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**Franc Zone: Stronger than ever?**

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## Abstract

The Franc Zone rests on an original mechanism, the *compte d'opération (CO)*. This account gives the CFA a credible external convertibility backed by the French Treasury. We argue that the monetary policy imposed by the *CO* aims at balancing external accounts, in a manner inspired by the monetary approach of the balance of payments. This feature and the fixed nominal exchange rate identify the zone with a convertibility regime. Using a co-integration model adapted for panel data, we test the sensitivity of the money supply to external accounts in order to infer the *CO* efficiency for implementing external monetary adjustment. An incidental question also appears: what are the consequences of the 1994 devaluation for the nature of the regime? We adapt our test to obtain the difference between the ante- and the post-devaluation periods. We conclude that the zone behaves as a convertibility regime and that the devaluation reinforces, instead of weakens, its nature.

Keywords: Franc Zone, *compte d'opération*, 1994 devaluation, panel unit roots test, panel co-integration model.

JEL Classification: C22, C23, E51, E52, F31, F32, F33, N17.

## Résumé

La Zone Franc est fondée sur un mécanisme original : le Compte d'Opérations. Ce compte donne au Franc CFA une convertibilité externe crédible, soutenue par le Trésor Français. Nous faisons l'hypothèse que la politique monétaire mise en place par le Compte d'Opérations vise à équilibrer les soldes extérieurs. Cette caractéristique et le taux de change fixe identifient la Zone au régime de convertibilité. Grâce à un modèle de co-intégration, adapté au panel, nous évaluons la sensibilité de la base monétaire aux comptes externes de manière à en déduire l'efficacité du Compte d'Opérations pour mettre en place un ajustement monétaire des soldes extérieurs. Une question incidente se pose alors, quelle conséquence la dévaluation de 1994 peut-elle avoir eu sur la nature du régime ? Nous adaptons notre test de manière à évaluer la réaction avant et après 1994. Nos tests nous donnent la conviction que la Zone Franc est bien un régime de convertibilité et que la dévaluation, au lieu d'affaiblir le régime, l'a renforcé.

mots clé : Zone Franc, Compte d'Opérations, dévaluation de 1994, test de racine unitaire en panel, modèle de co-intégration en panel.

## 1. Introduction.

Since the 1994 devaluation, some people maintain that the zone has lost its soul, and contest its nature as a fixed exchange regime. In addition, well before the events of 1994, they often cast doubt on the regime's discipline, arguing that the French support is without cost because of the small amounts involved. We contest this view, and we argue that the Zone, despite the devaluation, has remained a genuine convertibility regime.

Our conviction is based on the *compte d'opérations* function. This tool is driven by a set of institutional rules shared by the member countries of the CFA union and France. We argue that these rules rest on the monetary approach of the balance of payments. Consequently, they influence monetary policy following the external position of the Zone in order to balance external accounts, as in other convertibility regimes i.e. currency boards.

Two debates are thus in question: is the Franc Zone a convertibility regime or not? And what is the impact of the 1994 devaluation on monetary policy? In order to acquire evidence, we test the convergence hypothesis between the base money and external position in the Zone using a co-integration model adapted for panel data. The main idea is to obtain evidence about the efficiency of the *compte d'opérations* in making base money significantly dependent on the reserve. In addition, we split our sample into two periods, post and ante-devaluation; in this way we can quote the modification of monetary policy due to devaluation.

In the first section, we briefly expose the convertibility regime adjustment mechanism in order to present the balance of payments monetary explanation. In the second section, we describe the history of the *compte d'opérations* and its present features in order to link this institution with the monetary approach presented in the first section. Finally, we present our econometric test.

## 2. Monetary explanation of the balance of payments.

Economists studying the Gold Exchange and the Gold Exchange Standard systems (GEs), in use at the end of the XIX<sup>th</sup> and the beginning of the XX<sup>th</sup>, century elaborated the monetary explanation of the balance of payments. The topic thus has a deep theoretical background (Rist 1938, Friedman 1969). This theoretical support could easily be used to analyse a convertibility regime such as the Franc Zone.

