IMF WORKING PAPER

WP/94/93

INTERNATIONAL MONETARY FUND

African Department

Linkages in Price Level and Inflation Rate Between CFA Franc Zone Countries and France

Prepared by Diep Nuven 1/

Authorized for distribution by Pierre Dhonte

August 1994

Abstract

The price level behaviors of the CFA franc zone countries with respect to the price level of France, defined in terms of long-run convergence in price level and short-run linear dependence of their inflation rates are not homogenous and have a break-point in the mid 1980s except for Congo. This paper quantifies the evolution of the price level behavior of each CFA franc zone country from 1979 to 1993 using the cointegration and error-correction model techniques. The interzone linkages are also examined using the simple vector autoregression model.

JEL Classification Number:

C22, E37

1/ The author thanks Gerard Belet, Pierre Dhonte, Michel Galy, James Gordon, Geoffrey Mwau, David Orsmond, Gilbert Terrier, Jules de Vrijer (all from the African Department, IMF) for valuable comments and suggestions. The usual disclaimer applies.

Contents

Summary

This paper investigates convergence in the price levels of the CFA franc zone countries to that of France and the interdependence of their inflation rates using the cointegration technique. Monthly data from 1979 to 1993 show that cointegration in price levels is accepted at the 5 percent confidence level in only 2 of 11 CFA franc zone countries. These results seem to contradict previous findings and the commonly held view that support the long-term convergence of price levels of these countries.

The Chow test proves that there is a change in the price level behavior in the mid-1980s. Regressions from 1979 to the break point and from the break point to 1993 provide different results. Over the first subperiod, the price levels of six countries are cointegrated with the price level in France. They are Burkina Faso, the Congo, Côte d'Ivoire, Mali, Niger, and Togo. Over the second subperiod, the price levels of seven countries are cointegrated with the price level in France: Burkina Faso, Cameroon, the Central African Republic, the Congo, Niger, Senegal, and Togo. Moreover, in all cases except the Congo, the cointegration regression coefficients change more or less significantly.

The above results clearly indicate a structural change in the price level pattern of the CFA franc zone countries in the mid-1980s. These findings are confirmed by the results of the error-correction model, which makes it possible to estimate the speed of adjustment of the price levels. Although the error-correction model explains little of the variations in the CFA countries' monthly inflation rate, it can be helpful in predicting these inflations. The vector autoregression model is used to examine the causal relationship in inflation rates among the countries of the same monetary union. Based on the available data, no causal relationship can be determined.

I. Introduction

This paper examines the convergence of the price level of the CFA franc zone countries (hereafter called CFA countries) to that of France and the interdependence of their inflation rates. The currency of the CFA countries is linked to the French franc at a fixed parity that was CFAF 50 = FF 1 up to 1993 (on January 12, 1994, the parity was changed to CFAF 100 = FF 1). There is de facto freedom in capital and goods market movements between France and the member countries and between the member countries. Moreover, the CFA countries form two distinctive currency unions, each with its own central bank: the BCEAO (Banque Centrale des Etats de l'Afrique de l'Ouest) whose members comprise Benin, Burkina Faso, Cote d'Ivoire, Mali, Niger, Senegal, and Togo; and the BEAC (Banque des Etats de l'Afrique Centrale) with a membership comprising Cameroon, Central African Republic (C.A.R), Chad, Congo, Equatorial Guinea, and Gabon. The relationship between the price levels and inflation rates of the CFA countries and those of France are expected to be asymmetric. France is the economically dominant country in the union and thus the inflation rates of the CFA countries should have little impact on France's inflation rate. On the contrary, a change in price level in France should cause some change in price levels in the CFA countries. Throughout this paper, these causality assumptions will be made.

Given these arrangements, based on the Relative Purchasing Power Parity (PPP), one would first expect that in the long run the price level of each CFA country converges to the French price level. In terms of econometrics, the price level time series of France and each CFA country are expected to be cointegrated 1/. Second, the inflation rate of each CFA country would closely follow the French inflation rate. Any existing linkage between inflation rates would be best expressed in the framework of cointegration by the Engle-Granger (1987) error-correction model since the inflation rate is the first difference of the logarithm of the price level 2/. If the error-correction model (ECM) is applicable to the CFA countries, it will be helpful in predicting their inflation rates. And finally, there may be causality in price levels among the CFA countries in the sense that changes in the price level of one country cause changes in the price levels of other countries. If this Granger causality exists, then past inflation rates

---

1/ First, the price level time series are expected to be non-stationary and their first difference time series, stationary, i.e., the price level time series are expected to be integrated order 1, or I(1). Second, two I(1) variables are cointegrated when there exits a linear combination of the two that is stationary. Then the two variables are linked in the long run.

2/ Engle and Granger (1987) have shown that if two variables are cointegrated, then their first differences can be modeled as an error-correction model.

in some CFA countries are helpful in predicting inflation rates in other CFA countries.

Honohan (1992) studied the price level convergence in the CFA franc zone and in the South African rand zone. Using quarterly CPI from the early 1960s to 1988 for Burkina Faso, Cameroon, Congo, Cote d'Ivoire, Gabon, Niger, Senegal, and Togo, he found cointegration between France's and each CFA country's consumer price level, with the consumer price inflation rate in the CFA countries being largely determined by France's inflation rate despite wide short-run variations and slow long-run convergence.

