Inflation in the West African Countries:
The Impact of Cocoa Prices, Budget Deficits, and Migrant

Remittances

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Abstract

We verify whether cocoa prices could be a source of inflation in five countries of the West African region within a framework that includes other variables such as migrant remittances to the region and a fiscal policy variable represented by the government budget deficit. Unlike earlier studies that explicitly use money supply variables, the inclusion of migrant remittances enables to examine the effect of an international capital flow variable on inflation. The results reveal that the influence of cocoa prices on consumer price inflation is strong and statistically significant. The influence of the budget deficit and the flow of migrant remittance variables on inflation are, however, weak.

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1. Introduction

Commodity prices are traditionally recognized as leading indicators of inflation. The notion is that commodity prices are set under competitive conditions, usually in highly competitive auction markets, respond more quickly to general economic shocks, such as an increase in demand. This presumption stems from the common view that changes in commodity prices are an outcome of developments occurring solely in commodity markets. Yet, drawing on Dornbusch's (1976) theory of exchange rate overshooting, Frankel (1986) provides an overshooting theory of commodity prices that suggests that the influence of commodity prices on consumer prices occurs through a money-driven overshooting of commodity prices being corrected over time, i.e., commodity prices overshoot their new long-run equilibrium in the advent of a change in monetary policy because the prices of other goods are sticky. Boughton et al. (1989) also show—in a two-country model designed to examine the theoretical effects of monetary, fiscal, and supply-side disturbances on commodity and manufactures prices and on exchange rates—that if monetary shocks dominate, then commodity prices should lead general price movements, and the level of commodity prices should be correlated with the general inflation rate.

More recently, Malliaris (2006) has shown that analytically it is very difficult to propose a general theory of inflation because as economies evolve over time both new causes of inflation emerge and the consequences of inflation become more complex.

Given that the West African region accounts for over sixty percent of global cocoa output, this work verifies whether cocoa prices could be a source of inflation in the region within a framework that includes other variables such as migrant remittances to the region (that have been growing at an average annual rate of forty percent) and a fiscal policy variable represented by the government budget deficit. The inclusion of migrant remittances enables us to examine the effect of an international capital flow variable on inflation.

It is presumed that an increase in the domestic and/or world price of cocoa as well as migrant remittances would generate a balance-of-payments surplus and an accumulation of international reserves, which, depending on monetary policy—i.e., full sterilization or not—may boost inflation (see also Edwards, 1984).

The analysis is carried out by means of small-scale models for five cocoa producing countries: **Benin, Cameroon, Cote d'Ivoire, Ghana, and Togo.**

The models are specifically designed to predict consumer price inflation. In view of the small numbers of observations, panel specifications were also considered. Forecasts for the most recent observations are generated and then compared to the respective realized inflation data.

The agricultural export sector in most of these countries, accounts for a high proportion of employment as well as foreign exchange earnings. Thus, it is plausible to envisage that higher commodity prices would imply higher nominal wages and higher overall price levels—the so called wage-price spiral. It would also imply higher government expenditures which have almost invariably led to higher budget deficits. The evidence for the commodity related wage-price spiral is seemingly paradoxical, given the often-suggested recommendation that governments of developing countries should pay farmers in the commodity export sector fairer prices.

Results of the study reveal that the influence of cocoa prices on consumer price inflation is strong and statistically significant. Many variables are modelled better as having a one-year lag causal effect on inflation, thereby supporting the view that the influence of commodity prices on CPI inflation occurs through an overshooting of commodity prices being corrected over time. The influence of the budget deficit and migrant remittance variables on inflation is, however, weak.

The plan of the paper is as follows: **Section 2** describes the data. **Section 3** reports some preliminary experiments with single-equation regression and a panel model, which serve to explore the information on the dynamic correlation structure and statistical significance. **Section 4** reports the main prediction experiments. **Section 5** concludes.

2. The data

2.1. Inflation

Inflation continues to be a source of serious problems in many developing countries. High inflation disrupts steady growth and by distorting movements in relative prices, it leads to a misallocation of resources. Our focus is on inflation as measured by the consumer price index (CPI). For some countries, however, CPI data were only available for rather short time spans. Benin, for example, had CPI data available only for the period 1992–2001. In such a case, the rate of CPI inflation is concatenated with GDP (gross domestic product) inflation. In the case of Benin, the GDP deflator was available for 1960–2001, such that inflation π is defined for the range 1961–2001. The CPI and GDP data were obtained from the World Bank Development Indicators database.

