Effects of Global Food and Energy Prices on Noncore Inflation

The empirical results of Model (1) convey that noncore inflation "weakly" cointegrates with food and energy prices in the CEMAC-4 region.[20] Table 2 displays the eigenvalues of Johansen's cointegration rank (trace) test. It shows (see also Figure 3) that there exists a significant long-run relationship beyond the short-run dynamics among those variables. Yet, the analysis country by country yields mixed results. A significant cointegration relationship between noncore CPI and the indices of food and energy commodity prices is only found to be statistically significant in the case of Cameroon and Gabon,[21] which might reflect the relatively higher share of imported food products compared to the other CEMAC members.

For the CEMAC region as a whole the test rejects the null of no cointegration for both analyses, aggregating the data and pooling it. This suggests that global food and energy prices affect noncore inflation in the CEMAC-4 region. Besides, we also test cointegration for the region using Pedroni's panel cointegration tests. As in the previous test, the results are mixed. However, we find that in the Augmented Dickey-Fuller (ADF) test the null of no cointegration is rejected for both pooled and group-mean estimations. Because this is one of the most powerful panel cointegration tests performed, this indicates robustness in the finding of a significant impact of global food and energy prices on the food and noncore inflation of the CEMAC-4 region.

Next, the estimates of the cointegration equation containing the long-run component and the estimation of the short-term dynamics of Model (1) are shown in Table 3. For the cointegration equation, a minus in front of a coefficient means a positive relationship between the variable to which the coefficient applies and the variable on which the vector is normalized. Thus, the estimates suggest that for every 1 percent increase in the energy price inflation (ECI), the noncore inflation will significantly increase by 0.2 percent in CMR and CAR. These findings were expected given the economic structure of the CAR—the only oil importer in the region—and Cameroon—the lowest oil producer as a share of GDP among the oil exporters in the region.

In Gabon, the effects of both ECI and FCI are significant on noncore inflation in the long run. The effect of FCI is also weakly significant (at 10 percent level) and high in value for the Republic of Congo. In this country an increase in 1 percent of FCI increases the noncore inflation by 1.03 percent. This result points to the impact of infrastructure bottlenecks, which directly affect price

[20] Unit root and panel unit root tests (available upon request) show that all variables used in Model (1) are nonstationary in (log) levels for all countries and the CEMAC region, reinforcing the use of cointegration techniques in the analysis.

[21] The null hypothesis of no cointegration relationship is rejected at the 5 percent level for these two countries.

dynamics in the region. There, the increase of imported food prices is amplified by the lack of infrastructure linking the main port of the country to its capital.

The robustness tests using Pedroni's (1999, 2001, 2004) panel cointegration estimations suggest somewhat different results. Using FMOLS and DOLS estimations, Table 4 shows that the pass-through of energy imported prices is more significant than the effect of FCI. Different from Table 3, Table 4 displays only the coefficients of the long-run cointegration relationship. Moreover, positive values in that table now mean positive relationships between the variables to which the coefficients apply and the noncore inflation.

Hence, that table shows that practically all coefficients of ECI for the individual countries are highly significant and positive. Again, this means that variations in international energy prices are reflected on domestic prices in the long run. For the FCI, instead, most of the coefficients are not significant. This low pass-through of price variation in global food prices to domestic noncore inflation in the long run might be explained by (i) controlled prices and (ii) structural bottlenecks. Moreover, differences in the weight of the food in the CPI basked might explain the heterogeneity across countries.

When the data for the CEMAC-4 region is aggregated in Table 3, the only weakly significant coefficient is the one for FCI ("Aggregate" column). Indeed, a 1 percent increase in the FCI rate leads to an increase in the noncore inflation of 0.16 percent. Yet, for the pooled-OLS estimation in Table 3 ("Pooled OLS" column), no variable in the cointegration relationship is significant. In turn, the robustness check using Group-FMOLS and Group-DOLS in Table 4 points again to a highly significant pass-through of ECI to noncore inflation for the CEMAC-4 region as a whole. The effects are also similar to the ones in Cameroon, which is the largest economy (and thus carries the largest weight) in the CEMAC-4 region.

Table 3 shows, further, the error-correction coefficient of Model (1). Looking at the different columns, that coefficient indicates for most of the countries (except the Congo) a noncore inflation reaction to deviations of its long-run relationship given by Model (1) of around 16 percent (0.16). Hence, only 16 percent of the deviation in noncore inflation is corrected in the first quarter after the deviation occurs.

Shock responses of Model (1) for the CEMAC-4 region as a whole are displayed in Figure 3. The first plot in the figure shows the sum of short- and long-run effects in the year-on-year noncore CPI index of an increase in the prices of food imports (FCI) and energy imports (ECI) for the CEMAC-4 region. The second plot shows the impulse responses of a 1 percent increase in both import price indexes via a Cholesky decomposition. The figure shows that an increase in both food import prices (FCI) and energy import prices (ECI) leads to a higher noncore inflation in CEMAC-4. The short-term effects of FCI and ECI on noncore inflation peak approximately at the same time, after 5 or 6 quarters. After that, they decay—but remain positive—over time.

Figure 4 displays the same impulse responses as in Figure 3 for each country in the sample individually. A missing line in that figure conveys that the cointegration test is nonsignificant between noncore CPI and the particular explanatory variable (ECI or FCI). Thus, the fact that the impulse response of noncore CPI to a 1 percent increase in ECI for the Republic of Congo is missing indicates that these two series do not cointegrate for that country. These results are complementary to Table 3, because a significant coefficient in the cointegration relationship of

Table 3 only means that the coefficient is statistically *different from zero* and not that the explanatory variable *cointegrates* with noncore inflation.

Therefore, Figure 4 suggests that energy import prices do not have a long-run relationship with noncore CPI in the Congo. As discussed in IMF (2011b) that may be explained by the fact that petrol prices at the pump are regulated and fixed by the state. The latter thus do not react to developments in global oil and other energy-based commodity prices.

The impulse responses per country yield other interesting results. Figure 4 shows that the effects of food import price hikes on the year-on-year rate of noncore inflation are initially negative for Cameroon and CAR, but turn large and positive very rapidly after a couple of quarters. In all other cases, the aggregate responses of FCI and ECI are always positive. In addition, the effect of these indices on noncore inflation appears to peak in around 4 or 5 quarters, and after which decays over time toward zero.

Table 5 shows, in addition, the variance decomposition of innovations in noncore inflation. It explains the percentage of noncore inflation variability for 4, 20, and 40 quarters owing to, respectively, energy imported (ECI) and food imported (FCI) price indices. The results indicate that for all countries/regions the degree of noncore inflation variability explained by ECI and FCI increases over quarters. Further, in line with Table 3 and Figures 3 and 4, the variable that explains most noncore inflation variability among ECI and FCI is the one with a more significant relationship with noncore inflation in Model (1). In particular, ECI explains a large share of noncore inflation variability in Cameroon and the CAR, whereas FCI accounts for most of that variability in the Congo and Gabon. In turn, owing again to the importance of food prices in the consumer baskets of most of the CEMAC-4 countries, noncore inflation variability is mostly explained by FCI for the aggregate CEMAC-4 region; whereas for the pooled sample, both imported indices explain a small share of noncore inflation variability.