Like Honohan's study, the main part of this paper tries to empirically verify the convergence of the price levels of the CFA countries to the French price level. More specifically, we want to find out in the near past and across the CFA countries to what extent the price levels converged to the French price level and whether the knowledge of the present French inflation rate and past data on price levels and inflation rates helped to predict the inflation rate in the CFA countries. We will neither try to explain why a convergence process in the price level may be triggered nor test the PPP under fixed exchange rates. As Honohan stated in his paper, "although our results reinforce the traditional model of the small open economy under fixed exchange rates, they must not be pushed too far."

Of course the economic background of the cointegration in the price level is still the PPP. Throughout the paper the linear relationship in price levels is called cointegration regression and the cointegration coefficient of the French price level is called beta. Again, if the PPP holds true for the CFA zone and the price indices are relative to the same base year, since the exchange rate is fixed within the CFA zone, beta should equal unity. But as Taylor (1988) and Cheung and Lai (1993) point out, beta is effected by many factors, including the structures of the price level index, variations in product quality, and transportation costs, resulting in an estimated value of beta likely not equal to unity 1/. Unlike Honohan's paper, this paper does not assume that beta is equal to 1.

The second difference is that while Honohan's study showed a common trend in the price levels of the CFA franc zone, our paper tries to uncover how and to what extent the convergence in price level and the linkage in inflation rate have changed during the last decade, which

---

1/ If the theoretical domestic and foreign prices are g and g^*, respectively, the PPP relationship under fixed exchange rates is $g=g^*+u$. If the actual domestic and foreign prices p and p^* are linearly related to g and g^*, respectively, then they are linearly related to each other and the beta coefficient of the regression between p and p^* is likely to be different than unity. See Cheung and Lai (1993).

Honohan called "divergences in cumulative inflation rates over as long as six or seven years.". In fact, changes in price behavior apparently occurred across all the CFA countries in the mid 1980s as illustrated by Charts 1 for the BCEAO countries and Chart 2 for the BEAC countries.

The sample period in our study is the 15 years from 1979 to 1993. To illustrate the changes in price behavior the sample period will subsequently be divided into two subperiods for each country. Since the cointegration tests require a large number of observations, preferably 50 or more, monthly data will be used. The choice of economic variables is limited. Not many monthly price level data are available in the CFA countries. In fact, the only monthly price level data available for most of the CFA countries are the consumer price indices. The CPI may not be the appropriate variable if one wants to test the PPP. But since our purpose is to find meaningful empirical linkages of price levels through cointegration regression and of inflation rates through the ECM, the CPI as an economic variable serves well this dual purpose: its logarithm is a good proxy of the price level and the first difference of its logarithm is a good proxy of the inflation rate.

Finally, the impact of France's price level and inflation rate will be removed fror the inflation rates of the CFA countries and the residual time series will be used to study the dynamic interdependence of inflation rate among the CFA countries.

The paper is organized as follows. Section II presents the data and the methodology. In Section III, the results of the impact of France on price levels and inflation rates in the CFA countries are presented and discussed. Section IV provides the results of the Granger causality among the CFA countries and Section V, a summary and concluding remarks.

II. Data and methodology

1. Data

The monthly seasonally adjusted consumer price indices (CPI) available in the IMF Information Notice System from January 1979 to December 1993 constitute our data base. The base of the CPI is 1980. Data for Benin and Equatorial Guinea are not available. The CFA countries under study include six countries from the BCEAO Burkina Faso, Cote d'Ivoire, Mali, Niger, Senegal, and Togo and five countries belonging to the BEAC Cameroon, Central African Republic, Chad, Congo, and Gabon. The price levels are defined as the countries' 100*ln(CPI). All these price levels will have the same base of 1980 equal to 100*ln(100)=460.5. The countries' month-to-month inflation rates expressed in percent are approximated by the first difference of the price level.

2. Methodology

Since regressing one random walk against another can lead to spurious results, the first step is to test the time series for unit roots before running the regression. If the null hypothesis of a unit root cannot be rejected, then it is useful to know the order of integration of the time series by testing its first difference for a unit root. If the null hypothesis of a unit root can be rejected for the first difference of the time series, then the original time series is said to be integrated order 1, i.e. I(1). The following step is to test the cointegration of two I(1) time series, which implies that the two variables move together in the long run. If the two variables are cointegrated, then the third step consists of running the regression of their first differences using an error-correction term to find the short-term linkage between the variables. These above steps are detailed as follows:

Step 1: The price levels of France and of each of the CFA countries are tested for random walk. The Dickey-Fuller *F*-test (see Pindyck and Rubinfeld, 1991) and the Dickey-Fuller *t*-test are used (see Engle and Granger, 1987 and Engle and Yoo, 1987). The null hypothesis of random walk (or unit root) is rejected if the computed statistics are greater than their critical values. Otherwise, the first difference of the price level time series, i.e., the inflation rate time series is tested for a unit root. If the null hypothesis of a unit root cannot be rejected for the price level and can be rejected for the inflation rate, then the price level is I(1).

Step 2: To test the cointegration between the two I(1) time series, the Durbin-Watson statistic of the cointegration equation and the Dickey-Fuller *t*-test are used. The augmented Dickey-Fuller *F*-test (ADF) seems to have lower power than the two above alternatives. The DW, DF, and ADF critical values for cointegration tests can be found in Pindyck and Rubinfeld (1991), Engle and Granger (1987) and Engle and Yoo (1987). If the price level of a CFA country is cointegrated with that of France, we say that there is convergence in long-run price levels between this CFA country and France with cointegration coefficient beta. The beta coefficient does not have to equal unity (cf. footnote on page 2).