In general, inflation is found to be higher and more variable in Ghana than in the other countries—all Francophone countries. The respective Francophone countries have the CFA franc as their currency. Given that the CFA Franc was formerly pegged to the French Franc and more recently to the Euro, the Francophone countries have lower inflationary rates comparable to those in France and for that matter in the Euro area.

2.2. Budget deficit

Inflation is usually largely a result of expansionary fiscal policy financed by deficits in government budgets. Fiscal deficits, in turn, are by definition the use by the public sector of some resources additional to those generated by government revenues. The deficits can be financed by the issuance of bonds (which raises interest rates and thereby makes private investment less attractive), or by money creation with the usual inflationary consequences. Akçay et al. (2002) argue that, even in the absence of deficit monetisation, adjustments in the private sector to higher deficit policies may very well lead to inflation. They cite the real and/or financial sectors (Miller, 1983) or the "unpleasant monetarist arithmetic" (Sargent and Wallace, 1981) as mechanisms through which inflation can be transmitted.

We denote the government's deficit quota by q, and define it as the ratio of fiscal deficit to nominal GDP. The availability of this series varied considerably across countries. For Benin, no deficit quota was available for a reasonable time range. As a result, it is replaced by a 12-months bond rate, which is available for 1970–2004. For Cameroon, the deficit quota was available for 1975–1995 and for 1998–1999. We chose to interpolate the missing values by

using a time-series algorithm, which results in a series for 1975–2001. For Ghana, a series was available for 1970–1998, which we extrapolated using a first-order autoregression until 2001. In the case of Togo, the only possible time range was 1977–1987, which was too short to be of practical use. Thus, the influence of the deficit quota is not considered in the case of Togo.

2.3 Cocoa prices

Cocoa price data were obtained from the International Cocoa Organisation. Wherever local cocoa prices are available, we consider these local prices as indicative of the evolution of those cocoa prices that are relevant to the local economies. For Cameroon, Ghana, and the Cote d'Ivoire, such local cocoa prices are available for the years 1980–2003. For the remaining countries, we use the international price instead. Two versions of these international prices are available, the one denoted in SDR currency and the other in US dollars. We consider either version and retain the one that delivers the better econometric fit.
In all cases, cocoa prices in levels are assumed to affect inflation in their logarithmic growth rates κ, which we will casually call the cocoa inflation. Prices for Francophone countries are slightly higher than for Ghana. Prices of most agricultural export commodities in West Africa are not set under competitive conditions. Rather, they are set by governments and are adjusted on yearly basis. Yet, co-movements were observed among all the prices (dollar equivalents) with the implication that strong price transmission exists among countries and between the international price and domestic prices (results not reported). Thus, we argue that these domestic cocoa prices exhibit flexible behaviour. Although Nigeria is the third largest producer of cocoa in the region, the exceptionally strong influence of oil on the economy is expected to blur the influence of cocoa prices. For this reason Nigeria was excluded from the analysis.

2.4 Migrant remittances

Migrant remittances are transfers from relatives working abroad, mainly in developed economies and are of considerable importance in many developing countries. By definition, these transfers are part of disposable income but not of GDP. They are part of the Balance of Payments Statistics and comprise the combined value of worker remittances and labour income (compensation of employees). The World Bank Development Indicators database serve as the source of data on remittance flows. For those countries where data on migrant remittances from abroad were available, we also consider this variable as a potential influence on inflation. For Benin and Togo, the remittances are available for 1974–2001, and for Cameroon, for 1960–2001. For Ghana, the official series starts in 1975 but it shows zero entries for some early years. For the Cote d'Ivoire, remittances will not be considered. We denote remittances by r. These remittance data were previously used by Jumah and Kunst (2005).

3. Preliminary regressions

Prediction of an economic series requires modelling the target series exclusively as a function of lagged explanatory variables, since current exogenous variables are unavailable out of sample. In order to gain insights into the mechanisms at work, however, we initially report results from some 'static' regressions that contain current regressors. Table 1 reports such regressions, with the dependent variable specified as π in all cases and the lagged variables taken from the list of possible regressors q , q-1, κ, k-1, r,r-1 such that only one lag was retained for each variable. The regression model

$$\pi_t = a + b_1 q_{t-*} + b_2 k_{t-*} + b_3 r_{t-*} + \varepsilon_t \quad (1)$$

is estimated by least squares for each individual country over the time range ending in 2001, with * either being 0 or 1, as suggested by t–statistics. There is no case, where we obtained more than one significant lag of a regressor, such that a full model with current and lagged regressors would be definitely over-specified. One significant lag of a regressor, such that a full model with current and lagged regressors would be definitely over-specified.