Basically, the GEs provide two adjustment mechanisms. First of all, the GEs rule the money supply. Suppose that, worldwide, money is fully or partially backed by a metal commodity. The new issues are, thus, constrained by metal production. In case of a money demand increase, the money supply cannot increase with the demand. Two reactions are expected. First, the production of the commodity money, that is to say the metal mining and minting, increases and hence consumes labour and capital. If metal production is perfectly elastic, all the commodity money demand is satisfied. However, capital and labour are evicted by the metal production from the remainder of the economy that supposes an increase in the price of these factors and a slowing down of the growth rate, which reduces the growth of money demand. However, as the production of metals is not perfectly elastic, the main part of the adjustment will take the form either of a currency revaluation, that is to say a fall in prices or the form of a quantity adjustment resulting in depression. Both phenomena reduce the money demand growth. The success of this kind of adjustment rests on price flexibility, and historically we notice cases of rapid growth and deflation (Friedman 1969). But in the case of price rigidity, as for example wage rigidities, the GE could be recessive. The commodity money, when the commodity is a metal, thus demonstrated some clear drawbacks due to the money supply's strong inelasticity. The present convertibility regimes always tightly regulate

the money supply, but the "commodity" which backs the issues is now a foreign currency. The "commodity production sector" is, thus, no longer mining and minting of a scarce metal, but all economic activity able to provide currency, that is to say export and finance. These regimes give an incentive to develop outward-looking industries, goods, services and finance.

Secondly, in the classic GE, and even more so the GES, all countries in the world are not necessarily gold or silver producers. The main part of the national metal stock variations is due to trade and finance. Thus the GE also rests on an external adjustment. Hume (1752) and Cantillon (1755) first exposed this adjustment. A price growth greater than international inflation leads to a loss in competitiveness. Consequently, the balance of payments will show deficits. These deficits mean an exit of money commodity; the flow of commodity provokes a reduction in the base money. The reduction of the money base leads to a slow-down of inflation, indeed deflation, in order to restore the balance of payments equilibrium. In this way, the GE assumes the role of an automatic balance of payments adjustment mechanism. The present convertibility regimes are, thus, supposed to provide the same mechanism. In currency boards, the use of foreign currency to back local issue concentrates all the monetary policy mechanism on the balance of payments adjustment. In the case of the Franc Zone, there is no backing rule to institutionalise a balance of payments adjustment mechanism. However, institutional rules regulate the *compte d'opération* which represents the balance of payments of the Zone. The institutional rules applicable in the Zone aim at balancing this account, thus equilibrating the balance of payments. We may thus find in the two regimes a similar monetary policy aimed at adjusting the external accounts.

In particular, as in a currency board regime, the base money stock and the base money supply have to be clearly influenced by the stock of foreign reserves and the flux of foreign reserves. In the fourth section, in order to test this assumption, we provide an empirical test used in previous studies (Combes and Veyrune 2002) to evaluate the monetary policies of currency boards. The next section describes the unusual tool used by the Zone to ensure convertibility: the *compte d'opérations*.

### 3. The *compte d'opérations*.

For the Franc Zone, everything begins in 1878 in Algeria (Lelart 1996). At that time, the French and British were running empires which constituted vast commercial and financial structures. The money and exchange problems were puzzling. French Francs and Pounds Sterling were commodity money, based on gold, silver or both metals. This kind of money was scarce and hardly exportable. To facilitate exchange dependent territories were strongly encouraged to found Colonial Banks, mainly metropolitan private commercial bank branches, which were empowered to manage colonial issues. However, the exchange stability, indeed the convertibility, of colonial issue into metropolitan issue was not guaranteed. To solve the convertibility problem, the British, following currency school principles, imposed a 100% backing rule to colonial issue. However, instead of backing the issue with commodities such as the metropolitan issue they backed colonial issue with sterling, insuring by the way the colonial money convertibility in sterling.

The French administration's response to the same difficulty was significantly different from the British method. French colonial administrators acted in a more empirical way. Indeed, the custom ensured that the French migrants in Algeria were used to transferring funds across Mediterranean by the mean of postal orders. The migrants simply bought a postal order with Algerian bank bills in a Constantine, Oran or Algiers postal agency and sent it by mail to Marseilles. The receiver, in France, mandated by the order cashed it in a French postal agency. The receiver simply sold the note for French Francs. To avoid the conversion of Algerian Francs and French Francs, the Treasury systematically provided the post office with

French Francs in exchange for its net balance in Algerian Francs. Indeed, the post office made the compensation between trans-Mediterranean payments. As we can imagine, a rapidly growing territory such as Algeria experienced a greater exiting flux (towards the metropolis) than entering flux, that is to say the territory experienced a balance of payments deficit. Because of these balance of payments deficits, the postal account for compensation allowed a net balance in Algerian Francs to occur, accumulated by the French Treasury.