B. The Impact of Noncore Inflation and Economic Activity on Core Inflation

Our second model, Model (2), analyzes the “second-round” effects of noncore inflation on the core components of inflation, while controlling for economic activity. Once again, this is done for particular countries and the CEMAC-4 region as a whole.

The results of cointegration tests among the core CPI index, the noncore CPI index, and real GDP are shown in Table 6 and Figure 5. Only for Cameroon this test is highly significant, implying a cointegration relationship between those variables. For the other countries and for the CEMAC-4 as a whole such relationships are found to be nonsignificant (see Table 6). This finding already indicates the weak pass-through effects of noncore-to-core inflation in the CEMAC countries. It also correctly shows that aggregate demand has no significant effects on the long-run dynamics of core inflation. For Cameroon, the effects of a 1 percent increase in ECI and FCI on core inflation are estimated too, with a peak at 0.32 percent after 10 quarters and at 0.14 percent after 14 quarters, respectively.

Tables 7 and 8 show that the coefficient of long-run cointegration relationship between core and noncore CPI is different from null in Cameroon, CAR, and for the pooled OLS CEMAC-4 sample. These results are also robust in the Pedroni’s (2001) panel cointegration estimations. For the CEMAC-4 region the coefficient of noncore CPI in the “Pooled OLS” column in Table 7 suggests

that for every 1 percent in noncore CPI inflation, core inflation increases 0.85 percent. However, these coefficients are heterogeneous and depend on the country and estimation method used.

Unexpectedly, a significant long-run relationship between core inflation and aggregate demand (real GDP) is found for the Congo in both Tables 7 and 8. In contrast with the expected dichotomy between prices and the real economy in the long run, this positive relationship may be related to controlled prices and the Congolese economic structure.[22] For the group of countries, the relationship in Table 8 using Pedroni's (2001) panel cointegration techniques is exactly the opposite, depending on the estimation used (FMOLS and DOLS). Both for the Congo and CEMAC-4 and the CEMAC region, the pass-through from noncore to core inflation is positive.

Finally, Table 9 explains the percentage of core inflation variability (variance decomposition) for 4, 20, and 40 quarters owing to, respectively, noncore inflation (Noncore) and real GDP (RGDP). Again, the results indicate that for all countries/regions the degree of core inflation variability explained by Noncore and RGDP increases over quarters. Further, the variable that explains most of the core inflation variability is the one with a significant relationship with core inflation in Table 7. Thus, Noncore inflation explains up to 27 and 69 percent in core inflation variability in Cameroon and the CAR, respectively. As mentioned before, RGDP explains core-inflation variability in the Congo. In Gabon, though, both Noncore and RGDP explain a small part of the core inflation variability. For the CEMAC-4 region, depending on the sample (aggregate or pooled-OLS), noncore inflation accounts for up to 28 or 35 percent of core inflation variability.

V. Policy Implications

The findings of our analysis stress that inflation is rather driven by supply shocks in the region. As expected, the structure of the economy also plays a role in the inflation pass-through. National governments are another important driving force of inflation dynamics in the CEMAC countries through two channels: (i) controlled prices, which hinder the pass-through from the fluctuations in international market prices into domestic prices; and (ii) the predominant role of government expenditure in domestic activity, which seems to affect prices in some members in a significant manner. In summary, some of the policy implications of our findings for single members and for the region as a whole are as follows:

- CEMAC countries are vulnerable to commodity price shocks. Global food and energy prices are important drivers of noncore inflation in the region. At the country level, different length and size of the pass-through of changes in global commodity prices on noncore inflation among countries highlight differences in governments' interventions, but also the role of the oil sector (see also David and others, 2011).

- In the absence of country-tailored monetary policy, CEMAC countries should build adequate fiscal space and reserve buffers. This could be done by increasing revenue mobilization,[23] boosting expenditure efficiency while protecting social sectors, and

[22] For a recent discussion on long-run monetary neutrality and potential other technical reasons for our findings, see McCallum (2004).

[23] Keen and Mansour (2009) and IMF (2011c) discuss several reform strategies to improve revenue mobilization in SSA and other developing countries.

advancing structural reforms that increase economic diversification. Oil exporters (e.g., the Congo) are found to be vulnerable to food price shocks as well. Thus, they should build fiscal buffers accordingly, not only through structural reforms to increase non-oil revenues, but also through savings of a substantial part of their oil windfalls.

- Improvements in infrastructure bottlenecks could ease inflationary pressures over time. However, in some countries, domestic activity seems to have a strong inflationary impact on core inflation in the short run (e.g., the Congo). Hence, the planned scaling up in infrastructure projects in the near term could add to inflationary pressures. Increased inflation is likely to make the poor worse off through lower real disposable income (in particular, minimum wage and pensions, state subsidies, and transfers might not be fully indexed). Striking the right balance between the much-needed increase in public capital investment and avoiding a substantial rise in inflationary pressures in the near term could be challenging, but feasible, provided the authorities embrace a more gradual capital spending approach.

- Managing price volatility in the region would require a further liberalization of domestic prices while tailoring transfers to the poor. Well-targeted subsidies and compensatory measures are generally more effective in alleviating poverty than subsidies to petroleum products, which tend to have high opportunity costs (Baig and others, 2007; Coady and others, 2010). Further, generalized subsidies, general public sector wage increases, ad-hoc tax reductions, and export restrictions should be avoided.

VI. Conclusions

This paper analyses inflation dynamics in the CEMAC region. Using cointegrated VAR models, it estimates (i) the effect of global energy and food prices on the noncore component of inflation; and (ii) the pass-through from noncore inflation and domestic activity into core inflation (overall CPI excluding food and energy).

We find that imported commodity price shocks are significant in explaining inflation in the CEMAC countries. National governments are another important driving force of inflation dynamics in the region, mainly through two channels: (i) controlled prices, which hinder the pass-through from the fluctuations in international market prices into domestic prices; and (ii) the predominant role of government capital expenditure in domestic activity. The magnitude and the length of a rise in core inflation owing to buoyant domestic demand following a scaling up in public investment could be important enough to exert inflationary pressures. On the contrary, reducing infrastructure bottlenecks would tend to ease those pressures in the medium term.

The heterogeneous reaction of inflation to energy or food price shocks for the countries in the region implies different policy measures to tackle the issue. On one hand, in the absence of a country-tailored monetary policy, countries more vulnerable to energy price shocks (e.g., Cameroon) should build adequate fiscal space and reserve buffers to attenuate the impact of oil shocks on the poor. On the other hand, oil producers vulnerable to food prices might want to build buffers by boosting growth through a strengthening of their non-oil sector, allowing more flexibility in their domestic prices and designing well-targeted subsidies and compensatory measures for poverty alleviation.