Step 3: If the price levels of a CFA country and France are cointegrated, then the short-run inflation rate of this CFA country may be linked to France's inflation rate through an error-correction model. The Engle-Granger ECM uses the lagged residual of the price level cointegration regression as the error correction term or gap:

$$(1) \qquad DP_{CFA} = a + c*DP_F + d*gap,$$

where DP is at the same time the first difference of the price level and the inflation rate. The coefficient d of the gap is called the adjustment coefficient and is expected to be strictly negative. The

coefficient c is expected to be positive but it might not be statistically significant. The speed of adjustment in price level which represents the rate of convergence in price level can be now quantified. For monthly data, it takes $t_{.5} = \ln(.5)/d$ months to reduce a given deviation from equilibrium by 50 percent 1/. The term $t_{.5}$ is called 50% reduction time.

The sample period is January 1979-December 1993. To examine the change in inflation behavior of each CFA country, one should split the sample period into two distinct subperiods. To find the breakpoint we applied the Chow tests for a series of points in time. The breakpoint corresponds to the highest *F*-value. The breakpoint depends on the individual country.

To study the Granger causality between the CFA countries, a vector autoregressive (VAR) model is used for two separate periods and for the two separate monetary unions. Each country's variable is the residual of the error-correction regression, whether the country's price level is cointegrated with that of France or not, and should be independent of French price level and inflation rate. The VAR model contains only lagged variables in the right-hand side. The Granger causality shows whether or not the knowledge of a variable helps to predict the future value of another variable, which is the month-to-month inflation rate after the impact of France's price level and inflation rate have been removed.

III. Impact of France on price levels and inflation rates in the CFA countries

1. Stationarity

The results of the analysis show that all the inflation rate time series are stationary and all the price level time series are I(1) over the sample periods 1979-93.

2. Cointegration

The results of the cointegration estimations are presented in Appendices I - III. Over the period 1979-93, France's price level is cointegrated with those of Burkina Faso and Congo at the 5 percent level. For the rest of the CFA countries, although the R^2 of the cointegration regression are quite high, except those for Niger and Chad, the null hypothesis of no cointegration cannot be rejected at the 10 percent level. Based on the DF *t*-test over the entire sample period

---

1/ The ECM is equivalent to the differential equation $dy = aydt$, where y is the deviation from price level equilibrium resulting in the response function $y = e^{at}$ and the 50 percent reduction time $t_{.5} = \ln(.5)/a$.

1979-93, one may conclude that the link in price level between France and CFA countries varied in magnitude, from strong (Congo, Burkina Faso) to weak (Cote d'Ivoire, Mali, Togo, Cameroon, Chad) and nonexistent (Niger, Senegal, C.A.R., Gabon). These results are in contrast to Honohan's findings. Changes in the price level behavior of most CFA countries with respect to France's price level during the 1980s are confirmed by Chow tests. The breakpoints obtained by Chow tests are presented in Table 1.

Table 1. Breakpoints of CFA zone countries

Country	Break point
Burkina Faso	May 1986
Cote d'Ivoire	February 1986
Mali	August 1986
Niger	June 1986
Senegal	February 1985
Togo	June 1983
Cameroon	October 1986
C.A.R.	October 1985
Chad	October 1983
Congo	May 1984
Gabon	January 1988

The rest of this section looks at the behavior of each CFA country's price level during the two subperiods prior to and after its own breakpoint. They are called first and second subperiods and vary from one country to another. Over the first subperiod, the hypothesis of no-cointegration can be rejected at the 5 percent level for six countries (Burkina Faso, Cote d'Ivoire, Mali, Niger, Togo, and Congo). Every R^2 of the cointegrating regressions is close to unity, Chad being an exception. The estimates of beta are also close to 1, except in Cote d'Ivoire and Chad. We also note that the cointegration regression t-values are large, except in Chad, which implies that the confidence intervals of beta are narrow. Based on both the DW and DF t-values we can conclude that over the first subperiod the link in price level between France and all CFA countries was strong or moderately strong, with the exception of Chad and Gabon.

Over the second subperiod, the hypothesis of no-cointegration can be rejected for seven countries at the 5 percent level - Burkina Faso, Niger, Senegal, Togo, Cameroon, C.A.R., and Congo. However, for all these countries except Congo, the estimates of beta are no longer close to unity. In particular, the coefficients for Niger and Senegal are significant and negative, meaning that in the long run, Niger and Senegal's price levels are negatively correlated with France's price level. Note that the R^2 for each country is also smaller than over the first subperiod, except for Niger. The above results can be summarized

in Table 2. We can see that there is a dramatic shift in price level behavior of the CFA countries with respect to France's price level in the mid-1980s, with Congo as an exception.

Table 2. Results in cointegration in price level.