The intervention of the Treasury to avoid the exchange between Algerian and French Francs was still just an *ad hoc* solution. The main drawback of it was that no method was forecast to regulate the balance of payments deficit, that is to say the Treasury contribution. At the beginning, the Treasury advance represented such a small amount in comparison to the French Franc monetary aggregates that the Treasury could at a small cost provide any French Francs that Algeria needed. However, as soon as the Algerian Franc position of the Treasury increased, there was a demand for an adjustment mechanism of this account to be implemented. The Treasury simply made a deposit of its Algerian issue position in the Algerian (Central) Bank accounts; as a result, the balance of payments deficit became an outstanding debt for the bank. The banks of issue and the commercial banks were regulated by some statutory rules. In particular, the overall liability of a bank of issue could not exceed one third of the metallic reserve (commodity money in gold). In the case of commercial banks, the statutes indicated that the total amount of liability couldn't exceed one third of the bank's equity. The Bank of Algeria was both a bank of issue and a commercial bank, it was thus ruled by the two rules of "one third". As the balance of payments belonged to the bank liability because of the Treasury account, the status of the bank led to a monetary policy regulation aimed at limiting the balance of payments deficit, that is to say the Treasury interventions. In addition to the statutory rule, the fact that the bank governor was appointed by the French administration ensured that the bank board would take care of the Treasury account equilibrium by adapting its monetary policy in order to adjust the external accounts. In exchange, the Treasury provided unlimited access to French Francs in order to make any payment from the territory. Indeed, the Treasury extracted the Algerian Franc from the exchange market. The convertibility of Algerian Francs into French Francs was guaranteed by the French administration at a known and fixed rate. The French Franc was convertible, thus the issue of the Bank of Algeria via the French Franc gained a complete convertibility. In addition, the Treasury committed itself never to demand a redemption of the advances. The French administration attained the same goal as the British administration but by different means: the "Treasury account" which later took the name of *compte d'opérations*; instead of the 100% backing rule.

The *compte d'opération* was spread all over the French Empire<sup>1</sup> and disappeared with independence. The only place where it remained effective was Equatorial and Western Africa. The newly independent former French colonies of Africa had preserved their common currency, the French CFA, divided into two monetary unions following the colonial monetary *partage*: the *Union Monétaire Ouest Africaine* and the *Communauté Monétaire d'Afrique Centrale*. Now, the management of the monetary policy for the unions is completely assumed by two regional Central Banks with only the friendly participation of the French authorities. The currency unions are independent from foreigners. On the contrary, the exchange regime is still based on the *compte d'opérations* which assumes the participation of the French Treasury. The mechanism has seen little change since 1878; the *compte d'opérations* is now managed on the Treasury accounts and the regulation, formerly implicit, is today explicitly included in an agreement drawn up between France and the countries in the Zone. The agreement, called *conventions de coopération*, aims at legalising the former practices governing the *compte d'opération* management. In particular, the *conventions* specify the

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<sup>1</sup> Expected Indochina.

rights and the duties of each partner. The French Treasury guarantees the convertibility of the CFA into Euros. This guarantee is characterised by three terms (Vinay 1988)

- the advances made by the Treasury to African Regional Bank are unlimited;
- the advance is permanent. In any case, the French administration can demand to be refunded its advances;
- the advance is mutual, meaning that the partners have the same status.

In the absence of a staff appointed by the Treasury running the monetary institution of the Zone, the equilibrium of the *compte d'opération* has been devolved to legal rule curbing the monetary policy if the deficit of this account, that is to say the balance of payments deficit, increases. These rules, which are in fact monetary policy rules, are called *clauses de sauvegardes*. They are numerous and are frequently revived. We quote only the most significant ones which effectively drive the monetary policy.

- A permanent minimum reserve of 20% of the total liabilities is required. An appropriate monetary policy has to be implemented in order to preserve at least this ratio.
- In the case of more than 3 months of account deficits, the refunding provided by the Central Bank is automatically reduced by 20%.
- The Central Banks are not allowed to provide the local Treasury with more than 20% of the state fiscal revenue of the previous year. 20% of fiscal revenue is a stock of advances to which a state is eligible; above this ratio no new advances are available.