The current analysis offers various possibilities for future research. For example, additional analyses could be performed, testing how food and energy price changes affect inflation expectations in the CEMAC region. The inflationary impact of fiscal policy could also be analyzed. That would indicate the correct policy mix that should be used in the region, particularly in the context of a monetary union.

TABLES AND FIGURES

Table 1a. Characteristics of CEMAC Countries in 2010 [1]

	Population (Millions)	Nominal GDP (Billion USD)	Share of the CEMAC GDP	Share of Oil GDP to Total Nominal GDP	Per Capita GDP USD (Median for CEMAC)	Real GDP Growth	Overall Inflation	Core Inflation	Noncore Inflation
CEMAC	41.9	71.4	100.0	38.2	2042.0	3.9	2.8	1.5	1.9
Cameroon	20.4	22.5	31.5	6.7	1100.6	3.0	2.6	3.0	1.3
Central African Republic	4.6	2.0	2.8	0.0	436.0	3.3	1.5	-0.2	3.1
Chad	10.2	7.8	11.0	37.8	767.7	5.1	1.0	-0.4	-5.5
Congo	3.9	11.5	16.1	66.5	2983.5	9.1	5.0	4.2	5.1
Equatorial Guinea	1.3	14.5	20.3	60.3	11033.3	-0.8	7.5	n.a	n.a
Gabon	1.5	13.1	18.3	48.9	8724.2	5.7	0.6	-0.6	4.4

Sources: IMF Staff calcutations, World Bank

[1] In Percent unless otherwise indicated

Table 1b. Summary of the Micro Structure in the domestic consumption

Countries	**Items with Controlled Prices**	**Share of Controlled Price Items in the CPI Basket (in percent)**	**Share of Imported Food Products (in percent) [2]**	**Share of Food (in percent)**
Cameroon	Fuel, gas, electricity, transportation [1]	12	Not available	22
Central African Republic	Fuel	2.4	Not available	70
Chad	Maximum prices for imported rice, flour, milk, sugar and cooking oil	Not available	About 6	46
Rep. of Congo	Food (bread, sugar, rice, vegetable oil), cement,fuel, electricity, gas, transportation	About 50	About 20	48
Gabon	Bread, sugar, transportation tariffs, milk, rice, flor, vegetable oil, gas, cement	Not available	35.5	32.9
Equatorial Guinea	Fuel	Not available	Not available	60

Source: Countries' authorities and IMF Staff calculations.

[1] Retail petroleum prices (in principle adjustment according to pricing formula for all countries).

[2] Share of imported food products to the total share of consumed food products (in percent).

Table 2. CEMAC: Cointegration Tests for Model 1, 1996–2010

Country/Region	Country Sample	Cointegration Test	Statistic	Cointegration Relations[g]	Observations	Sample Period (quarter)
Cameroon	Individual[b]	Unrestricted Rank Test[d]	0.34***	1	57	1996:3–2010:3
Central African Republic	Individual[b]	Unrestricted Rank Test[d]	0.31*	0	58	1996:3–2010:4
Congo, Republic of	Individual[b]	Unrestricted Rank Test[d]	0.32*	0	55	1996:4–2010:2
Gabon	Individual[b]	Unrestricted Rank Test[d]	0.42***	1	55	1997:1–2010:3
CEMAC-4[a]	Aggregate[c]	Unrestricted Rank Test[d]	0.34***	1	56	1996:3–2010:2
	Panel-Pooled	Unrestricted Rank Test[d]	0.23***	1	224	1996:3–2010:2
	Panel-Pooled	Panel Variance Ratio[e]	-0.51	0	224	1996:3–2010:2
	Panel-Pooled	Panel ρ test[f]	-0.73	0	224	1996:3–2010:2
	Panel-Pooled	Panel t- test[f]	-1.20	0	224	1996:3–2010:2
	Panel-Pooled	Panel ADF test[f]	-2.25**	1	224	1996:3–2010:2
	Panel-Group	Group mean ρ test[f]	0.22	0	224	1996:3–2010:2
	Panel-Group	Group mean t- test[f]	-0.73	0	224	1996:3–2010:2
	Panel-Group	Group mean ADF test[f]	-1.99**	1	224	1996:3–2010:2

Sources: IMF WEO, IMF country desks, International Trade Center, and authors' computation.

Notes: ***, **, and * indicate significance at 1, 5, and 10 percent level respectively.

[a] CEMAC-4 corresponds to the group Cameroon, CAR, the Republic of Congo, Gabon in the CEMAC region.

[b] Series for the particular country.

[c] Aggregation of the series for the group of countries as a whole.

[d] The statistic is the eigenvalue for the test with null hypothesis of none cointegration relation, with intercept and no trend.

[e] Pedroni's panel cointegration test, with null hypothesis of no cointegration (for all or most countries). The test is one-sided with a normal N(0,1) distribution in which high positive values reject the null hypothesis (see Pedroni 1999 and 2004).

[f] Pedroni's panel cointegration test, with null hypothesis of no cointegration (for all or most countries). The test is one-sided with a normal N(0,1) distribution in which high negative values reject the null hypothesis. Panel stats are weighted by long run variances (see Pedroni, 1999 and 2004).

[g] Number of cointegration relations is decided considering the rejection of the null hypothesis at 5 percent.

Table 3. CEMAC: Cointegration Relation and Short-Term Effects Estimations for Model 1, 1996–2010

Variable[a]	Cameroon	CAR	Congo, Rep.	Gabon	CEMAC-4[b] Aggregate[c]	CEMAC-4[b] Pooled OLS
Cointegrating relation						
Noncore CPI(-1)	1.00	1.00	1.00	1.00	1.00	1.00
Constant	-3.57	-3.10	-0.51	-2.98	-3.59	-1.81
ECI(-1)	-0.21***	-0.23***	0.11	-0.06**	-0.06	-0.28
	(0.04)	(0.04)	(0.27)	(0.03)	(0.04)	(0.41)
FCI(-1)	-0.03	-0.10	-1.03*	-0.29***	-0.16*	-0.33
	(0.08)	(0.09)	(0.72)	(0.07)	(0.09)	(0.96)
Error correction and short-term relation[d]						
Error correction term	-0.15***	-0.16***	-0.02**	-0.16***	-0.06***	-0.01
	(0.03)	(0.04)	(0.01)	(0.03)	(0.02)	(0.01)
Constant	0.01***	0.01*	0.00**	0.01***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
d(Noncore CPI(-1)*)*	-0.30**	0.00	0.35***	-0.21*	-0.14	0.14**
	(0.12)	(0.12)	(0.10)	(0.11)	(0.14)	(0.07)
d(ECI(-1)*)*	-0.01	0.01	-0.01	0.00	0.00	0.01
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
d(FCI(-1)*)*	-0.02	-0.04	0.04	-0.04	0.01	0.02
	(0.03)	(0.04)	(0.05)	(0.03)	(0.01)	(0.02)
Dummy 1997 quarter 4				-0.06***		
				(0.01)		
Dummy 2002 quarter 4		0.07***				
		(0.02)				
Dummy 2003 quarter 1			0.14***			
			(0.02)			
Dummy 2008 quarter 1				0.00		
				(0.01)		
Dummy 2008 quarter 4	0.00	-0.01	-0.01	-0.01	0.00	0.00
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
R-squared[e]	0.27	0.37	0.63	0.54	0.15	0.04
LR test for restrictions[f]	6.28**	5.30*	16.72***	4.38	13.74***	56.58***
AIC[g]	-9.21	-8.86	-9.65	-10.43	-11.41	-9.27
BIC[g]	-8.46	-8.01	-8.44	-9.45	-10.65	-8.95
Observations	57	58	55	55	56	224
Sample period (quarter)	1996:3–2010:3	1996:3–2010:4	1996:4–2010:2	1997:1–2010:3	1996:3–2010:2	1996:3–2010:2

