Estimating the Real Exchange Rate Misalignment : case of the cfa franc zone

Kuikeu, Oscar

21 June 2012

Estimating the Real Exchange Rate Misalignment : case of the cfa franc zone

Oscar KUIKEU[1]
École Supérieure des Sciences Économiques et Commerciales (ESSEC), Université de Douala, CAMEROUN

Abstract :

In cfa franc zone, the exchange rate was devalued, in 1994, in order to deal with the major macroeconomic imbalances that have affected the members during the 1980 decade. Thus, the aim of this paper is to know if this devaluation was relevant, and, in the sense that the devaluation is relevant only if the real exchange rate is overvalued, we will assess the degree of the real exchange rate misalignment in the cfa franc zone.

JEL Classification : C33, F31

Keywords : equilibrium real exchange rate, cfa franc zone

Résumé :

En zone franc, la monnaie a été dévaluée en 1994 face aux difficultés rencontrées par ses members dès le debut de la decennia 1980. Ceci dit, l'objectif de cette etude est d'évaluer si cette dévaluation était pertinente et, dans l'idée qu'il est pertinent de dévaluer uniquement lorsque le taux de change reel est surévalué, nous allons évalué les phases de sur/sous-évaluation du taux de change reel de la zone franc avant et après 1994.

JEL Classification : C33, F31

Mots-clés : taux de change reel d'équilibre, zone franc

[1] BP 1931 douala (Cameroun), email : projetlivre@yahoo.fr.

1. Introduction

The cfa franc zone is a monetary area which includes fourteen countries in Sub – Saharan Africa having signed, in 1972 and 1973, agreements on monetary cooperation with France ; eight, of these members countries, are in West Africa : Benin, Burkina Faso, Côte d'Ivoire, Guinea – Bissau, Mali, Niger, Senegal, Togo ; six, of them, in Central Africa : Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea, Gabon.

The area has a common currency, the cfa franc, defines as *franc de la coopération financière* in Central Africa and *franc de la communauté financière africaine* in West Africa, issued by the BCEAO (Banque Centrale des Etats de l'Afrique de l'Ouest) in West Africa and the BEAC (Banque des Etats de l'Afrique Centrale) in Central Africa ; the fifteenth member of the cfa franc zone, the Islamic Republic of Comoros, has its own currency (the Comorian franc) and its own central bank (Banque Centrale des Comores).

On january 1994, the cfa franc was devalued against the french franc by 50%. Since the advent of the European Monetary Union (EMU), the cfa franc is now pegged to the euro at a fixed rate of 655.957 cfa franc to 1 euro.

In this paper, our aim is to assess if the cfa franc devaluation of January 1994 was relevant, and, in the sense that an devaluation is relevant only if the real exchange rate is overvalued or when the country's external competitiveness deteriore (see the box 1 below), we will estimate the degree of misalignment of the cfa franc's real exchange rate.

Following Edwards (1989), MacDonald (1997), Clark and MacDonald (1998), it is now well admitted that, the dynamism of the real exchange rate arises from movements over time of the macroeconomic variables called "fundamentals" :

$$RER(t) = G\{F(t)\}$$

where RER is the real exchange rate, F a vector of "fundamentals", G a specific functional form.

When these "fundamentals" have reached their *sustainable* level (broadly defined as value of "fundamentals" that is consistent with the chosen nominal exchange rate regime), the real exchange rate is therefore at the long – run equilibrium level :

$$RER = G\left(F^*\right) \quad (1),$$

where RER^* is the equilibrium real exchange rate, F^* is the *sustainable* level of "fundamentals".