These rules are examples of a set of arrangements aimed at tightening monetary policy in case of a deficit in the *compte d'opérations*. If the situation becomes severe, the set of rules is implemented automatically by the Central Bank. Any deviation from the application of the rule needs the unanimity of the board; France thus has the right of veto.

In British colonies, the currency boards had a 100% backing rule; we can thus say that the issues of the board were endogenously convertible (Lelard 1996). This kind of convertibility is called endogenous because the board keeps in reserve the currency necessary to redeem all its issues. The Franc Zone doesn't impose such a backing rule; the currency needed to facilitate convertibility is provided by a credible external body, the French Treasury, which acts as an external "lender" on demand. The convertibility is, thus, said to be external. Whatever the nature of the convertibility, both regimes propose a permanent and unlimited convertibility and they are thus called regimes of convertibility. Both regimes are based on two adjustment mechanisms presented below. This regulation is inspired by the monetary explanation of the balance of payments. The next section empirically tests the efficiency of the *compte d'opérations* to run monetary policy on the monetary approach side to the balance of payments.

Before describing the empirical procedure, we need to have some idea of the consequences of devaluation on the regime. The main consequence is the change in the exchange rate between the CFA Francs and French Francs. On January 1<sup>st</sup> 1994, twice as many CFA Francs were required for a given amount in French Francs. The CFA was devalued by fifty percent. This devaluation was the first and only one since the CFA creation in 1948. So the exchange rate has not been completely constant during this period, as is assumed for a convertibility regime. However, the zone performances in terms of nominal exchange rate stability are outstanding: from 1948 to 1994, more than 45 years, there was no devaluation. Since 1994, the devalued exchange rate has remained firmly stable. No country in the world can match this performance. In addition, the status of the zone did not forecast that the exchange rate would be inalienable: the exchange rate had a fixed but adjustable

level. In 1994 the countries of the zone, in collaboration with France, simply used this legal possibility.

In other aspects, the events of 1994 had little effect: the *compte d'opération* stayed in action as before, the Central Bank statutes was not changed and the CFA continued to benefit from external convertibility at a fixed exchange rate. In the following section, we test the impact of devaluation on monetary policy and the nature of the regime. Our assumption is that devaluation does not weaken the regime.

#### 4. Empirical test.

Firstly in this section, we test the existence of a long-term relationship between base money and the external currency position. A significant long-term relationship infers the existence of a stable money-currency equilibrium. Secondly, we estimate the short term dynamics in order to highlight the place of reserve variation in money supply determination.

##### 4.1. A co-integration relationship between base money and the external currency position arising from the FZ rules.

The Franc Zone is quite a long experience (1956-2002). The Zone is composed of fourteen countries in Western and Central Africa. We select the thirteen countries, which have belonged to the Zone since 1985<sup>2</sup>. We use monthly data for the period (1985:M8 – 2001:M7). The panel is balanced.

Formally, we can write the co-integration or the long-run relationship between base money and external balance as:

$$M0_{i,t} = \beta \cdot X_{i,t} + \varepsilon_{i,t} \quad (1)$$

$M0_{i,t}$ , is the base money at time  $t$  for country  $i$ . It is the part of the money aggregate on which the monetary authorities have a monopoly of issue. The series are provided by the international financial statistics (IFS), December 2001. We use the ratio between the M0 aggregate and the GDP. Such a ratio allows us to have a more homogenous indicator to compare M0 variations between countries.

$X_{i,t}$  represents the amount of currency reserve belonging to the monetary authorities of the country  $i$  at time  $t$ . This variable represents the aggregate assumed to conduct the monetary policy in the Zone. The data on reserves are extracted from IFS December 2001. We use the ratio of the external position to the GDP.  $X_{i,t}$  represents the stock of foreign assets residing in the country on each date. We note that this evaluation of foreign assets is the foreign asset available to the Central Banks; only a part of the stock of foreign assets belongs to the board.

$\varepsilon_{i,t}$  is the usual disturbance term for country  $i$  at time  $t$ .