Sources: IMF WEO, IMF country desks, International Trade Center, and authors' computation.

Notes: ***, **, and * indicate significance at 1, 5, and 10 percent level respectively. Values in parenthesis report standard errors.

[a] For the variables below the symbol (-1) corresponds to the first lag of the variable, while the symbol *d()* corresponds to the first difference of the variable. Further, dummy variables are included for all observations with residuals exceeding three standard deviations.

[b] CEMAC-4 corresponds to the group Cameroon, CAR, the Republic of Congo, Gabon in the CEMAC region.

[c] Aggregation of the series for the group of countries as a whole.

[d] This part of the table reports the short-term effects of the cointegration relation, including the error correction term estimated from the cointegration relation. It is estimated via a VAR in first differences from which we just report the short-term effects on Noncore CPI. For the Republic of Congo the short-term effects are estimated for two lags instead of only one as for the other countries/region. Here, we just report the coefficients for the first lag, though. The dummies included are significant at least on the estimation of short-term effects of one of the estimated variables.

[e] The R-squared refers to the estimation of the the short-term effects of the cointegration relation on Noncore CPI.

[f] Chi-square statistic of the LR test for binding cointegrating restrictions (rank = 1): B(1,1)=1, A(2,1)=0, A(3,1)=0.

[g] Summary statistic for the VAR system as a whole.

Table 4. CEMAC: Pedroni's (2001) Panel Cointegration Relation Estimations for Model 1, 1996–2010

	Cameroon		CAR		Congo, Rep.		Gabon		CEMAC-4[a]	
Variable	FMOLS[b]	DOLS[c]	FMOLS[b]	DOLS[c]	FMOLS[b]	DOLS[c]	FMOLS[b]	DOLS[c]	Group-FMOLS[b]	Group-DOLS[c]
Intercept	3.58***	4.32***	3.51***	3.97***	2.82***	4.07***	3.73***	4.24***	3.41***	4.15***
	(0.17)	(0.17)	(0.17)	(0.11)	(0.42)	(0.97)	(0.16)	(0.13)	(0.23)	(0.09)
ECI	0.21***	0.22***	0.16***	0.03	0.35***	0.58***	0.12***	0.11***	0.21***	0.23***
	(0.04)	(0.04)	(0.04)	(0.03)	(0.08)	(0.18)	(0.03)	(0.03)	(0.02)	(0.03)
FCI	0.02	-0.13*	0.09	0.11**	0.10	-0.39	0.07	-0.02	0.07	-0.11
	(0.09)	(0.07)	(0.09)	(0.04)	(0.22)	(0.37)	(0.08)	(0.05)	(0.05)	(0.28)
Kernel width	5		5		5		5		5	
dynamic lags		5		5		5		5		5
Time demeaned	no									
Countries	4									
Sample period	1996:3–2010:2									
Observations	224									

Sources: IMF WEO, IMF country desks, International Trade Center, and authors' computation.

Notes: ***, **, and * indicate significance at 1, 5, and 10 percent level respectively for the null hypothesis that the coefficient is equal to 0. Values in parenthesis report standard errors.

[a] CEMAC-4 corresponds to the group Cameroon, CAR, the Republic of Congo, Gabon in the CEMAC region. Here the data is pooled and w e use group estimators for the panel estimations.

[b] Panel fully modified OLS estimator (see Pedroni, 1996, 2000, and 2001).

[c] Parametric dummy OLS based panel estimator pooled along the w ithin-dimension (see Kao and Chiang, 1997; Pedroni, 2000 and 2001).

Table 5. CEMAC: Variance Decomposition of Changes in Noncore Inflation, 1996–2010
(Percent)

Horizon (quarters)	4		20		40	
Country/Region	ECI	FCI	ECI	FCI	ECI	FCI
Cameroon	24.05	2.17	88.12	3.77	93.09	3.97
CAR	30.64	0.95	82.94	9.16	85.98	10.63
Congo, Rep.	7.59	13.95	4.30	50.35	1.81	76.79
Gabon	3.72	9.67	26.44	64.19	28.40	68.35
CEMAC-4[a] (Aggregate[b])	0.72	15.60	19.43	56.60	27.76	64.30
CEMAC-4 (Panel-Pooled)	1.27	1.75	7.27	6.02	18.20	12.09

Sources: IMF WEO, IMF country desks, International Trade Center, and authors' computation.

Notes: [a] CEMAC-4 corresponds to the group Cameroon, CAR, Republic of Congo, Gabon in the CEMAC region.

[b] Aggregation of the series for the group of countries as a w hole.

Table 6. CEMAC: Cointegration Tests for Model 2, 1996–2010

Country/Region	Country Sample	Cointegration Test	Statistic	Cointegration Relations[g]	Observations	Sample Period (quarter)
Cameroon	Individual[b]	Unrestricted Rank Test[d]	0.31***	1	56	1996:4–2010:3
Central African Republic	Individual[b]	Unrestricted Rank Test[d]	0.23	0	56	1997:1–2010:4
Congo, Republic of	Individual[b]	Unrestricted Rank Test[d]	0.33*	0	55	1996:4–2010:2
Gabon	Individual[b]	Unrestricted Rank Test[d]	0.25	0	57	1996:3–2010:3
CEMAC-4[a]	Aggregate[c]	Unrestricted Rank Test[d]	0.18	0	55	1996:4–2010:2
	Panel-Pooled	Unrestricted Rank Test[d]	0.04	0	220	1996:4–2010:2
	Panel-Pooled	Panel Variance Ratio[e]	0.82	0	220	1996:4–2010:2
	Panel-Pooled	Panel ρ test[f]	-0.88	0	220	1996:4–2010:2
	Panel-Pooled	Panel t- test[f]	-1.10	0	220	1996:4–2010:2
	Panel-Pooled	Panel ADF test[f]	-0.33	0	220	1996:4–2010:2
	Panel-Group	Group mean ρ test[f]	-0.50	0	220	1996:4–2010:2
	Panel-Group	Group mean t- test[f]	-1.10	0	220	1996:4–2010:2
	Panel-Group	Group mean ADF test[f]	-0.08	0	220	1996:4–2010:2

Sources: IMF WEO, IMF country desks, International Trade Center, and authors' computation.