Sustained deviations of the actual real exchange rate from its long – run equilibruim level represents real exchange rate misalignment :

$$RER(t) - RER^* = G\left(F(t) - F^*\right)$$

$$\text{or } RER^* - RER(t) = G\left(F^* - F(t)\right) \quad (2)$$

This study will be organized following Baffes, Elbadawi and O'Connel (1999)'s steps for estimating the degree of real exchange rate misalignment : in a first step, we will present an analytical model designed to identify the "fundamentals" of the real exchange rate in a representative emerging economy (section 2), in a second step, we will estimate, the elasticity coefficient, called long – run parameters, between the real exchange rate and its "fundamentals" (section 3), thus, the third step estimate the real exchange rate misalignment by combining these long – run parameters with a set of *sustainable* values for the "fundamentals" (section 4), finally, in conclusion, we will present a summary of the main results (section 5).

Box 1 : real exchange rate and international competitiveness

Formally in order to draw inferences about a country's international degree of competitiveness, it is usual to use the concept of real exchange rate.

In the economic literature the real exchange rate is generally defined in two principal ways and each of them provides a good index of a country's international degree of competitiveness.

In most modern theoretical works, the real exchange rate is generally defines in *internal* terms as, the domestic relative price of nontradable goods to tradable goods :

$$IRER = P_N / P_T$$

where P_N is the price of nontradable goods, P_T the price of tradable goods.

This definition captures incentives in a particular economy to produce or consume tradables relatively to nontradables. An increase in $IRER$ will make the production of nontradables relatively more profitable, inducing resources to move out of the tradables sector and into the nontradables sector. If there are no changes in relative prices in the rest of the world, this increase in $IRER$ represents a deterioration of the country's degree of international competitiveness – the country now produces tradable goods in a relatively (that is relative to the rest of the world) less efficient way than before –. The interpretation of a decline in $IRER$ is perfectly symmetrical and represents an improvement in the degree of international competitiveness.

A more traditional approach relies on the Purchasing Power Parity (PPP) and defines the *external* real exchange rate as the relative price of domestic to foreign consumption or production baskets :

$$ERER = \prod_{j=1}^{n} \left(E^j P / P^j \right)^{\theta_j}$$

where E^j is bilateral nominal exchange rate between the home country and the foreign partner j, P the domestic price index, P^j the foreign price index in the foreing contry j, θ_j is the weight of foreign partner j in the total trade of the home country.

If total factor productivity do not change, an increase or real appreciation (respectively a decline or real depreciation) in $ERER$ represents a deterioration (an improvment) of the country's international degree of competitiveness.

2. The "fundamentals" of the real exchange rate : Montiel (1999)

We consider a small open economy in which the domestic production structure consists of traded and nontraded goods sectors. The unique factor of production in each sector is a perfectly mobile labor. In this framework the real exchange rate is defined in *internal* term as the domestic relative price of nontradable goods to tradable goods :

$$e = IRER = P_N / P_T \tag{3}$$

where P_N is the price of nontradable goods, P_T the price of tradable goods.

In order to identify the "fundamentals" of the real exchange rate, Montiel (1999) follows an approach now standard in the economic litterature. The idea is to define the equilibrium real exchange rate like Nurkse (1945), as the value of the real exchange rate that is consistent with the two objectives of internal and external balance, for specified *sustainable* values of variables that may influence these objectives.

Internal balance holds when the markets of labor and nontraded goods clear :

$$y_N(e,\xi) = c_N + g_N = \theta c + g_N\,,\ \partial y_N/\partial e > 0\,,\ \partial y_N/\partial \xi < 0\,, \tag{4},$$

where y_N represents the supply of nontraded goods under full employment, c is total private spending measured in nontraded goods, θ is the share of spending devoted to nontraded goods, g_N is government spending on nontraded goods, ξ is a differential productivity shock.

External balance : The *external* balance has been defined in various ways in the literature. Montiel (1999) focuses on *stock* rather than *flow* equilibruim approach in wchich, the *external* balance holds when the country's net external assets in world's financial markets have reached a steady – state equilibrium in other words when the country's external liabilities or claims remain the same at each period of time. Since the current account balance helps to appreciate the evolution of the international investment position (equation (1)), the external balance then holds when the current account balance at each period of time is nul :

$$tb + rf^* = y_T(e,\xi) - g_T - (1-\theta)ec + rf^* = 0 \qquad (5),$$

where tb is the trade balance defined as the difference between domestic production of traded goods y_T and the sum of government g_T and private spending c on these goods, f^* is steady state value of total net external asset.