$\beta$  is the coefficient of the long-term relationship between base money and the stock of foreign assets. The Zone 's rules don't define any particular relationship between base money and foreign reserves. We assume that the monetary policy of the Zone is directed to ensure a long-run equilibrium of the *compte d'opération*, and thus of the balance of payments. This balance of payments equilibrium means a currency money ratio which converges toward a

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<sup>2</sup> Appendix A: countries belonging to the Franc Zone.

stable long-term equilibrium. We could not, therefore, pre-determine the value of  $\beta$ . We assume, however, that the coefficient has to be strongly significant and inferior to one: significant, because the reserves have to lead the monetary policy if a real balance of payments mechanism exists; inferior to one, because the reserve is only a part of the Central Bank base money counterpart. In the case of no balance of payments problem, variables other than the external position could change the base money.

Firstly, we test the order of integration of M0 (base money), and of the country's external position, with a specific unit root test adapted for panel: Maddala and Wu (1999) test based Dickey-Fuller statistics. Secondly, we provide an estimation of the long-run relationship between base money and the external position assumed in currency board regimes.

#### Unit root tests.

The unit root tests have been criticised because of their low power. But in maximising the asymptotic proprieties, the panel significantly improves the power of these tests. Nevertheless, the panel data structure leads to some specific problems: individual heterogeneity and cross-sectional correlation (Banerjee, 1999).

Maddala and Wu (1999) update a test developed by Fischer (1932) based on the p-values combination of augmented Dickey-Fuller unit root tests. The p-values are estimated for each country. They depend on the chosen distribution of the test; here we use the MacKinnon distributions. Hence, the MW statistics indicate the global significance of unit root estimations among countries. It is a non-parametric test, robust to different lag lengths and particularly well-suited for unbalanced panel. In practice, the MW method can be applied with any number of lags and any temporal or individual panel dimensions. The test also relaxes the assumption of cross-sectional independence. It is, therefore, particularly attractive.

The MW test can be formulated for each variable  $y_{i,t}$  as:

$$\Delta y_{i,t} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^k \theta_j \Delta y_{i,t-j} + e_{i,t} \quad (2)$$

$\rho_i$  are the unit root parameters estimated for each country.

The p-values of  $\rho_i$  ( $\pi_i$ ) are computed to obtain the MW statistic<sup>3</sup>:

$$\text{MW stat} = -2 \sum_1^n \ln(\pi_i) \alpha \chi^2(2n) \quad (3)$$

The test gives the significance for all  $\rho_i$ . If the MW statistic reveals that the  $\rho_i$  are not significant as a whole, we cannot reject the null hypothesis of a collective unit root in the panel.

The results are presented in table 1.

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<sup>3</sup>  $2n$  is the degree of freedom, with  $n$  the number of individuals in the sample.

Table 1  
Statistics for a MW test of panel collective unit root.

MacKinnon distribution	Base money	Foreign exchange reserves
Benin	0.846	0.2224
Burkina Faso	0.2293	0.1465
Cameroon	0.9375	0.0104
Chad	0.1138	0.3522
Congo	0.0212	0.9967
Equatorial Guinea	0.6	0.8198
Gabon	0.12	0.14
Ivory Coast	0.0461	0.28
Mali	0.3685	0.604
Niger	0.4053	0.116
Central African Republic	0.5464	0.6804
Senegal	0.3508	0.5731
Togo	0.45	0.4811
MW F-test	35.5	33.6
H0 : all $\rho_i$ are not different from 0		
Critical value 5% : 38.9		
Critical value 10% : 35.6		

This test is not able to reject the null hypothesis of collective unit root in the two variables, c.f. table 1. Hence, the base money and the external position are not means reverting, but they are stochastically non-stationary. The presence of unit root means that the two aggregates suffer shocks non-perfectly corrected from period to period: the shocks have permanent effects. In effect, most macro-economic aggregates are likely to follow such a process. Indeed, they are characterised by considerable inertia.