Notes: ***, **, and * indicate significance at 1, 5, and 10 percent level respectively.

[a] CEMAC-4 corresponds to the group Cameroon, CAR, the Republic of Congo, Gabon in the CEMAC region.

[b] Series for the particular country.

[c] Aggregation of the series for the group of countries as a w hole.

[d] The statistic is the eigenvalue for the test w ith null hypothesis of no cointegration relation, w ith intercept and no trend.

[e] Pedroni's panel cointegration test, w ith null hypothesis of no cointegration (for all or most countries). The test is one-sided w ith a normal N(0,1) distribution in w hich high positive values reject the null hypothesis (see Pedroni 1999 and 2004).

[f] Pedroni's panel cointegration test, w ith null hypothesis of no cointegration (for all or most countries). The test is one-sided w ith a normal N(0,1) distribution in w hich high negative values reject the null hypothesis. Panel stats are w eighted by long run variances (see Pedroni, 1999, and 2004).

[g] Number of cointegration relations is decided considering the rejection of the null hypothesis at 5 percent.

Table 7. CEMAC: Cointegration Relation and Short-Term Effects Estimations for Model 2, 1996–2010

Variable[a]	Cameroon	CAR	Congo, Rep.	Gabon	CEMAC-4[b] Aggregate[c]	CEMAC-4[b] Pooled OLS
Cointegrating relation						
Core CPI(-1)	1.00	1.00	1.00	1.00	1.00	1.00
Constant	-2.18	15.98	1.65	-4.59	5.49	-1.06
Noncore CPI(-1)	-0.62***	7.64**	0.31	-0.07	0.79	-0.85***
	(0.07)	(3.41)	(0.20)	(0.13)	(1.48)	(0.27)
Real GDP(-1)	0.06	-11.16	-1.24***	0.05	-1.70	0.07
	(0.08)	(7.14)	(0.34)	(0.22)	(1.05)	(0.06)
Error correction and short-term relation[d]						
Error correction term	-0.30***	-0.01**	-0.25***	-0.11**	-0.14**	-0.03**
	(0.09)	(0.00)	(0.08)	(0.04)	(0.05)	(0.01)
Constant	0.01	0.01***	0.03***	0.00**	0.00	0.00*
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
d(Core CPI(-1)*)*	-0.10	0.07	0.16	0.29***	0.17	0.13*
	(0.23)	(0.11)	(0.13)	(0.06)	(0.17)	(0.07)
d(Core CPI(-2)*)*	0.02	-0.10	0.03		0.32*	0.03
	(0.21)	(0.11)	(0.13)		(0.17)	(0.07)
d(Noncore CPI(-1)*)*	-0.03	0.03	0.09	-0.09*	-0.24	-0.05
	(0.12)	(0.07)	(0.17)	(0.05)	(0.39)	(0.06)
d(Noncore CPI(-2)*)*	0.13	0.14**	0.05		0.11	0.08
	(0.10)	(0.07)	(0.17)		(0.38)	(0.06)
d(Real GDP (-1)*)*	-0.03	1.17***	0.07	0.18*	1.40	0.05
	(2.49)	(0.43)	(1.02)	(0.09)	(1.18)	(0.34)
d(Real GDP (-2)*)*	-0.01	-1.47***	-0.38		-1.36	-0.11
	(2.39)	(0.43)	(1.07)		(1.37)	(0.34)
Dummy 1997 quarter 4				0.00		
				(0.01)		
Dummy 1998 quarters 3 & 4				0.00	0.01	0.01**
				(0.00)	(0.01)	(0.01)
Dummy 1999 quarter 4		-0.06***				
		(0.01)				
Dummy 2000 all quarters			-0.03**			
			(0.01)			
Dummy 2003 quarter 1			-0.01	-0.02***		
			(0.03)	(0.01)		
Dummy 2004 quarter 3	0.01					
	(0.01)					
Dummy 2006 quarter 1				-0.06***		
				(0.01)		
Dummy 2009 quarter 3					-0.01	0.00
					(0.01)	(0.01)
Dummy 2010 quarter 2				-0.07***	-0.01	-0.02
				(0.01)	(0.01)	(0.01)
R-squared[e]	0.17	0.50	0.26	0.87	0.32	0.07
LR test for restrictions[f]	9.00**	8.12**	12.63***	8.85**	3.08	4.84*
AIC[g]	-6.60	-6.11	-4.08	-7.41	-5.83	-5.07
BIC[g]	-6.28	-5.78	-3.72	-7.05	-5.43	-4.90
Observations	56	56	55	57	55	220
Sample period (quarter)	1996:4–2010:3	1997:1–2010:4	1996:4–2010:2	1996:3–2010:3	1996:4–2010:2	1996:4–2010:2

Sources: IMF WEO, IMF country desks, International Trade Center, and authors' computation.

Notes: ***, **, and * indicate significance at 1, 5, and 10 percent level respectively. Values in parenthesis report standard errors.

[a] For the variables below the symbol (-1) and (-2) correspond to the first and second lags of the variable, while the symbol *d()* corresponds to the first-difference of the variable. Further, dummy variables are included for all observations with residuals exceeding 3 standard deviations.

[b] CEMAC-4 corresponds to the group Cameroon, CAR, the Republic of Congo, Gabon in the CEMAC region.

[c] Aggregation of the series for the group of countries as a whole.

[d] This part of the table reports the short-term effects of the cointegration relation, including the error correction term estimated from the cointegration relation. It is estimated via a VAR in first differences from which we just report the short-term effects on Core CPI. The dummies included are significant at least on the estimation of short-term effects of one of the estimated variables.

[e] The R-squared refers to the estimation of the the short-term effects of the cointegration relation on Core CPI.

[f] Chi-square statistic of the LR test for binding cointegrating restrictions (rank = 1): B(1,1)=1, A(2,1)=0, A(3,1)=0.

[g] Summary statistic for the VAR system as a whole.