	Pre-breakpoint				Post-breakpoint			
Country	Cointegration/ convergence 1/	R2	Estimated beta	(t-value)	Cointegration/ convergence 1/	R2	Estimated beta	(t-value)
Burkina Faso	strong	0.96	0.83	(46.92)	strong	0.30	0.22	(6.2)
Cote d'Ivoire	strong	0.95	0.68	(38.30)	moderate	0.83	0.86	(21.6)
Mali	strong	0.96	1.01	(43.55)	moderate	0.04	0.12	(1.8)
Niger	strong	0.90	0.95	(23.96)	strong	0.93	-1.18	(38.5)
Senegal	weak	0.95	0.99	(36.71)	strong	0.35	-0.20	(7.5)
Togo	strong	0.98	1.16	(53.73)	strong	0.18	0.09	(5.20)
Cameroon	moderate	0.97	1.19	(52.89)	strong	0.55	0.36	(10.3)
C.A.R.	moderate	0.99	1.06	(124.00)	strong	0.44	0.16	(8.7)
Chad	weak	0.01	0.04	(0.70)	moderate	0.16	-0.33	(4.9)
Congo	strong	0.98	0.98	(62.70)	strong	0.88	0.84	(29.9)
Gabon	weak	0.99	1.03	(98.30)	weak	0.02	0.22	(1.2)

1/ Cointegration means linkage in price level or convergence in long-run price level.

3. Error correction model

Having established that there was a change in price level behavior in the mid-1980s in all the CFA countries except Congo, we only examine the error-correction regression results over the two subperiods prior to and following the breakpoint. The ECM (see equation (1) on page 5) is applied for each country over each subperiod even when the null hypothesis of no-cointegration cannot be rejected. The results are detailed in Appendices II and III and summarized in Table 3.

Table 3. Results for Inflation Rate from the Error-Correction Model

	Pre-breakpoint			Post-breakpoint		
Country	Estimated adjustment coefficient	(t-value)	50% reduction time 1/	Estimated adjustment coefficient	(t-value)	50% reduction time 1/
Burkina Faso	-0.46	5.2	1.5	-0.39	4.8	1.8
Cote d'Ivoire	-0.24	3.4	2.9	-0.09	2.4	7.8
Mali	-0.41	4.8	1.7	-0.09	2.2	7.3
Niger	-0.22	2.8	3.1	-0.22	3.8	3.1
Senegal	-0.08	1.8	8.6	-0.29	5.0	2.4
Togo	-0.30	2.6	2.3	-0.25	4.6	2.8
Cameroon	-0.17	3.6	4.2	-0.26	4.6	2.7
C.A.R.	-0.18	2.9	4.0	-0.36	4.7	1.9
Chad	-0.09	2.5	8.1	-0.13	3.4	5.4
Congo	-0.30	3.4	2.3	-0.18	2.7	3.8
Gabon	-0.07	2.2	9.5	-0.05	1.2	13.3

1/ Time in months to reduce a given price level deviation from equilibrium by 50 percent

All the estimates of the adjustment coefficients d are negative as expected. Moreover they all are statistically significant, except Senegal in the first subperiod and Gabon in the second subperiod, meaning that the deviation in price level between a CFA country and France is helpful in predicting the next period's inflation rate. The 50 percent reduction time $t_{.5}$, expressed in months needed to reduce a given price level deviation from equilibrium by 50 percent, is computed from the estimate of the coefficient d for each country in each subperiod. When comparing the results in Tables 2 and 3 one notes that whenever there is cointegration in price level, the 50 percent reduction time $t_{.5}$ is small, in fact less than four months, and vice versa. In other words, the results from the ECM reconfirm the results from the cointegration regression. Finally, the small values of the R^2 of the ECM regression suggest that France's inflation rate and the gap in price level explain little of the variation in the CFA countries' inflation rates, suggesting that the latter are influenced by other exogenous variables.

The above results can be summarized as follows: Congo's linkage with France in price level and inflation rate is strong throughout the entire period 1979-93. The estimated value of its beta coeffficient changes from 0.98 in the first period to 0.84 in the second period, and the 50 percent response time, from 2.3 months to 3.8 months. Compared with other CFA countries, these changes are small indeed. Cameroon and C.A.R.'s linkages in price level with France switch from moderate in the first period to strong in the second, while their beta coefficients are largely reduced in the second period. The linkages between Chad and France are erratic in the first period and become moderate in the second period while the linkages between Gabon and France go from moderate to weak. The BCEAO countries' changes in price level behavior are more homogeneous. Burkina Faso, Niger, and Togo's linkages are strong during the two subperiods although the estimates of their beta coefficients change from close to unity to 0.22, -1.18, and 0.09, respectively. Cote d'Ivoire and Mali's linkages go from strong to moderate but while Cote d'Ivoire's beta coefficient increases from 0.68 to 0.86, Mali's one decreases from 1.01 to 0.12 . The linkage between Senegal and France from weak to strong but its beta goes from 0.99 to -0.2.

IV. Causal Relationship Among CFA Countries

The error-correction model can be employed to remove the impact of France from the CFA countries in terms of inflation rate, whether there is cointegration or not. Indeed, the residuals of the ECM equations for all CFA countries are no longer dependent on France's price level and inflation rate. They are used in our Vector Autoregression (VAR) model to study the interzone Granger causality in the inflation rate. We found that the impact on the inflation rate across borders is insignificant after two months. Our VAR model contains the residuals on the left-hand side and the right-hand side contains the first- and

second-lag residuals. It is separately estimated for the BCEAO and BEAC countries. The sample periods are, respectively, the intersection of the first subperiods and second subperiods of the countries of each zone. For the BCEAO the periods are 1979-May 1983 and November 1986-93. For the BEAC, they are 1979-September 1983 and 1988-93.