#### Long-term representation.

Once established, the bi-variate the long-run relation could be described in three ways as follows:

- (1) All the countries across the panel are supposed to have the same behaviours thus the coefficients are identical:

$$M0_{i,t} = \alpha + \delta \cdot t + \beta \cdot X_{i,t} + \varepsilon_{i,t} \quad (4)$$

- (2) This specification is probably too restrictive. So, if we assume that the panel is heterogeneous, we can allow the coefficients to vary from country to country:

$$M0_{i,t} = \alpha_i + \delta_i \cdot t + \beta_i \cdot X_{i,t} + \varepsilon_{i,t} \quad (5)$$

- (3) In the last case, the panel structure is inappropriate: the use of the panel supposes some homogeneity among country behaviours in order to enable the estimation. In the case of a CB, the monetary authorities' means of intervention are regulated so we can assume the country's behaviours to be quite homogenous and their slopes to be close together. Our specification supposes the homogeneity of the slope  $\beta$  for all countries. However, we keep

the individual specific intercepts to allow for a certain heterogeneity among individuals due to the great diversity of country types in our sample, except for the use of the CB system. In addition, we introduce a trend in order to control for a determinist component which differs between base money and the external position (stochastic co-integration). Moreover, we allow this trend to vary across countries. Thus, this trend is country-specific. The sustainability of the exchange rate regime supposes not only a co-integration relationship, but also a negative or non-significant  $\delta_i$  (equation x). Indeed, in the opposite case, a positive and significant trend, we would observe a deterministic deviation between the two aggregates.

$$MO_{i,t} = \alpha_i + \delta_i t + \beta \cdot X_{i,t} + \varepsilon_{i,t} \quad (6)$$

In order to control for a likely residual auto-correlation we add a first order residual correlation, such as

$$MO_{i,t} = \alpha_i + \delta_i t + \beta \cdot X_{i,t} + (\varepsilon_{i,t} + \rho \varepsilon_{i,t-1}) \quad (7)$$

to the fixed effect model previously presented.

In the absence of other comprehensive co-integration tests, we use the estimation of  $\rho$  as a proxy for residual unit root evaluation. We know that the presence of a residual unit root is the sign of a co-integration failure. The model estimates the first order residual auto-correlation by a two-step method and provides a Durbin-Watson derived statistic<sup>4</sup>.

The following table gives the estimation of the equation (7).

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<sup>4</sup> We also run a Maddala Wu test on residuals in order to check the presence of unit root (Choi 2001) not presented in the present article. The test rejects the hypothesis of residuals non stationarity i.e. no individual stationarity test is able to reject the residual stationarity for all the countries in our panel.

Table 2.  
Engle Granger long-term relationship. Equation 7.

Fixed-effects (within) regression	Base money		Number of observations = 2203
$R^2 = 0.26$		slope	P-Values
	Reserves	0.55	0.0
	Benin	-0.000114	0.321
	Burkina Faso	0.0001433	0.199
	Cameroon	0.000206	0.387
	Chad	-0.0002265	0.094
	Congo	0.000092	0.568
	Equatorial Guinea	-0.00034	0.002
	Gabon	0.0002419	0.076
	Ivories Coast	-0.0002801	0.01
	Mali	-0.0001543	0.168
	Niger	-0.0001087	0.333
	CAR	0.0001197	0.387
	Senegal	-0.00109	0.0
	Togo	-0.0000107	0.92
	Devaluation	0.025	0.0
	Intercept	0.064	0.0
Residual first order correlation	$\rho = 0.85$		

The long-run estimation fits well with the model assumption, i.e. table 2: the slope of reserve is strongly significant, positive and inferior to one. The significance of this slope confirms the important role played by the balance of payments, or the external position in implementing monetary policy. On the contrary, we note that the model explains only 30% of the base money supply variance. Indeed, reserves are not the only base money counterpart in the Zone. Out of *compte d'opérations* deficit periods, the central bank acts freely; in particular it is able to accept private and (limited) public counterparts for base money. For the same reason, the base money is under-sensitive to reserve fluctuations. Indeed, in a crisis situation, the regulation of the *compte d'opérations* doesn't forecast explicit base money variation corresponding to reserve variations. The residual first order correlation is quite high but inferior to one, 0.85; that gives some evidence of the absence of unit root in residuals, thus of co-integration relationship validity. A significant first order correlation could be due to omitted variable determining base money supply previously recalled. Some individual specific time trends are significant. They reveal country-specific evolution, some towards a more restrictive policy i.e. Senegal, Chad, Ivory Coast and Equatorial Guinea, probably due to deep economic crisis. Another country, Gabon, experiences a positive trend, probably due to petroleum activity. These trends, positive or negative, constitute deviation from the panel long-run equilibrium: we obtain a stochastic co-integration with deterministic deviations. The situation is puzzling because it means that the Zone doesn't converge toward a coherent monetary policy. Consequently, this trend supports people who argue that the Franc Zone system is an inefficient tool.