Table 8. CEMAC: Pedroni's (2001) Panel Cointegration Relation Estimations for Model 2, 1996–2010

	Cameroon		CAR		Congo, Rep.		Gabon		CEMAC-4[a]	
Variable	FMOLS[b]	DOLS[c]	FMOLS[b]	DOLS[c]	FMOLS[b]	DOLS[c]	FMOLS[b]	DOLS[c]	Group-FMOLS[b]	Group-DOLS[c]
Intercept	1.74***	3.24***	1.03	4.63***	-0.29	1.22	5.00***	4.90***	1.87***	3.50***
	(0.10)	(0.43)	(0.67)	(0.79)	(0.47)	(1.40)	(0.36)	(0.38)	(0.40)	(0.26)
Noncore CPI	0.51***	0.45***	0.93***	0.88***	-0.38**	-0.19	-0.06	1.01***	0.25***	0.54***
	(0.06)	(0.08)	(0.16)	(0.07)	(0.14)	(0.20)	(0.09)	(0.10)	(0.05)	(0.04)
Real GDP	0.07	-0.09	-0.14	-0.80***	1.08***	0.70*	-0.02	-0.73	0.25***	-0.23***
	(0.06)	(0.10)	(0.36)	(0.19)	(0.22)	(0.36)	(0.13)	(0.08)	(0.09)	(0.04)
Kernel width	5		5		5		5		5	
dynamic lags		5		5		5		5		5
Time demeaned	no									
Countries	4									
Sample period	1996:4–2010:2									
Observations	220									

Sources: IMF WEO, IMF country desks, International Trade Center, and authors' computation.

Notes: ***, **, and * indicate significance at 1, 5, and 10 percent level respectively for the null hypothesis that the coefficient is equal to 0. Values in parenthesis report standard errors.

[a] CEMAC-4 corresponds to the group Cameroon, CAR, Republic of Congo, Gabon in the CEMAC region. Here the data is pooled and w e use group estimators for the panel estimations.

[b] Panel fully modified OLS estimator (see Pedroni, 1996, 2000, and 2001).

[c] Parametric dummy OLS based panel estimator pooled along the w ithin-dimension (see Kao and Chiang, 1997; Pedroni, 2000 and 2001).

Table 9. CEMAC: Variance Decomposition of Changes in Core Inflation, 1996–2010
(Percent)

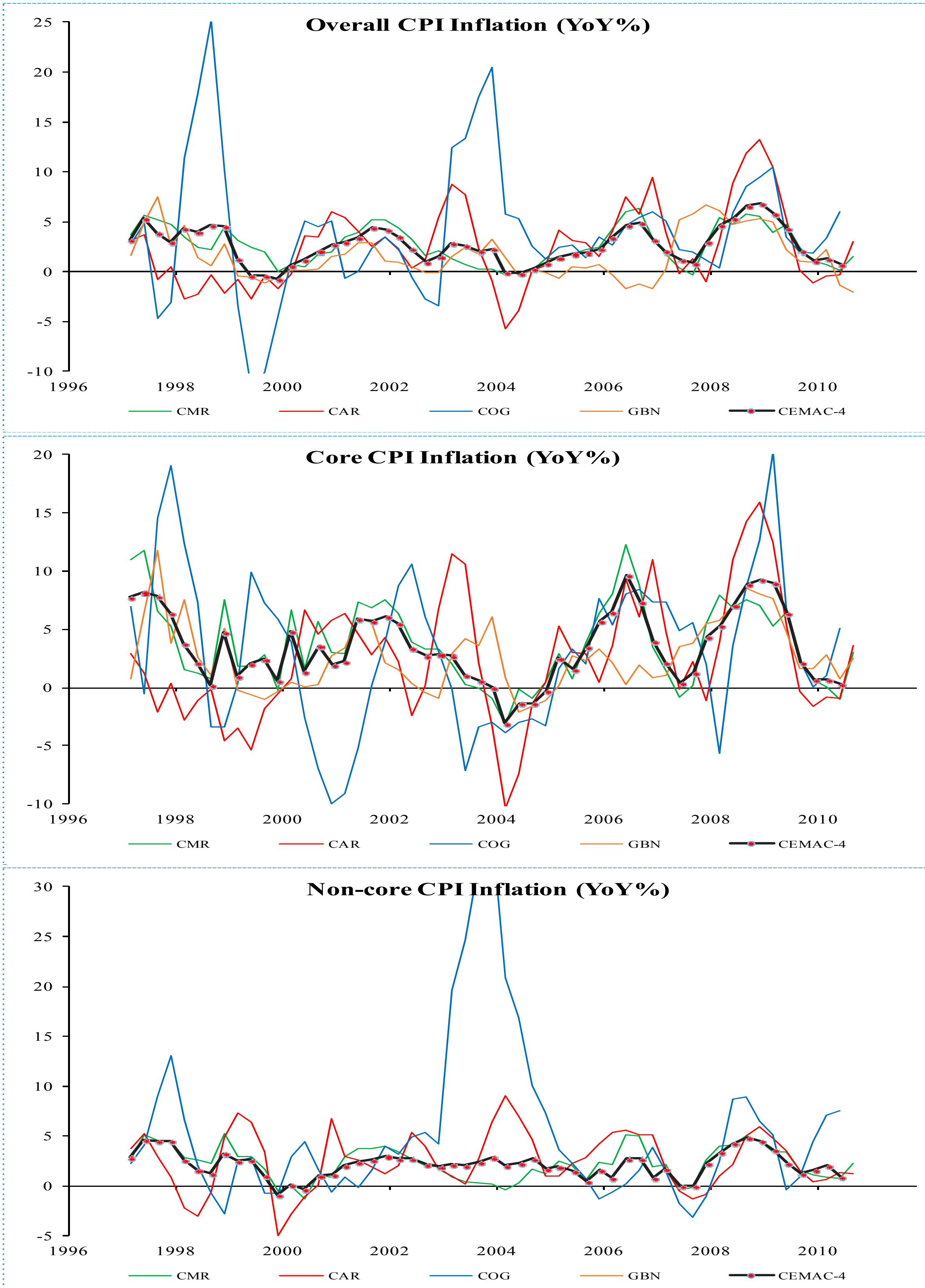
Horizon (quarters)	4		20		40	
Country/Region	Noncore	RGDP	Noncore	RGDP	Noncore	RGDP
Cameroon	11.85	0.02	27.24	5.73	27.51	9.30
CAR	0.20	3.69	46.67	5.36	69.37	9.79
Congo, Rep.	0.13	1.39	12.83	57.18	16.11	70.09
Gabon	2.66	1.62	3.25	7.79	8.17	7.60
CEMAC-4[a] (Aggregate[b])	2.26	1.83	20.90	14.31	28.61	22.40
CEMAC-4[a] (Panel-Pooled)	0.42	0.00	13.21	0.05	35.04	0.40

Sources: IMF WEO, IMF country desks, International Trade Center, and authors' computation.

Notes: [a] CEMAC-4 corresponds to the group Cameroon, CAR, the Republic of Congo, Gabon in the CEMAC region.