(4) and (5) give the following expression for the long – run real exchange rate :

$$e = (\theta/1-\theta)\left\{\frac{y_T(e,\xi) - g_T + rf^*}{y_N(e,\xi) - g_N}\right\} \qquad (6)$$

Partial derivatives with respect to the various exogenous variables included in the model give the following expression :

$$e = G\left(\underset{+}{g_N}, \underset{-}{g_T}, \underset{-}{tb}, \underset{+}{\xi}\right) \text{ with } tb = -rF^* \qquad (7)$$

where the sign + (respectively –) expresses real exchange rate appreciation (respectively real exchange rate depreciation), G a specific functional form.

We can split up total traded goods output into output of exportables y_X and importables y_M. However in this case external balance condition has to be modified as follows :

$$toty_X(e,tot)+y_M(e,tot)-g_M-(1-\theta)ec+rf^*=0 \text{ with } tot=P_X^W/P_M^W \text{ and } e=P_N/P_M^W \quad (8),$$

where g_M is government spending on importable goods, tot the external terms of trade, P_M^W is the world price of importable goods, P_X^W is the world price of exportable goods.

With this specification on hand, the external term of trade therefore collapses within the list of "fundamentals". Indeed variations in external term of trade affect both internal and external balance. An improvement in the terms of trade causes labor to be transferred from the importables and nontraded sectors to the expanding exportables sector. Thus, it induces a demand excess in the nontraded goods market ($\partial y_N/\partial tot<0$) and a supply excess in the traded good sector ($\partial(toty_X+y_M)/\partial tot>0$).

Since the equilibrium real exchange rate was defined as the rate that prevails when the economy is in internal and external balance, an improvement in the terms of trade requires a real appreciation in order to maintain both internal and external balance[24].

Nevertheless on the grounds of trade policy, the domestic price of exportable goods (P_X) and that of importable goods (P_M) may differ from world prices. This can be the case if we assume that the government applies taxes on imported products at a rate t_m and subsidizes

[2] But this effect of the external term of trade on the real exchange rate can be overcome by substitution effect (a supply excess in the nontraded goods market ($\partial y_N/\partial tot>0$) and a demand excess in the traded good sector ($\partial(toty_X+y_M)/\partial tot<0$)), leading to an depreciation of the real exchange rate (Baffes, J., Elbadawi, I. and O'Connel, S. (1999)).

exports to the rate t_x. Under this assumption we can express internal terms of trade (P_X/P_M) as a combination of external terms of trade (tot) and tariff measures ($\eta = 1 + t_m/1 - t_x$) :

$$P_X/P_M = tot/\eta$$

Since the stance of trade policy affects the internal terms of trade, he collapses within the set of "fundamentals". In order to illustrate our purpose we can for example consider a tightening trade policy modelled as an increase in export subsidies. This measure causes labor to be transferred from the importables and nontraded sectors to the expanding exportables sector. So the previous analysis about the effects of the external terms of trade on the equilibrium real exchange rate can be repeated. Therefore a tightening trade policy appreciates the real exchange rate.

The long – run relationship between the real exchange rate and its "fundamentals" (equation (7)) then becomes :

$$e = G\left(\underset{+}{g_N}, \underset{-}{g_T}, \underset{-}{tb}, \underset{+}{\xi}, \underset{+}{\eta}, \underset{+/-}{tot} \right) \qquad (9)$$

3. Estimating the long – run parameters

The purpose of this paragraph is to retrieve for the cfa franc zone the long – run parameters in (9) between its real exchange rate and its "fundamentals".

Before proceeding to estimate the long – run parameters, we recall the definition of the real exchange rate and its "fundamentals".