However, we note a significant and positive effect of the devaluation, i.e. dummy variable devaluation, which takes the value 0 after the devaluation. We thus choose to run the model again, but for two separate periods: 1985-1994 and 1994-2001.

Table 3.

Engle Granger long-term relationship after the 1994 devaluation. Equation 7.

Fixed-effects (within) regression	Base money		Number of observation=890
$R^2 = 0.40$		slope	P-Values
	Reserves	0.52	0.0
	Benin	-0.0000814	0.53
	Burkina Faso	-0.000023	0.855
	Cameroon	0.00026	0.146
	Chad	0.0002817	0.113
	Congo	-0.0001342	0.71
	Equatorial Guinea	-0.0001033	0.45
	Gabon	0.0000878	0.62
	Ivory Coast	-0.000115	0.40
	Mali	-0.001002	0.42
	Niger	-0.0002141	0.10
	CAR	0.0003106	0.085
	Senegal	-0.0005	0.0
	Togo	0.0000254	0.84
	Intercept	0.053	0.0
Residual first order correlation	$\rho = 0.75$		

Table 4.

Engle Granger long-term relationship before the 1994 devaluation. Equation 7.

Fixed-effects (within) regression	Base money		Number of observation=1300
$R^2 = 0.15$		slope	P-Values
	Reserves	0.49	0.0
	Benin	0.012	0.0
	Burkina Faso	0.0003	0.015
	Cameroon	0.000085	0.49
	Chad	0.0002817	0.113
	Congo	-0.00000005	0.96
	Equatorial Guinea	-0.001742	0.0
	Gabon	0.0000681	0.58
	Ivory Coast	-0.0005571	0.0
	Mali	0.0000578	0.65
	Niger	0.000292	0.10
	CAR	0.0003106	0.085
	Senegal	0.000667	0.0
	Togo	-0.0002148	0.088
	Intercept	0.053	0.0
Residual first order correlation	$\rho = 0.67$		

The model performs better after the 1994 devaluation: it explains a greater part of the variance and all trends become non-significant<sup>5</sup> c.f. tables 3 and 4. We infer from this simple test that our model performs better after the 1994 devaluation. As our model assumes that the Franc Zone aims at equilibrating the balance of payments via the *compte d'opérations*, we conclude that there was a strengthening of the Zone's rules after devaluation. The coefficient is marginally higher in the post-devaluation period; we therefore infer that the long equilibrium is quite stable across the periods.

#### 4.2 Short-term dynamics and the strengthening of the Zone's monetary policy.

We could imagine that, due to various internal and external shocks, the base money would tend to deviate from its long-term relationship with the country's external position, defined in equation (7). However, contrary to other monetary regimes, the FZ system allows for a mechanism which sends the base money back to its long-run correspondence with Zone external assets (proxy of the country's external position). This mechanism defines an error correction model close to that presented by Engle and Granger (EG) (1987). The EG method has often been criticised; above all it demonstrates a very poor performance on a small sample<sup>6</sup>. It is also particularly sensitive to the presence of omitted variables. The rule-based model may bring a correct specification moreover; the use of a fixed effects model catches the effect of time-invariant characteristics<sup>7</sup>.

The dynamic short-run relationship could be written as:

$$\Delta M0_{i,t} = a_i + b.\Delta X_{i,t} + \sigma.(\varepsilon_{i,t-1}) + (e_{i,t} + \rho e_{i,t}) \quad (8)$$

$b$  gives the dynamic between the base money supply and the reserve variations.  $b$  is considered to be constant across countries.  $\sigma$  is the coefficient of the error correction term. It gives the rate of convergence of the model to its long-term equilibrium. We assume a relatively slow convergence due to the gradual aspect of the *CO* adjustment mechanism. If  $\sigma$  is significantly  $-1 < \sigma < 0$ , the model is convergent on the long-run equilibrium defined in (7). If  $\sigma$  is not different from 0, the model would not converge on an equilibrium. According to the Granger theorem, co-integrated variables always converge. A significant convergence coefficient  $\sigma$  is thus the indicator of a correct co-integration specification.

The following table presents the short term dynamics for the period 1985-2001.