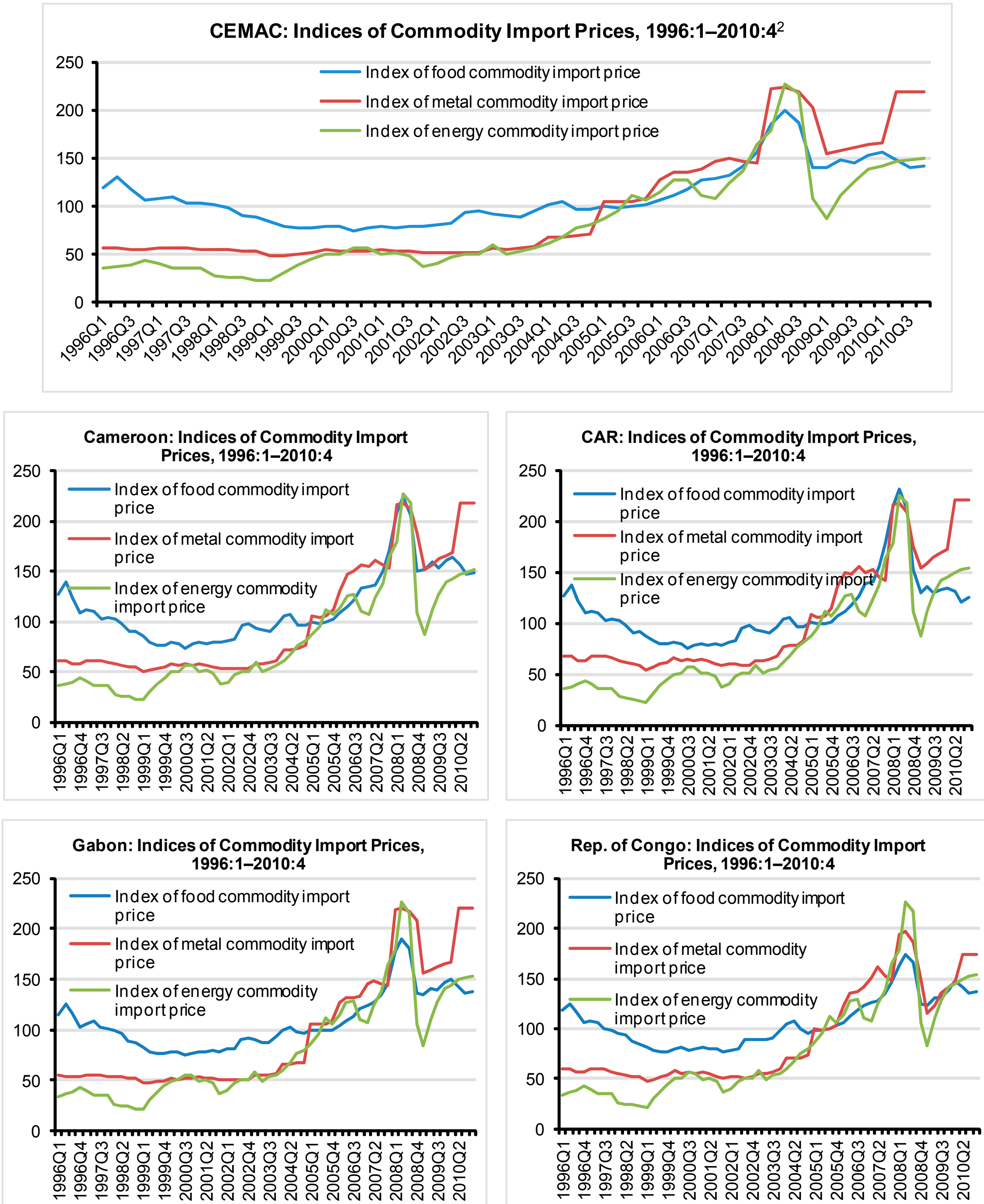
[b] Aggregation of the series for the group of countries as a w hole.

Figure 1. CEMAC: Quarterly Overall and Noncore CPI Inflation, 1996–2010



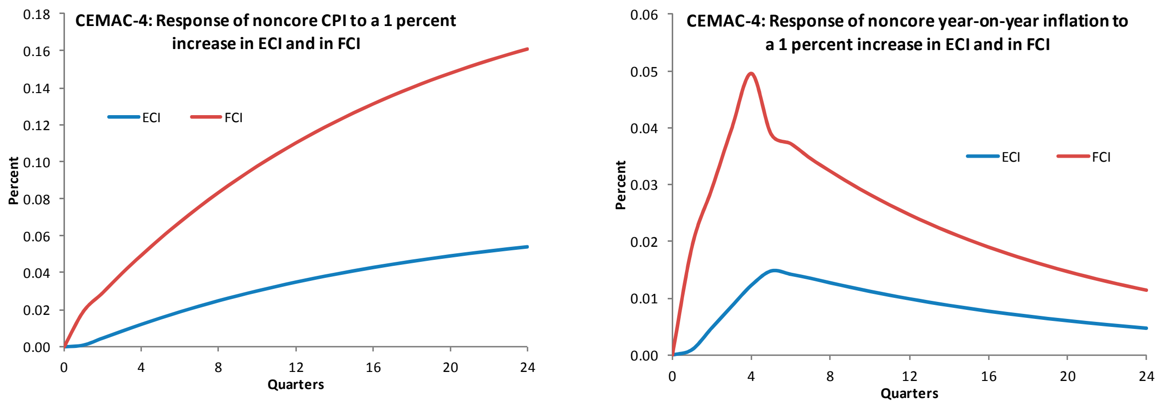
Source: IMF Staff calculations.

Figure 2. CEMAC: Index of Commodity Import Prices, 1996:1–2010:4[1]