3.1. Definition of the real exchange rate and fundamentals

Constructing the series of the real exchange rate is quite problematic. Indeed, in practice the price indices of tradable and non – tradable goods are not readily available. If the price index of non – tradable goods is generally approached by the domestic consumer price, debates however are more intense for the prices of tradable goods. As part of this study we propose to use the consumer price index of foreign countries and to approach the series of internal real exchange rate by the external real exchange rate. The relevance of this approach is developed quite easily (see box 2 below).

Box 2 : external real exchange rate and internal real exchange rate

Let $BERER$ be the bilateral external real exchange rate between the home country and the foreign partner j :

$$BERER = E^j P / P^j \quad (10),$$

where E^j represents the bilateral nominal exchange rate between the home country and the foreign partner j, P the domestic price level, P^j the foreign partner j's price level.

We can break down consumer prices as a weighted average of traded and non – traded goods prices :

$$P = (P_N)^{\alpha} \cdot (P_T)^{1-\alpha} \text{ and } P^j = \left(P_N^j\right)^{\alpha} \cdot \left(P_T^j\right)^{1-\alpha} \text{ with } 0 < \alpha < 1 \quad (11),$$

where P_N represents the price of non – traded goods, P_T the price of traded goods, α the share of non – tradables goods (assumed to be the same for the home and the foreign country).

(11) and (12) gives :

$$BERER = \frac{(P_N / P_T)^{\alpha}}{\left(P_N^j / P_T^j\right)^{\alpha}} \cdot \frac{E^j P_T}{P_T^j} \quad (12),$$

In the long – run we can assume that the law of one price applies to tradables :

$$E^j P = P^j$$

The ratio P_N / P_T (respectively P_N^j / P_T^j) represents the internal real exchange rate for the home country (respectively for the foreign partener j) :

$$BERER = (IRERD)^{\alpha} / (IRERF)^{\alpha} \text{ with } IRERD = P_N / P_T \text{ and } IRERF = P_N^j / P_T^j \quad (13)$$

Taking the logarithms of both sides and then differentiating equation (14) gives, for small changes :

$$\frac{\Delta BERER}{BERER} = \alpha\left(\frac{\Delta IRERD}{IRERD}\right) - \alpha\left(\frac{\Delta IRERF}{IRERF}\right) \quad (14)$$

where Δ represents the absolute change.

In the long run we can assume that, the relative change in the foreign country's internal real exchange rate is proportional to the relative change in the home country's internal real exchange rate :

$$\frac{\Delta IRERF}{IRERF} = k\frac{\Delta IRERD}{IRERD} \text{ with } 0 < k < 1$$

So we obtain :

$$\frac{\Delta BERER}{BERER} = \alpha(1-k)\left(\frac{\Delta IRERD}{IRERD}\right)$$

Therefore, under some assumptions, the relative change in the home country's external real exchange rate is proportional to the relative change in its internal real exchange rate, and, thus, there is a link between the fundamentals and the external real exchange rate.

We use the following fundamentals, those, who, following (10), have the expected effect on the real exchange rate :

Government spending on non – traded goods : measured as the share of government consumption in GDP.

Government spending on traded goods : measured as the share of GFCF in GDP.

Stance of trade policy : like it is common in the literature (Edwards (1989), Baffes, Elbadawi and O'Connel (1999)) we assume that other things being equals, a more liberal trade regime means higher trade volumes. Therefore, we use ratios of trade (export plus import) to GDP as a measure of the *stance of trade policy*.

Trade balance to GDP ratio.

External terms of trade : measured as the ratio of export price index to import price index.

The frequency of data is annual and covers 9 of the 15 countries of the cfa franc zone (Benin, Burkina-Faso, Cameroon, Côte d'Ivoire, Gabon, Mali, Niger, Senegal and Togo) observed between 1980 – 2001. They were taken from various sources, CEPII for the real exchange rate and Penn World Table for the other.