For country B's inflation to cause country A's inflation,
(a) the coefficients of B's lagged variables should be significant,
(b) A's inflation should not cause B's inflation,
(c) the statistic R^2 should not be too small so that the lagged variables of B should contribute significantly to the explanation of the variation of A, and
(d) the sum of the significant coefficients of the lagged independent variables should be positive since rising inflation in B should cause rising inflation in A in the near future and if B is contemporaneously correlated with C, some coefficients may be significant and negative.

The Granger causality simply means that the knowledge of B's inflation may help to predict A's future inflation. The VAR results presented in Table 4 should be interpreted with that in mind. Besides the causality of Burkina Faso and Mali on Niger over the period 1979-May 1983, the VAR does not support other causal relationship for any of the countries.

Table 4. Results in Interzone Granger Causality

BCEAO	1979–May 1983				Nov 1986–1993			
Country	Causing country	Lag	Estimated coefficient	R bar-square	Causing country	Lag	Estimated coefficient	R bar-square
Niger	Burkina Faso	1	0.345	0.10				
	Mali	1	0.261					
	No other significant results				No significant results			
BEAC	1979–November 1993				April 1988–1993			
	No significant results				No significant results			

V. Concluding Remarks

This paper empirically examined the long run convergence of 11 CFA countries' price levels to that of France and the ex post predictability of their month-to-month inflation rates based on France's contemporaneous inflation rate and all past price level and inflation rate data. Using the cointegration approach, we shed some light on the linkage between France and each CFA franc zone country in price level and inflation rate. We found that there is clearly a breakpoint in the price level behavior of every CFA country except Congo with respect to France's price level in the mid-1980s. The linkage between a CFA country and France over each subperiod is defined in terms of long-run convergence in price level and quantitatively specified by (a) the estimated value of beta as the level of convergence in price level, (b) the 50 percent reduction time $t_{.5}$ as the rate of convergence in price level, and (c) the relationship between the inflation rates expressed by the error-correction model.

The above-defined linkage varies greatly among the CFA countries. Overall the linkage between the BCEAO countries and France is more homogeneous and solid than between the BEAC countries and France, although Congo is strongly linked to France. The error-correction model is helpful in predicting the inflation rate of all the CFA countries, although both France's inflation rate and the lagged difference in price level explain little of the variations in their month-to-month inflation rates. We employed the Vector Autoregression model to study the causality in inflation rates among the countries of the same monetary unions. Our conclusion is that the Granger causality in inflation rates cannot be determined.

This paper quantifies the changes in behavior of the price levels and does not elaborate on the economic causes of these changes which surely are country or region specific. As a final note, we want to point out some likely causes of these changes:

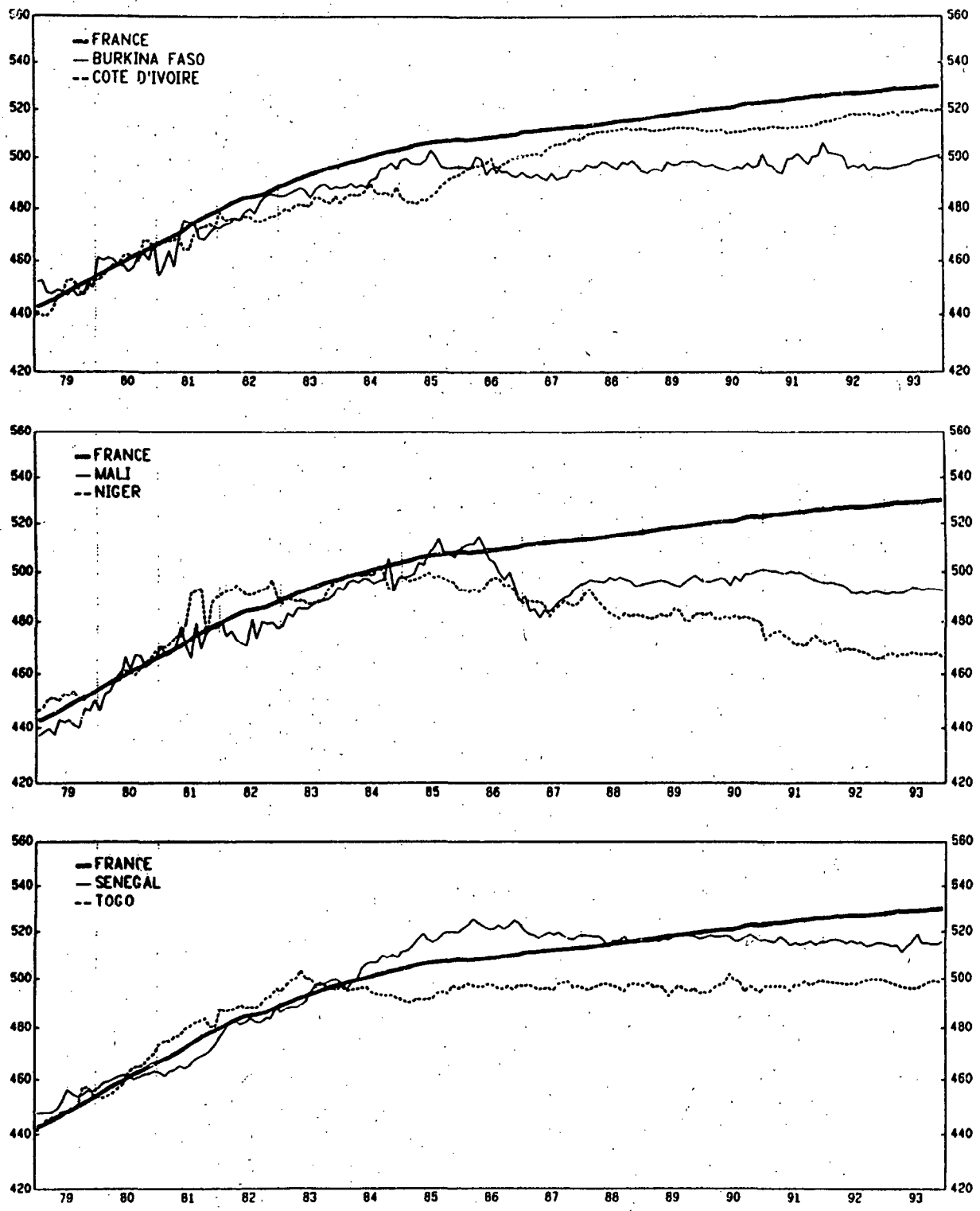
(1) the maintenance of a fixed parity in exchange rates despite changes in export prices sometime in the 1980s, which may have resulted in an unbalanced PPP;