Table1: Preliminary regressions. Dependent variable is CPI inflation π.	Benin	Cameroon	Cote d'Ivoire	Ghana	Togo
constant	-1.316	0.126	0.036	-0.144	0.006
	[-1.945]	[2.690]	[3.598]	[-0.478]	[0.040]
q	-0.019*	0.010 *	-0.000 *	-0.000 *	-
	[-2.215]	[1.574]	[-0.739]	[-0.448]	-
κ	0.184	0.230	0.084	0.575 *	0.160
	[2.108]	[4.669]	[2.069]	[3.588]	[1.386]
r	0.108 *	0.039 *	-	0.019	0.004
	[2.181]	[1.634]	-	[0.795]	[0.331]
R2	0.435	0.635	0.396	0.492	0.098
d	1.710	2.322	1.744	1.623	1.278

Note: Asterisks indicate that explanatory variables have been used in first lags.

There is some dispersion among the countries. The coefficient of determination R2 is poor for Togo. The Durbin-Watson statistic did not indicate too serious autocorrelation in most errors, excepting the Togo regression. While the Durbin-Watson d is not the most powerful instrument for checking autocorrelation, the rather short samples do not suggest a focus on sophistication in this regard. Residual correlograms were inconspicuous, and second-order lags were generally insignificant. These observations suggest restricting attention to first-order time lags throughout the analysis.

Cocoa inflation is the most important determinant for CPI inflation, its coefficient is positive and significant in most cases. The influence of the other regressors is less certain. Evidence on the influence of deficits on inflation is mixed. There are cases of positive and of negative effects of deficits, while remittances usually help in moderating inflation. The significance of such effects is restricted to the case of Benin. Many variables are modelled better as having a one-year lag causal effect on π, thus supporting the view that the influence of commodity prices on consumer prices occurs through an overshooting of commodity prices being corrected over time (see also, Browne and Cronin, 2007). This lagged effect could be a useful property for forecasting. In those cases where local cocoa prices are not available, the US

dollar price series yield better, though very similar, results than the SDR series. Consequently, the remainder of this paper will employ the US dollar price series.

Building on the single-equation model, we also experiment with panel-type analysis. The panel models assume that some or all regression coefficients were equal for all countries. A difficulty is that the variables are defined heterogeneously. For example, the fiscal indicator was replaced by a bond rate in the case of Benin, while we do not use any fiscal indicator for Togo. For all other countries, a deficit/GDP ratio is used. In order to make up for this inconsistency, we re-defined the fiscal indicator for Benin by inverting the sign, which is implied by the observation that higher deficits, i.e., more negative fiscal balances, corresponded to higher bond rates. Furthermore, the Benin variable is brought to a comparable scale. A similar problem had to be solved crudely for the remittances data. We find that the hypothesis of common effects $\mu_i = \mu$ in the equation

$$\pi_{it} = a + b_1 q_{it} + b_2 k_{it} + b_3 r_{it-1} + \mu_i + \varepsilon_{it} \quad (2)$$

is rejected at the 1% significance level. In this panel model, the index i denotes countries and therefore runs from 1 to N=5, while the index t is the time subscript. For details on panel estimation, see Hsiao (2004) or Baltagi (2001). The current value of q and κ and the first lag of r are selected according to the better fit relative to the full specification. In view of the small number of cases (N=5), we focus attention on the fixed-effects specification. The results are given in Table 2. The cocoa price inflation κ has the expected positive coefficient, while the influence of the remaining variables remains statistically insignificant. Also, for the panel regression, remittances appear to have a slightly negative, i.e., dampening influence on inflation.

Table 2: Fixed-effects estimation. Dependent variable is CPI inflation π.	
q	-0.004
	[-0.757]
κ	0.141
	[2.677]
r_{-1}	-0.018
	[-1.632]
Country effects	
Benin	0.275
Cameroon	0.012
Ghana	0.431
Cote d'Ivoire	0.043
Togo	0.263
R^2	0.516
d	1.924

From Table 2, the fixed effects estimates are large for Benin, Ghana, and Togo, which indicates that these countries show stronger inflationary tendencies than Cote d'Ivoire and

Cameroon. These effects could be due to missing variables or to a stronger reaction to cocoa inflation κ, which was dampened by the panel restriction of a common b2. The latter reason

may play a role for Ghana, where the coefficient in the individual regression turns out to be the largest in the whole group of countries.