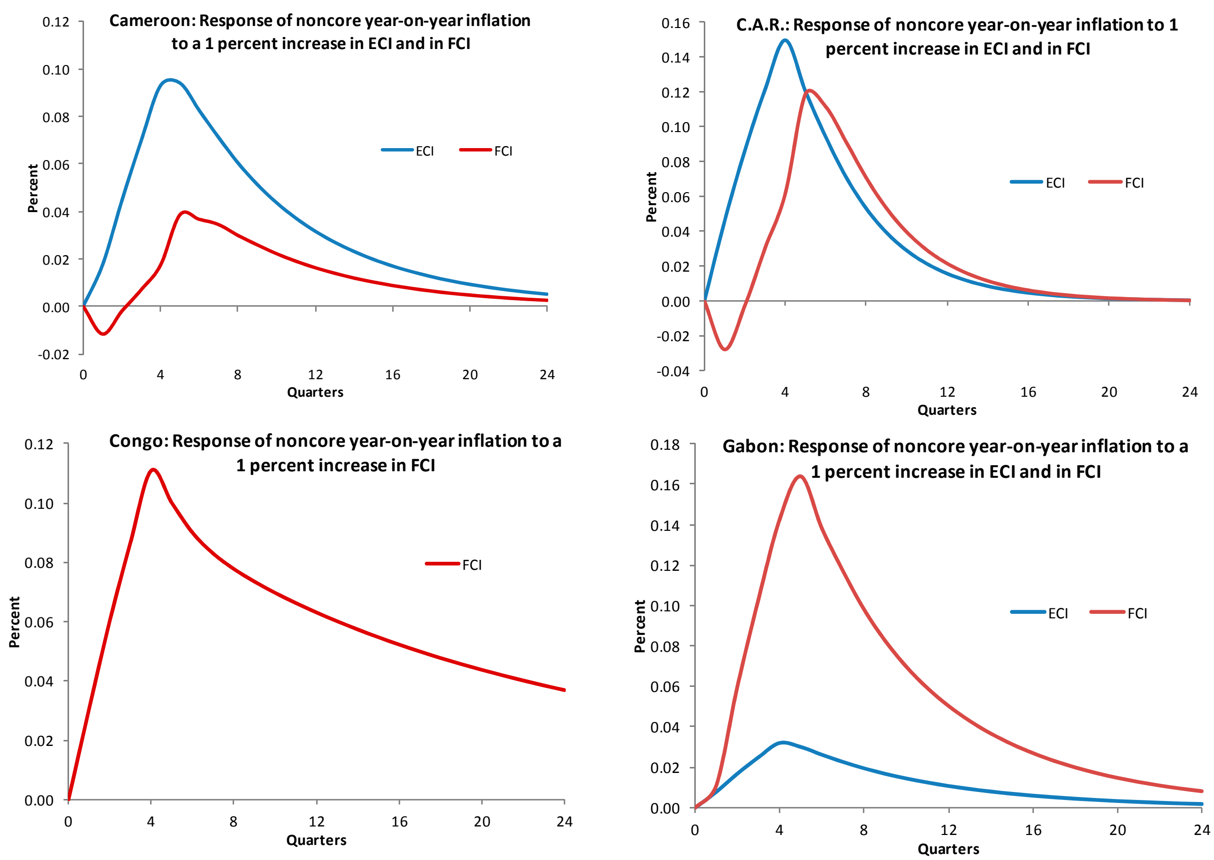
Source: International Trade Centre, and authors' computations.
Notes: [1] The base year is 2005 = 100.
[2] CEMAC region is here composed of the 6 CEMAC countries: Cameroon, the Central African Republic (CAR), Chad, Equatorial Guinea, Gabon, and the Republic of Congo.

Figure 3. CEMAC–4: Response on Noncore CPI to a 1 Percent Increase in ECI and FCI Indices, 1996:3–2010:3



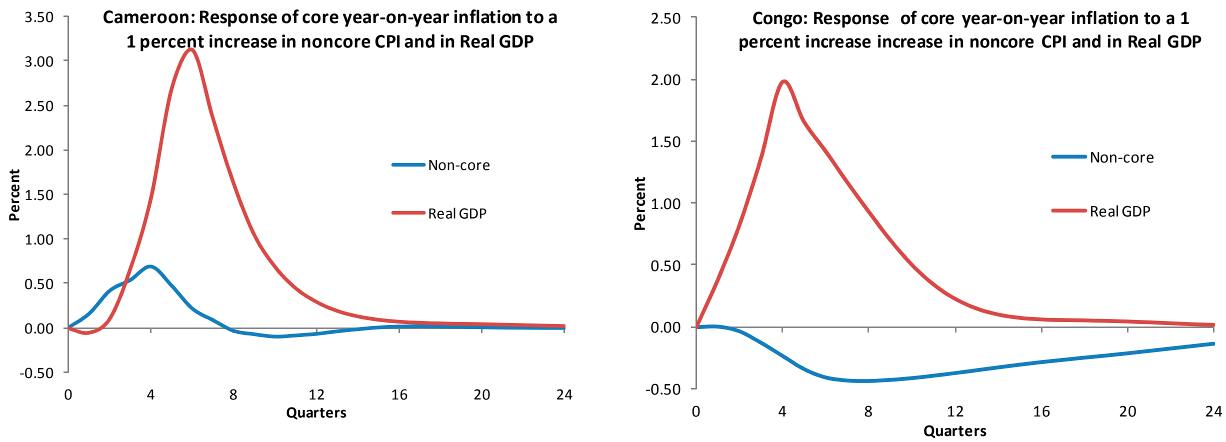
Source: IMF Staff calculations.

Figure 4. CEMAC Selected Countries: Response on Noncore Year-on-Year Inflation to a 1 Percent Increase in ECI and FCI Indices, 1996:3–2010:3



Source: IMF Staff calculations.

Figure 5. CEMAC Selected Countries: Response of Core Inflation to a 1 Percent Increase in Noncore CPI and Real GDP: 1996:3–2010:3



Source: IMF Staff calculations.

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Appendix

CEMAC: Descriptive Statistics of the Main Variables, 1996:1–2010:4

	No. of Obs.	Mean	St. Dev.	Min	Max
Headline CPI inflation (YoY%):					
CAR	55	2.5	4.0	-5.7	13.3
CMR	55	2.6	1.9	-0.3	6.4
COG	54	4.1	6.7	-11.7	25.2
GBN	55	1.6	2.4	-2.0	7.5
CEMAC-4	54	2.6	1.8	-0.7	6.8
Core CPI inflation (YoY%):					
CAR	55	2.5	5.3	-10.4	15.9
CMR	55	3.8	3.5	-3.2	12.3
COG	54	3.2	6.6	-10.0	20.2
GBN	55	2.7	3.0	-2.1	11.8
CEMAC-4	54	3.5	3.1	-3.1	9.6
Noncore CPI inflation (YoY%):					
CAR	55	2.5	2.9	-5.0	9.0
CMR	55	2.2	1.7	-1.3	5.3
COG	54	5.5	8.1	-3.1	35.7
GBN	55	0.0	2.6	-7.3	4.8
CEMAC-4	54	2.2	1.3	-0.9	4.9
Real GDP growth (YoY%):					
CAR	118	2.5	3.5	-6.8	10.1
CMR	118	2.4	4.3	-7.4	14.6
COG	118	3.9	4.6	-5.1	19.7
GBN	118	1.9	4.5	-14.7	13.1
CEMAC-4	118	2.5	2.5	-4.6	7.9
Food Commodity Price Index inflation (YoY%):					
CAR	56	2.2	20.5	-41.3	65.8
CMR	56	3.1	18.8	-29.1	64.3
COG	56	2.3	14.0	-25.0	35.7
GBN	56	2.6	15.0	-25.7	49.2
CEMAC-4	56	2.7	15.9	-25.9	50.9
Energy Commodity Price Index inflation (YoY%)					
CAR	56	16.0	36.8	-51.2	119.5
CMR	56	16.0	36.8	-51.3	119.4
COG	56	16.7	38.4	-53.5	128.0
GBN	56	16.6	38.2	-53.3	126.9
CEMAC-4	56	16.0	36.9	-51.6	120.5

Sources: IMF WEO, IMF country desks, International Trade Center, and authors' computation.