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Real Exchange Rate Misalignment in the cfa franc zone after the cfa franc devaluation of January 1994

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Abstract:
In cfa franc zone, the exchange rate was devalued, in January 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 assess the degree of over/undervaluation (namely real exchange rate misalignment) of the currency in the cfa franc zone since the cfa franc devaluation of January 1994.

JEL Classification: C33, F31
Keywords: equilibrium real exchange rate, cfa franc zone, cointegration, panel

Résumé:
En zone franc, la monnaie a été dévaluée en 1994 face aux difficultés rencontrées par ses membres dès le début de la décennie 1980. Ceci dit, si on admet aujourd'hui l'idée d'un franc cfa surévalué avant la dévaluation de 1994 et, ainsi, du bienfait dudit ajustement, n'est-il pas raisonnable aujourd'hui d'avoir une idée de l'ampleur de la sur/sous-évaluation (encore appelé mésalignement) du franc cfa depuis la dévaluation de janvier 1994. Tel est l'objectif de cette étude.

JEL Classification: C33, F31
Mots-clés : taux de change reel d'équilibre, zone franc, cointegration, panel

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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, defined 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 États de l’Afrique de l'Ouest) in West Africa and the BEAC (Banque des États 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 the real exchange rate misalignment in the CFA franc zone since the CFA franc devaluation of January 1994.

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:

\[
RER^* = G(F^*)
\]  

(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 equilibrium level represents real exchange rate misalignment:

\[
RER(t) - RER^* = RER(t) - G(F^*)
\]  

(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 estimates the real exchange rate misalignment (section 4), finally, in conclusion, we will present a summary of the main results (section 5).

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:

\[ e = \frac{P_N}{P_T} \]  

(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 literature. 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:

\[ y_N(e, \xi) = c_N + g_N = \theta c + g_N, \quad \frac{\partial y_N}{\partial e} > 0, \quad \frac{\partial y_N}{\partial \xi} < 0, \]  

(4)

where \( y_N \) represents the supply of nontraded goods under full employment, \( c \) is total private spending measured in nontraded goods, \( \theta \) is the share of spending devoted to nontraded goods, \( g_N \) is government spending on nontraded goods, \( \xi \) 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 equilibrium approach in which, 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 null:
\[ tb + rf^* = y_T(e, \xi) - g_T - (1 - \theta)ec + rf^* = 0 \] (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:

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

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

\[
e = G \left( g_N, g_T, tb, \xi \right) \text{ with } \quad tb = -rF^*
\] (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:

\[
tot y_X(e, tot) + y_M(e, tot) - g_M - (1 - \theta)ec + rf^* = 0 \text{ with } \quad tot = \frac{P_X}{P_M} \text{ and } \quad e = \frac{P_N}{P_M}
\] (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 \( (\partial(y_N + y_M)/\partial tot > 0) \).

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\(^2\).

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 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.

\(^2\) 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 \( (\partial(y_N + y_M)/\partial tot < 0) \)), leading to an depreciation of the real exchange rate (Baffes, J., Elbadawi, I. and O’Connel, S. (1999)).
The long–run relationship between the real exchange rate and its “fundamentals” (equation (7)) then becomes:

\[
e = G(N, T, b, \xi, \eta, t)
\]

(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 1 below).

**Box 1 : 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 \( j \):

\[
BERER = E_j / P_i / P_j
\]

(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:

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

(11),

where $P_N$ represents the price of non-traded goods, $P_T$ the price of traded goods, $\alpha$ the share of non-traded goods (assumed to be the same for the home and the foreign country).