Statistically, equality of coefficients b1 to b3 across countries is rejected at reasonable significance levels, which appeared to invalidate the panel approach. In order to assess the sensitivity of the results with respect to the variation of specific coefficients across individuals, we consider the mixed-effects approach that is illustrated in Frees (2004) and has been implemented in the statistical program STATA 9. In the simplest form of such models, a coefficient bj is viewed as a random variable, $N(\bar{b}j, \bar{\sigma}j)$ with mean $\bar{b}j$.

Table 3 reports the coefficient estimates based on this approach for the full sample. Due to the small sample size and problems with degrees of freedom and missing values, we allow only one coefficient to be random in each model.

Roughly, random modelling of all coefficients corresponds to individual least-squares regression, while random modelling of the intercept only corresponds to the random-effects panel model, which is rejected convincingly using the Hausman test. Thus, the mixed-effects specifications can be viewed as intermediate between the individual least-squares and the fixed-effects models. The point estimates in Table 3 mainly serve as a tool for exploring the sensitivity of the results of the two (preferred) benchmark models. Relative to the FE–model, some models yield a slightly larger effect of cocoa inflation b2, while the effect of lagged remittances b3 show a reverted, positive sign in three specifications. As a result, the evidence of a dampening effect of remittances on inflation is found to be fragile and should be interpreted with caution.

We take up the fixed-effects panel approach in the forecasting experiment again, in order to assess whether the statistically rejected simplified model may still be useful in improving predictive accuracy. Improved forecasting performance based on statistically invalidated model specifications has been reported in econometric research (see Clements and Hendry, 1999). These important research contributions suggest that invalid models should not be discarded automatically for the aim of prediction.

Table 3: Mixed-effects estimation. Dependent variable is CPI inflation π.

(The coefficient marked over each column is assumed as random).	q	κ	r_{-1}	constant
q	0.003	0.001	-0.004	-0.003
[0.55]			[-1.51]	[-0.64]
κ	0.257	0.300	0.235	0.159
[4.94]			[5.98]	[3.04]
r_{-1}	0.006	0.007	0.002	-0.003
[2.40]			[0.71]	[-0.44]
σu	0.083	0.041	0.045	0.099
σε	0.101	0.127	0.128	0.106

Note: σu is the estimate for the standard deviation of the relevant variable-specific random effect. σε is the estimate for the standard deviation of the idiosyncratic errors.

4. Prediction

4.1 Forecasts using single equations

For the first forecast experiment, single-step predictions of π are calculated using a variant of the equation that is shown in Table 1. In view of the requirements of forecasting, we rule out the use of current regressors. Instead, π is now regressed on one own lag π-1 and on lags of the three other variables, q-1, $-\kappa-1$, r-1 whenever these are available. Own-lag dependence is surprisingly weak but we will not give detailed coefficient estimates, as they change over the experiment. In detail, the first forecast is for π in 1996 based on data and estimates up to 1995. Similarly, out-of-sample predictions are generated for the years 1997–2001, which yield six different predictions for all countries.

Table 4: Statistics for single-equation prediction experiment.			
	MAE	RMSE	st.d.
Benin	0.0808	0.914	0.0651
Cameroon	0.0330	0.0419	0.0675
Cote d'Ivoire	0.0205	0.0284	0.0609
Ghana	0.1148	0.1316	0.2042
Togo	0.0244	0.0283	0.0774

Note: MAE and RMSE are the usual mean absolute errors and root mean square errors for comparing forecasts and observations over the years 1996–2001. st.d. is the standard error of the predicted variable π.

The success of the experiment varies somewhat across countries. Table 4 gives the main statistics. For the case of Benin, the root mean squared error (RMSE) over the six prediction years exceeds the standard error of the variable π over the full sample. This indicates that the forecasts are very poor. Indeed, an inspection of the forecasts revealed that inflation is persistently over-predicted for the whole range. This behaviour is probably due to the incidence of high inflation in the early 1990s. A similar feature, although in a less pronounced way, is seen for the case of Cameroon. In the remaining three countries, forecasts track sample observations reasonably well.