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<sup>5</sup> Except for Senegal, it remains significantly negative.

<sup>6</sup> For the present study, we have at our disposal quite a wide panel: 2203 observations.

<sup>7</sup> Other methods have been developed in the area of co-integration, such as the one-step procedure or the Henry method. They both present bias consisting in lagged dependent variable endogeneity in a panel specification. Assessing respective bias of the methods, we prioritise the EG procedure.

Table 5.  
Engle Granger short-run dynamics. Equation (8).

Number of observations =2179		
Random effect		
R-sq:0.30		
	Coef.	P-Value
$\Delta x_{i,t}$	0.61	0.000
$(\epsilon_{i,t-1})$	-0.06	0.000
$\rho = -0.045$		

Both coefficients are strongly significant and the residuals first order correlation is null. We infer the existence of an error correction mechanism driving the monetary policy in order to respect a certain base money / external position ratio. However, the convergence rate is slow: 6% of the deviation is corrected each period. As we use monthly data, it takes 12 months to completely adjust to a deviation. The slowness of the adjustment process could, again, support the inefficiency of the Zone's institutions to run monetary policy.

To investigate this question further, we ran our model on ante and post-devaluation periods, as for the long-run equilibrium. Again the results are quite interesting.

Table 6.  
Engle Granger short-run dynamics after the 1994 devaluation. Equation (8).

Number of observations =879		
Within estimator		
R-sq:0.37		
	Coef.	P-Value
$\Delta x_{i,t}$	0.50	0.000
$(\epsilon_{i,t-1})$	-0.16	0.000
$\rho = -0.18$		

Table 7.  
Engle Granger short-run dynamics after the 1994 devaluation. Equation (8).

Number of observations =1287		
Ransom effect		
R-sq:0.32		
	Coef.	P-Value
$\Delta x_{i,t}$	0.79	0.000
$(\epsilon_{i,t-1})$	-0.058	0.000
$\rho = -0.09$		

As for the long-run, the model better fits post-devaluation in every aspect. In particular, the rate of convergence, which was slow before devaluation, at 5.8%, became quite high, 16% after devaluation. Consequently, instead of twelve and a half months needed to adjust a deviation before 1994, we need only four and a half months after 1994. This test provides other evidence of the strengthening of the monetary policy after the devaluation. In particular, the external account monetary adjustment, which is based on the *CO*, a fundamental feature of the Zone, appears to be more efficient after the devaluation.

## 5. Conclusion.

The money supply in the Franc Zone is effectively managed to a significant extent by the external position. This feature infers that the *compte d'opération* is an efficient tool for adapting monetary policy to the balance of payments or external position situation. This mechanism, as a central part of the Zone's monetary policy, is clear evidence of the Zone's being a convertibility regime. It would now be interesting to compare the different convertibility regimes, especially the currency boards and the Franc Zone, to assess their respective performance in terms of external position objectives.

Another interesting finding of this work is the strengthening of the Zone's principle after the devaluation. Some might see the devaluation as a denial of the Zone's basic principle. On the contrary, this event seems to revive the spirit of the Zone. Indeed, our model, which is close to the genuine basic function of the *CO* fits better after the devaluation than before. We could thus infer that, far from signalling the abandonment of fixed exchange rates and predicting a softening of monetary policy, devaluation confirms the nature of the exchange rate regime as a convertibility regime and pursues the monetary adjustment of balance of payments variations.

### Appendix no. 1

Countries belonging to the Franc Zone (*rapport de la Zone Franc 2000*)

COUNTRY NAME	SINCE	MONETARY UNIONS	POPULATION
Benin	1960	BCEAO	6,300,000
Burkina Faso	1960	BCEAO	11,300,000
Cote d'Ivoire	1960	BCEAO	15,800,000
Guinea	1997	BCEAO	1,200,000
Mali	1984	BCEAO	10,800,000
Niger	1960	BCEAO	10,800,000
Senegal	1960	BCEAO	9,500,000
Togo	1960	BCEAO	4,700,000
Cameroon	1960	BEAC	15,000,000
Central African Republic	1960	BEAC	3,600,000
Congo	1960	BEAC	2,900,000
Gabon	1960	BEAC	1,200,000
Equatorial Guinea	1985	BEAC	400,000
Chad	1960	BEAC	7,700,000

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