3.2. The long – run parameters

We assessed equation (9) in panel data, while the Fisher homogeneity test confirm well the existence of heterogeneity between members of the cfa franc zone[3], the Hausman[4] specification test tell us that the nature of the heterogeneity is a two way error or random effect, indeed H =

[3] The Fisher statistic is $F = \left(\left(SCR_R - SCR_{SR}\right)/SCR_{SR}\right) \cdot \left(\left(N(T-1)-K\right)/(N-1)\right)$ where SCR_R is the Sum of Square Residuals of the pooled model, (SCR_{SR} the Sum of the Square Residuals of the fixed effect model), N the number of cross-section, T the time serie, and $F \rightarrow F(N-1, NT-K-N)$. Here F = 6.68 who is significative at 5% level.

[4] The Hausman statistic H is given by $H = \hat{q}'[V(\hat{q})]\hat{q}$ with $\hat{q} = \hat{\beta}_W - \hat{\beta}_{GLS}$ and $V(\hat{q}) = V\left(\hat{\beta}_W\right) - V\left(\hat{\beta}_{GLS}\right)$ where W stand for Within estimator and GLS for General Least Square estimator, $H \rightarrow$ *Khisquare*(k) where k is the number of independent variables.

4.97 who is significative at 10% level. Table 1 below presents the result of the GLS estimate of equation (9), here, we present only the estimate of significant parameters

Table 1 : the long-run parameters (for significant parameters only)

RER	Coefficients	t – student
open	-103.643	-6.74*
tot	-5.301	-21.45*
Constant	687. 810	25.08*
	Statistics	
Adjusted R^2	0.75	
Nobs	198	

Notes : * (**, ***) the null hypothesis is rejected at 1% (5%, 10%), *Nobs* = number of observations, ***RER*** = real exchange rate, ***open*** = openness (exportation+importation in percentage of GDP), ***tot*** = external terms of trade.

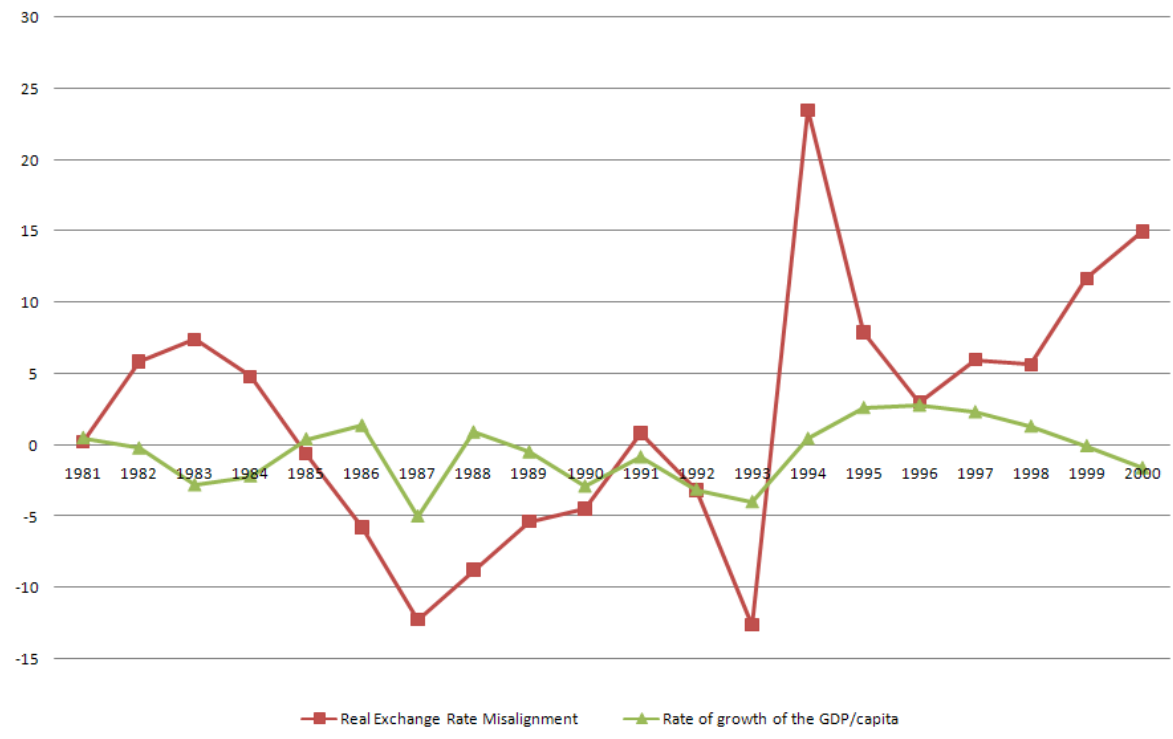
As pointed out by the theoretical model trade – liberalizing reforms (an increase of *openness*) as well as an improvement in the *external terms of trade* depreciate the real exchange rate. Thus, all the significant parameters have the right sign.