4.2 Forecasts using a fixed-effects panel

In analogy to the single-equation model, the fixed-effects panel also has to be adapted to the forecasting situation. Equation (1) is replaced by

$$\pi it = a + b1qit\text{-}1 + b2kit\text{-}1 + b3rit\text{-}1 + \mu i + \varepsilon it \qquad (3)$$

such that the regressors are available one time period ahead of the predicted rate of inflation. Coefficients bj, j=1,…,3, μi, i=1,…,5 are estimated by the usual least-squares dummy variables approach (e.g., see Baltagi, 2001, or Hsiao, 2004) for the time period ending in 1995, and πit was predicted for i=1,…,5 and for t=1996.

The procedure was repeated for the following observations, until 2001 was reached. Since coefficient estimates change over time, we do not report them. The general pattern conformed to the version of Table 2, with a strong positive effect of cocoa inflation κ and insignificant effects from the remaining variables.
The forecasting performance of the panel approach is summarized in Table 5. We note that reaction to using the panel rather than single equations was not homogeneous.

The results improve remarkably for Benin and Ghana and deteriorate for all other cases. Presumably, deteriorations are rooted in the unsatisfactory treatment of the regressors q and r, which are not quite identically defined across countries. If these regressors affect inflation in individual countries, this information is lost or blurred in the panel. Conversely, improvements in forecasting accuracy may be due to the increase in degrees of freedom and to a more precise estimation of the influence from cocoa inflation κ.

Table 5: Statistics for panel prediction experiment.			
	MAE	RMSE	st.d.
Benin	0.0345	0.0146	0.0651
Cameroon	0.0560	0.0475	0.0675
Cote d'Ivoire	0.0722	0.1105	0.0609
Ghana	0.0413	0.0529	0.2042
Togo	0.0531	0.0533	0.0774

Note: see Table 3.

It is also of some interest to compare the prediction performance of the panel model to a version with suppressed individual effects, such that the forecast corresponds to the average country in the set. In this experiment, the results for Benin and Togo are of comparable quality, while those for the remaining cases deteriorate strongly. This reflects the fact that Cameroon, Cote d'Ivoire, and Ghana demonstrated a greater difference to the sample average. As Table 5 shows, individual effects are below average—i.e., there is less inflation—for Cameroon and Cote d'Ivoire and above average for Ghana.

In accordance with their characteristics, which were intermediate between the single-equation and the fixed-effects models, the mixed-effects models introduced in Section 3 revealed a forecasting performance that was, in a sense, intermediate. For Benin and Ghana, they outperformed the single-equation model but did not quite attain the precision of the FE panel.

For the remaining countries, they are dominated markedly by the single-equation model. Therefore, their prediction performance is not reported in detail here.

5. Summary and conclusion

Some recent studies have shown that the traditional role of commodity prices as leading indicators of consumer price inflation occurs through a money-driven overshooting of commodity prices being corrected over time. Yet, a re-examination of the causes of inflation has shown lately that analytically it is very difficult to propose a general theory of inflation because as economies evolve over time both new causes of inflation emerge and the consequences of inflation become more complex. This paper verifies whether cocoa prices could be a source of inflation in five countries of the West African region within a framework that includes other variables such as migrant remittances to the region and a fiscal policy variable represented by the government budget deficit. Unlike earlier studies that explicitly use money supply variables, the inclusion of migrant remittances enables us to examine the effect of an international capital flow variable on inflation.

The results show that the influence of the cocoa price on consumer price inflation is strong and statistically significant. This revelation renders the recommendation that developing country governments should pay farmers in the commodity export sector fairer prices open to

discussion. Higher commodity export prices for farmers would lead to higher inflation, a lowering of the purchasing power and thus, a worsening of the situation of the very farmers the government intends to help. One solution for this puzzle would be a diversification of the economy away from export dependence on a single agricultural commodity. Another would be the existence of a central bank whose credibility ensures that inflationary expectations are well anchored because with well-anchored expectations, price shocks are less likely to have second-round effects.

The influence of other explanatory variables, i.e., the budget deficits and migrant remittances remained much weaker, although some studies (e.g., Catao and Terrones, 2003; and Fischer et al., 2002), have established a strong, nonlinear relationship between fiscal deficits and inflation in developing and high-inflation economies. Celasun et al. (2004), however, have shown that improvements in primary fiscal balances have played a major role in curbing inflationary expectations. They deduce that strengthened primary balances seem to have sent strong signals about the commitment of governments to public debt sustainability, despite the fact that in some countries the stocks of public debt were increasing on account of large banking sector bailouts. It appears that migrant remittances tend to dampen inflationary tendencies rather than augment them.

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