(11) and (12) give:

$$BERER = \frac{(P_N/P_T)^\alpha}{(P_N^j/P_T^j)^\alpha} \cdot \frac{E^j/P_T}{P_T^j}$$

(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 partner $j$):

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

(13)

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

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

(14)
where \( \Delta \) 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:

\[
\frac{\Delta \text{IRERF}}{\text{IRERF}} = k \frac{\Delta \text{IRERD}}{\text{IRERD}} \quad \text{with} \quad 0 < k < 1
\]

So we obtain:

\[
\frac{\Delta \text{BERER}}{\text{BERER}} = a(1-k) \left( \frac{\Delta \text{IRERD}}{\text{IRERD}} \right)
\]

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, Cameroon, Côte d’Ivoire, Congo, Mali, Niger, Senegal, Tchad and Togo) observed between 1980 – 2010. They were taken from various sources, Penn World Table for the real exchange rate and UNCTAD database for the other.

3.2. Determining the order of integration

For the three tests (Harris and Tzavalis (1999), Levin, Lin and Chu(2002), Im, Pesaran and Shin (2003)) that we use, the null is unit root. The results of these tests were grouped in the following table:

Table 1: unit root tests

<table>
<thead>
<tr>
<th></th>
<th>Harris and Tzavalis</th>
<th>Levin, Lin and Chu</th>
<th>Im, Pesaran and Shin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>none</td>
<td>constant</td>
<td>trend</td>
</tr>
<tr>
<td>lreer</td>
<td>(1) 0.1</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>(2) -59.3*</td>
<td>-26.2*</td>
<td>-15.1*</td>
</tr>
<tr>
<td>lgn</td>
<td>(1) -0.1</td>
<td>-5*</td>
<td>-4*</td>
</tr>
<tr>
<td></td>
<td>(2) -69*</td>
<td>-30.4*</td>
<td>-18.1*</td>
</tr>
<tr>
<td>lgt</td>
<td>(1) -0.7</td>
<td>-9</td>
<td>-6*</td>
</tr>
<tr>
<td></td>
<td>(2) -76.3*</td>
<td>-33.5*</td>
<td>-20.3*</td>
</tr>
<tr>
<td>b</td>
<td>(1) -12.3*</td>
<td>-10.6*</td>
<td>-6.54*</td>
</tr>
<tr>
<td></td>
<td>(2) -75.8*</td>
<td>-33.1*</td>
<td>-19.8*</td>
</tr>
<tr>
<td>lopen</td>
<td>(1) -3.4*</td>
<td>-5*</td>
<td>-4.3*</td>
</tr>
<tr>
<td></td>
<td>(2) -75.2*</td>
<td>-32.8*</td>
<td>19.4*</td>
</tr>
<tr>
<td>ltot</td>
<td>(1) -0.0</td>
<td>0.0</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>(2) -70.5*</td>
<td>-31.2*</td>
<td>-18.6*</td>
</tr>
</tbody>
</table>

Notes: * (**, *** ) the null hypothesis is rejected at 1% (5%, 10%) level. (1) : level, (2) : first difference. 
lreer = log real exchange rate, lgn = log government consumption (percentage of GDP), lgt = log GFCF (percentage of GDP, b = trade balance ratio (percentage of GDP), lopen = log openness (exportation+importation in percentage of GDP), ltot = log external terms of trade.

So if I(d) represents the order of integration, with these results we concluded in favor of I(1) for all series. Thus, conditions for the existence of cointegrating relationships are already satisfied.

3.3. Cointegration test

We use the pooled within dimension tests (panel v-stat, panel rho-stat, panel pp-stat, panel adf-stat) and the group between dimension tests (group rho-stat, group pp-stat, group adf-stat) of Pedroni (1995, 1999). All of these statistics are distributed N(0,1) under the null of unit root.
For the *panel v-stat* the right tail of the normal distribution is used to reject the null hypothesis and, for this statistic, large positive value imply that the null of no cointegration is rejected, concerning the other six statistics, it is the left tail of the normal distribution who is used to rejected the null hypothesis, and, for these other six statistics, large negative value imply that the null of no cointegration is rejected. In this study we have made the choice to conduct these tests with a constant term in the cointegrating vector. The results of these tests were grouped in the following table:

<table>
<thead>
<tr>
<th>Statistics</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pooled within dimension tests</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Panel v-stat</em></td>
<td>-0.81</td>
<td></td>
</tr>
<tr>
<td><em>panel rho-stat</em></td>
<td>1.33</td>
<td></td>
</tr>
<tr>
<td><em>panel pp-stat</em></td>
<td>-0.47</td>
<td></td>
</tr>
<tr>
<td><em>panel adf-stat</em></td>
<td>6.98*</td>
<td></td>
</tr>
<tr>
<td><strong>Group mean between dimension tests</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>group rho-stat</em></td>
<td>2.42</td>
<td></td>
</tr>
<tr>
<td><em>group pp-stat</em></td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td><em>group adf-stat</em></td>
<td>7.64</td>
<td></td>
</tr>
</tbody>
</table>

*Notes*: * (**, *** ) the null hypothesis is rejected at 1% (5%, 10%) level.

On the basis of this result we choose to work with the hypothesis of cointegration between real exchange rate and its fundamentals.

### 3.4. The long – run parameters

Table 3 below presents FMOLS estimates of the long – run relationship (equation (9)). We assume this (equation (9)) linear in logarithm:
Table 3: Cointegrating relation – FMOLS regression

<table>
<thead>
<tr>
<th>lreer</th>
<th>Coefficients</th>
<th>t – student</th>
</tr>
</thead>
<tbody>
<tr>
<td>lgn</td>
<td>0.2711</td>
<td>15.2657*</td>
</tr>
<tr>
<td>lgt</td>
<td>-0.0579</td>
<td>-37406*</td>
</tr>
<tr>
<td>b</td>
<td>-0.4788</td>
<td>-9.5663*</td>
</tr>
<tr>
<td>lopen</td>
<td>-0.3362</td>
<td>-25.6867*</td>
</tr>
<tr>
<td>ltot</td>
<td>-0.1054</td>
<td>-6.4947*</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.7955</td>
<td>-50.4047*</td>
</tr>
</tbody>
</table>

Notes: * (**, ***): the null hypothesis is rejected at 1% (5%, 10%) level. lreer = log real exchange rate, lgn = log government consumption (percentage of GDP), lgt = log GFCF (percentage of GDP), b = trade balance ratio (percentage of GDP), lopen = log openness (exportation+importation in percentage of GDP), ltot = log external terms of trade.

As pointed out by the theoretical model an increase in the government spending on non-traded goods appreciate the real exchange rate. An increase in the government spending on traded goods, an improvement in the trade balance ratio to GDP, trade – liberalizing reforms (an increase of openness), as well an improvement in the external terms of trade depreciate the real exchange rate. Thus, all the parameters have the right sign.

4. Estimating the degree of misalignment

We have defined the real exchange misalignment as the difference between the real exchange rate and its equilibrium value (equation (2)). Following Baffes, Elbadawi and O'Connel (1999) we can decompose the real exchange rate misalignment as follow:

\[ RER(t) - RER' = RER(t) - G(F) - G(F' - F) \]

The term \( RER(t) - G(F) \) is called short-run misalignment (the misalignment calculated using the actual rather than sustainable values of fundamentals) and here we have chose to computed only this.

We use the long – run parameters reported in table 3 to compute \( G(F) \) and the degree of real exchange rate misalignment between 1980 and 2010 and we will stand that the real exchange rate is overvalued (respectively, is undervalued) if \( Misalignment > 0 \) (respectively, if \( Misalignment < 0 \)).
The figure 1 below represents the degree of exchange rate misalignment in cfa franc zone after the cfa franc devaluation of January 1994 (between 1994 and 2010).

As depicted in the figure after the cfa franc devaluation of january 1994, the real exchange rate in cfa franc zone fell sharply until 2003 and rises during four years between 2004 and 2007.

5. Conclusion

The aim of this study was to assess the degree of over/undervaluation of the currency in cfa franc zone after the cfa franc devaluation of January 1994. Because, following our calculations, during the whole period after the devaluation considered here (1995 – 2010), the cfa franc’s real exchange rate was undervalued by -4.5% on average, we conclude that the cfa franc devaluation, of January 1994 was benefit.
References