4. Estimating the degree of misalignment

We have defined the equilibrium real exchange rate as that value of the real exchange rate conditional on a vector of *sustainable* values for the fundamentals (equation (1)). However the construction of *sustainable* values for "fundamentals" is not a trivial exercise. Since the fluctuations in such variables will contain both permanent and transitory components, in the literature it is common to identify the *sustainable* values of these variables by their permanent component. Thus identifying the relevant set of *sustainable* values for the "fundamentals" empirically involves implementing statistical techniques or time series technique. Here, permanent components were proxied by three – year moving averages. Thus, if *sustainable* is the equilibrium real exchange rate (equation (1)), *Misalignment* = *Sustainable*–*RER* and we will stand that the real exchange rate is undervalued (respectively, is overvalued) if *Misalignment* >0 (respectively, if *Misalignment* < 0).

The figure 1 below represents the degree of the real exchange rate misalignment in the cfa franc zone for the whole period considered in this study (1980 – 2001), this is a relevant measure of the cfa franc's real exchange rate, in fact, while in the literature, we find that real exchange rate overvaluation reduces economic growth (Kuikeu (2011)), this measure of the cfa franc's real exchange rate show that; in the cfa franc zone, the real exchange rate is negatively linked to the economic growth.

Figure 1 : Real Exchange Rate Misalignment and economic growth in the cfa franc zone



As depicted in the figure 1 the real exchange rate in the cfa franc zone is undervalued during the first half of the 1980 decade (1980 – 1985) and fell sharply during the second until 1993. Our calculations imply that during this last period (1986 – 1993) the real exchange rate of the cfa franc zone was overvalued by 6.43% on average. After the devaluation of the cfa franc implemented in 1994, the real exchange rate of the cfa zone rises sharply. Between 1995 and 2000, our calculations imply that the real exchange rate of the cfa zone was undervalued by 8.22% on average.

5. Conclusion

The aim of this study was to know if the January 1994 cfa franc devaluation was relevant, and in the sense that devaluation is relevant only if the real exchange rate is overvalued, we have estimate the degree of cfa franc's real exchange rate misalignment. Because, following our calculations, during the whole period before the devaluation (1980 – 1993), the cfa franc's real exchange rate was overvalued by 2.58% on average, we conclude that the cfa franc devaluation, of January 1994, was relevant[5].

[5] For a comparative study, the annex presents the wide variety of authors who have assessed the cfa franc zone's real exchange rate misalignment.

References

Baffes, J., Elbadawi, I. and O'Connel, S. (1999) 'Single equation estimation of the equilibrium real exchange rate', in *Exchange rate misalignment* : c*oncepts and measurement for developing countries*, L. Hinkle et P. Montiel (eds), World Bank Research Publication.

Clark, P. and MacDonald, R. (1998) 'Exchange rate and economic fundamentals – A methodological comparison of BEERs and FEERs', *IMF Working Papers*, No. 98/67, International Monetary Fund.

Devarajan, S. (1997) 'Real exchange rate misalignment in the CFA zone', *Journal of African Economies*, vol. 6, No. 3, March, 35 – 53.

Edwards, S. (1989) *Real exchange rate*s, *Devaluation and adjustment* : *Exchange rate policy in developing countries*, MIT Press, Cambridge, Massachussetts.