(2) the untimely change or lack of timely change in the structure of each country's CPI basket, in particular the weight of import goods and price-controlled goods such as rent;

(3) the influence on price level and inflation of neighboring non-CFA franc zone countries, such as Nigeria, which experienced some important economic and trading practice changes in the mid 1980s.

CHART 1

CFA ZONE (BCEAO)
SEASONALLY ADJUSTED PRICE LEVEL, 1979-93 1/

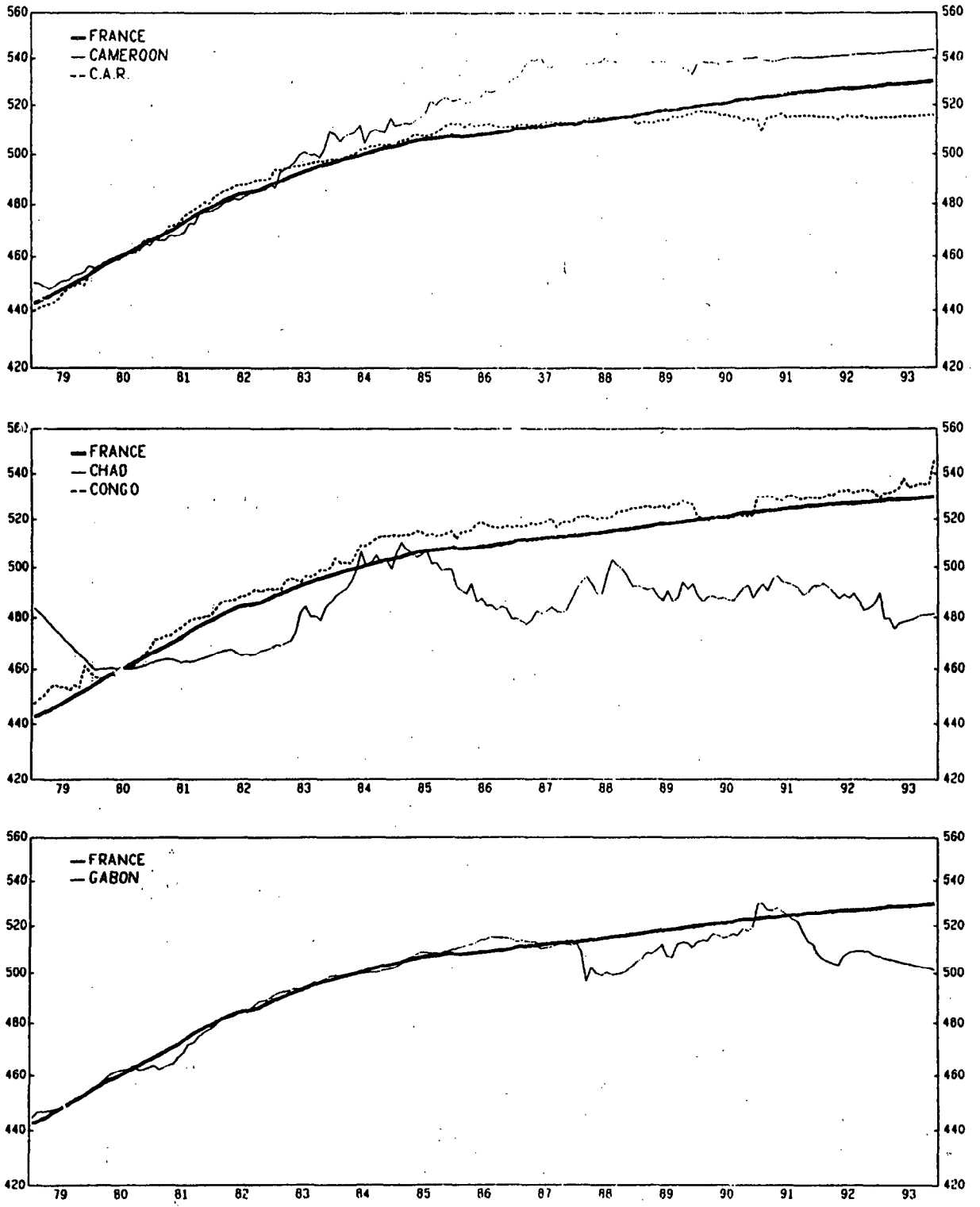


Source: IMF, Information Notice System.