Elbadawi, I. and R. Soto (1997) 'Real exchange rates and macroeconomic adjustment in Sub – Saharan Africa and other developing countries', *Journal of African Economies*, vol. 6, No. 3, October, 1 – 56.

Kamel, N.M. and M.A. Véganzones (2002) 'Exchange rate regime and competitiveness of manufactured exports, the case of MENA countries', *MENA Working Paper Series*, No. 27.

Kuikeu, O. (2011) « A new explanation on real exchange rate misalignment effect on economic growth : evidence from Cameroon », *Economic Growth eJournal*, vol. 3, No. 102, September, Economic Research Network .

MacDonald, R. (1997) 'What determines real exchange rates ? The long and short of it', *IMF Working Paper*, No. 97/21, International Monetary Fund.

Montiel, P.J. (1999) 'Determinants of the long – run equilibrium real exchange rate : An analytical model' in *Exchange rate misalignment* :*Concepts ad measurement for developing countries*, L. Hinkle and P. Montiel (eds), World Bank Research Publication.

Nurkse, R. (1945) 'Conditions of international monetary equilibrium' in *Essays in International Finance* 4, Princeton University Press, International Finance Section, New Jersey, USA.

Ondo Ossa, A. (1992) ' Taux de change du franc cfa et construction européenne ', *Monde en Développement*, No. 77 – 78, tome XX, 59 – 74.

Sekkat, K. and Varoudakis, A. (1998) 'Exchange rate management and manufactured exports in Sub – Saharan Africa', *OCDE Development Centre Technical Paper*, No. 134.

Annex : empirical literature review

Authors	Country	Method	Variables	Period	Conclusion
Baffes, Elbadawi, O'Connel (1999)	Côte – d'ivoire et Burkina – Faso	Cointegration, Engle and Granger.	GFCF/GDP, trade balance, openness, external term of trade, productivity choc	côte – d'ivoire : 1965 – 1993 Burkina – Faso : 1970 – 1993	Between 87-93 the real exchange rate of Côte – d'Ivoire is overvalued by about 37%, that of Burkina undervalued by about 14%
Devarajan (1996)	12 Cfa countries (Cameroon, Congo, Togo, Gabon, Mali, Côte d'Ivoire, Sénégal, Central African Republic, Niger, Burkina, Benin, Chad)	Computable General Equilibrium Model (CGEM)		1980 – 1994	The Cfa franc is overvalued in 1993 by about 31% in average. Oil producers (Cameroon, Congo, Gabon) were the most overvalued, unlike small economies whose Chad, which displays an undervaluation of its real exchange rate.
Elbadawi and Soto (1998)	8 countries of which côte – d'ivoire and Mali	Cointegration, Engle and Granger	External term of trade, openness, net inflow of capital, public expenditure, public investment, world real interest rate and country risk	côte d'ivoire : 1960 – 1993 Mali : 1968 -1993	The degree of overvaluation in Mali does not seem to be very affirmed during this period prior to the devaluation unlike the situation in Côte d'Ivoire
Kamel and Véganzones (2002)	53 LDC among which 7 Cfa countries	Dynamic umbalanced panel data analysis	External term of trade, openness, net inflow of capital, public expenditure, public investment, external debt service	1970 - 1999	The Cfa franc is overvalud by about 61 % in average between 1975 – 1999 and by about 28 % between 1985 - 1999
Ondo ossa (1992)	13 Cfa countries	PPP (base 1981)		1980 -1990	The Cfa franc is not overvalued during the decade 1980
Sekkat and Varoudakis (1998)	11 SSA countries of which 6 Cfa countries	Panel data anlysis (fixed effect and random effect)	External term of trade, openness, net inflow of capital, excess domestic credit expansion, changes in the official nominal exchange rate	1970 -1992	The Cfa franc is overvalued by an average of 20% in the early 1970. Nevertheless, the magnitude of the distortion decreases considerably during the first half of the observation period, until the early 1980. Then increases significantly between 1983 - 84 until 1993.