1/ Defined as 100*ln(CPI), with 1980 equal to 100*ln(100)=460.517.

CHART 2

CFA ZONE (BEAC)
SEASONALLY ADJUSTED PRICE LEVEL, 1979-93 1/



Source: IMF, Information Notice System.

1/ Defined as 100•ln(CPI), with 1980 equal to 100•ln(100)=460.517.

APPENDIX 1. Cointegration and Error Correction Models – Period 1979–93
(Monthly data)

		Burkina Faso	Cote d'Ivoire	Mali	Niger	Senegal	Togo	Cameroon	C.A.R.	Chad	Congo	Gabon
Cointegration regression in price level with France												
Regression	Beta	0.62	0.88	0.62	0.19	0.91	0.54	1.27	0.88	0.36	1.03	0.82
	T–value	40.65	62.43	23.40	4.83	39.67	26.31	72.08	60.53	11.88	116.62	36.00
	Significance of beta= 1											
	R2	0.90	0.96	0.75	0.12	0.90	0.80	0.97	0.95	0.44	0.99	0.88
	DW	0.28	0.13	0.14	0.04	0.04	0.05	0.08	0.04	0.08	0.37	0.06
	Signif. of coint. test											
DF t–test	Coefficient 1/	−0.14	−0.06	−0.07	−0.02	−0.01	−0.04	−0.05	−0.02	−0.48	−0.16	−0.02
	t–value	3.62	2.40	2.56	1.54	0.85	2.37	2.40	1.27	2.35	3.57	0.81
	Signif. of coint. test	*									*	
ADF F–test	Unrestricted R2	1047.82	444.41	1390.47	1161.60	361.67	389.65	433.43	150.21	1263.87	490.89	613.06
	Restricted R2	1095.87	452.61	1448.41	1229.20	366.40	414.31	441.73	161.46	1299.37	522.73	625.95
	F–value	1.74	0.70	1.58	2.21	0.50	2.40	0.73	2.85	1.07	2.46	0.80
	Signif. of coint. test											
Error–correction regression in inflation with gap= lagged residual of cointegration regression												
France	Coefficient	0.79	0.56	0.79	1.42	0.88	1.01	0.42	1.17	0.11	0.58	1.10
	t–value	1.52	1.69	1.23	2.65	2.92	3.50	1.25	5.82	0.20	1.68	2.84
	Significance				*	*	*		*			*
Gap	Coefficient	−0.14	−0.06	−0.07	−0.03	−0.01	−0.04	−0.06	−0.02	−0.50	−0.17	−0.01
	t–value	3.60	2.39	2.55	1.65	0.85	2.60	2.94	1.23	2.38	3.69	0.75
	Significance	*	*	*			*	*		*	*	
	T1 (50%)	4.98	10.95	9.92	27.61	54.88	15.50	11.06	36.01	1.40	4.15	47.60
	T2 (95%)	21.55	47.39	42.95	119.52	237.53	67.07	47.86	155.84	6.06	17.96	206.04
	R2	0.08	0.05	0.04	0.05	0.06	0.09	0.07	0.17	0.03	0.09	0.05

* Indicates significant at the 5 percent level.
For cointegration test, the critical DW value is 0.386.
For Dickey–Fuller cointegration test, the critical t–value is 3.37, and for the ADF F–test, the critical value is 6.5.
For OLS, the critical t–value is 1.96.

1/ Note that every estimate of the slope in the DF t–test regression is negative.

APPENDIX 2. Cointegration and Error Correction Models – First period
(Monthly data)

		Burkina Faso	Cote d'Ivoire	Mali	Niger	Senegal	Togo	Cameroon	C.A.R.	Chad	Congo	Gabon
Period	from	Jan 79	Jan 79	Jan 79	Jan 79	Jan 79	Jan 79	Jan 79	Jan 79	Jan 79	Jan 79	Jan 79
	to	Apr 86	Jan 86	Jul 86	May 84	Jan 85	May 83	Sep 86	Sep 85	Sep 83	Apr 84	Dec 87
Cointegration regression in price level with France												
Regression	Beta	0.83	0.68	1.01	0.95	0.99	1.16	1.19	1.06	0.04	0.98	1.03
	T–value	46.92	38.30	43.55	23.96	36.71	53.73	52.89	124.00	0.70	62.70	98.30
	Significance of beta=1			*	*	*					*	
	R2	0.96	0.95	0.96	0.90	0.95	0.98	0.97	0.99	0.01	0.98	0.99
	DW	0.88	0.43	0.81	0.42	0.13	0.62	0.19	0.29	0.06	0.59	0.12
	Signif. of coint. test	*	*	*	*		*				*	
DF t–test	Coefficient 1/	−0.46	−0.23	−0.41	−0.21	−0.05	−0.30	−0.12	−0.15	−0.07	−0.29	−0.06
	t–value	5.25	3.40	4.73	2.68	1.20	2.83	2.57	2.14	2.04	3.26	1.85
	Signif. of coint. test	*	*	*								
ADF F–test	Unrestricted R2	625.85	314.70	1024.43	737.83	155.73	149.37	279.70	46.13	74.27	139.87	60.28
	Restricted R2	773.50	364.51	1096.39	793.01	165.39	169.78	314.42	49.45	105.84	162.06	64.14
	F–value	9.44	6.01	2.88	2.09	1.98	3.01	5.21	2.23	10.20	3.57	3.17
	Signif. of coint. test	*								*		
Error–correction regression in inflation with gap=lagged residual of cointegration regression												
France	Coefficient	0.74	1.15	−0.31	2.12	−0.40	1.19	−0.61	1.52	−1.79	−0.08	0.71
	t–value	0.83	1.55	0.28	1.21	0.58	1.09	1.03	4.80	1.89	0.11	3.31
	Significance								*			*
Gap	Coefficient	−0.46	−0.24	−0.41	−0.22	−0.08	−0.30	−0.17	−0.18	−0.09	−0.30	−0.07
	t–value	5.21	3.44	4.81	2.75	1.82	2.64	3.58	2.89	2.53	3.39	2.17
	Significance	*	*	*	*		*	*	*	*	*	*
	T1 (50%)	1.50	2.85	1.68	3.12	8.57	2.30	4.18	3.96	8.06	2.27	9.49
	T2 (95%)	6.48	12.35	7.28	13.51	37.08	9.97	18.07	17.14	34.88	9.84	41.10
	R2	0.251	0.133	0.210	0.116	0.046	0.125	0.126	0.251	0.131	0.161	0.163

* Indicates significant at the 5 percent level.
For cointegration test, the critical DW value is 0.386.
For Dickey–Fuller cointegration test, the critical t–value is 3.37, and for the ADF F–test, the critical value is 6.5.
For OLS, the critical t–value is 1.96.

1/ Note that every estimate of the slope in the DF t–test regression is negative.

APPENDIX 3. Cointegration and Error Correction Models – Second period
(Monthly data)

		Burkina Faso	Cote d'Ivoire	Mali	Niger	Senegal	Togo	Cameroon	C.A.R.	Chad	Congo	Gabon
riod	from	May 86	Feb 86	Aug 86	Jun 84	Feb 85	Jun 83	Oct 86	Oct 85	Oct 83	May 84	Jan 88
	to	Dec 93	Dec 93	Dec 93	Dec 93	Dec 93	Dec 93	Dec 93	Dec 93	Dec 93	Dec 93	Dec 93
integration regression in price level with France												
Regression	Beta	0.22	0.86	0.12	−1.18	−0.20	0.09	0.36	0.16	−0.33	0.84	0.22
	T−value	6.15	21.60	1.78	38.53	7.46	5.24	10.28	8.74	4.86	29.89	1.18
	Significance of beta=1											
	R2	0.30	0.83	0.04	0.93	0.35	0.18	0.55	0.44	0.16	0.88	0.02
	DW	0.73	0.14	0.17	0.44	0.42	0.44	0.32	0.69	0.19	0.47	0.12
	Signif. of coint. test	*			*	*	*		*		*	
DF t−test	Coefficient 1/	−0.39	−0.09	−0.09	−0.23	−0.29	−0.25	−0.25	−0.36	−0.12	−0.18	−0.05
	t−value	4.86	2.40	2.19	3.84	4.97	4.55	4.49	4.79	3.14	2.67	1.22
	Signif. of coint. test	*			*	*	*	*	*			
ADF F−test	Unrestricted R2	247.95	74.13	180.48	298.28	156.28	159.08	83.21	81.36	1047.98	318.97	344.51
	Restricted R2	279.41	77.78	197.56	326.82	183.46	177.00	103.05	88.65	1121.28	335.87	376.42
	F−value	5.33	2.14	3.79	5.07	8.52	6.65	9.30	4.03	3.99	3.13	2.96
	Signif. of coint. test					*	*	*				
ror−correction regression in inflation with gap= lagged residual of cointegration regression												
France	Coefficient	0.26	0.31	0.28	−0.22	−0.68	−1.02	−0.52	0.02	3.72	0.84	0.95
	t−value	0.21	0.47	0.24	0.23	0.88	1.93	0.71	0.03	2.55	0.90	0.41
	Significance									*		
Gap	Coefficient	−0.39	−0.09	−0.09	−0.22	−0.29	−0.25	−0.26	−0.36	−0.13	−0.18	−0.05
	t−value	4.83	2.39	2.16	3.77	4.98	4.57	4.63	4.71	3.44	2.66	1.24
	Significance	*	*	*	*	*	*	*	*	*	*	
	T1 (50%)	1.77	7.80	7.33	3.13	2.38	2.78	2.69	1.91	5.41	3.77	13.33
	T2 (95%)	7.66	33.75	31.73	13.54	10.28	12.03	11.63	8.26	23.44	16.30	57.69
	R2	0.209	0.060	0.050	0.113	0.194	0.169	0.206	0.191	0.126	0.066	0.023

* Indicates significant at the 5 percent level.
For cointegration test, the critical DW value is 0.386.
For Dickey−Fuller cointegration test, the critical t−value is 3.37, and for the ADF F−test, the critical value is 6.5.
For OLS, the critical t−value is 1.96.

1/ Note that every estimate of the slope in the DF t−test regression is negative.