

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 Franc 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.

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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 (Stasavage 1997), 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 (a dummy variable), post and ante-devaluation; in this way we can quote the modification of monetary policy due to devaluation.

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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 Standard (GEs), in use at the end of the XIXth and the beginning of the XXth century elaborated the monetary explanation of the balance of payments. The topic thus has a deep theoretical background (Rist 1938, Friedman 1969, Barro 1979). 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 stock. 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 GEs 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. Barro (1979) presents a model of price determination under a commodity standard. If G_m represents the commodity stock held by the banks, then the supply of money would equal $P_g G_m$ under a strict commodity standard. In the franc zone, the money supply is explicitly guaranteed, previously in French Francs now in Euros, at a fixed rate e . The commodity backing is thus replaced by an external security residing in the *compte d'opération* (CO). We could thus re-write the commodity model as

$$M_s = aCO.e \quad (1)$$

Obviously, the more CO is inelastic and constrained to a limited quantity of French Francs (now Euro), the more money supply is closed to a commodity standard. By adding to the model, a demand for money dependant of real income y (transaction purpose), and of the general prices level of goods anticipated by people (real cash balance desired) $E(P)$ we could get a formulation for the price level determination depending of CO .

$$M_d = y + E(P) \quad (2)$$

$$P_t = CO * E(P) / y \quad (3)$$

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 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 (Ges) also rests on an external adjustment. Hume (1752) and Cantillon (1755) first exposed this adjustment in the basic Price-Species-flow model (PSF) (Cesarano 1998, Faust 1979 and Berdell 1995). 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 (GEs) assumes the role of an automatic balance of payments adjustment mechanism. The limitations of (PSF) have often be debated, in effect the basic model assumes real variables to be invariant and the law of one price to hold only at the equilibrium. Hume himself notes that an entering moderate flux, that to say a slow money growth, should be invested in productive activities and be used in order to reduce underemployment of the production capacity (Fausten 1979). In consequences, this path of money growth stimulates output growth without increasing prices. Inversely, an existing flux should be offset by a growth slowdown without price dropping. However forward of some points in money growth (fall), the prices react more than real variables. The law of one price (PPP) is defined as the equilibrium position in the long run. However, price could deviate in short run. The (PSF) explains why the external position and base money should vary, under a fixed exchange rate and without sterilisation, to bring price back to the equilibrium position.

More recently, the Monetary Approach of the Balance of Payment (MABP) revives (PSF) model (Frenkel 1976, Frenkel and Jonhson 1976). The (AMBP) argues that in term of external balance the nominal variables are leader, and real variables follower. The overall balance is thus confused with the local money balance, that to say an excess offer of money is automatically siphoned by the external account in order to respect PPP equilibrium. On the contrary, the only determinant of money growth is thus a positive external "money balance". In truly fixed exchange rate regime or convertibility regime, (PSF) and (AMPB) argue that the money supply is endogenous, determined by the external money balance, and that the monetary policy should contribute to the external equilibrium via an automatic mechanism which assumes the absence of sterilisation of external flux policies.

The present convertibility regimes are, thus, supposed to provide the same mechanism. In orthodox 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. Theoretically, this view rest on the monetary approach of global balance. If P_t , M_s and y are respectively local price, money supply and gross domestic product, the following equation summarizes the monetary approach of global balance. P_t^* , M_s^* and y^* are the same variable but for the rest of the world.

$$P_t - P_t^* = (\Delta M_s - \Delta M_s^*) - (\Delta y - \Delta y^*) \quad (4)$$

(AMBP) rests on some monetarist concepts ; price growth is determined by the money supply growth exceeding the money demand variations due to transaction purpose (y). Under fixed exchange regime the equilibrium hold as long as the PPP holds. Assuming the money supply to be a multiple of base money (B_s) as $M_s=kB_s$ and the base money to be defined by its two counterparts: net foreign asset belonging to the central bank (NFa), and the net domestic asset belonging to the central bank (ND_a). ND_a is composed of the advances to government bodies and advance to private sector as bank refunding such as :

$$B_s=1*NF_a+1*ND_a \quad (5)$$

With (NF) the net external position of the zone and (d) the real exchange rate appreciation due to a positive inflation differential between local price variations and international price variations for a given productivity growth rate (a). The balance of payment unbalance that to say the excess demand for currency on the exchange market or the excess money supply on local money market (AMBP) is thus a function of (d). The adjustment mechanism in a perfectly passive monetary policy context, as under an orthodox currency board, could be written as:

$$BP=\Delta NF=-f(d) \quad (6)$$

We assume that a constant fraction (α) of the total external position belong to the monetary authorities.

$$\Delta F_a=\alpha\Delta F \quad (7)$$

In a pure (PSF), non-sterilisation context, the currency drain impacts proportionally (Nfa) and the (Nda) are assumed to be invariant. In a orthodox currency boards, the (Nda) are virtually forbidden, however we allow for a disturbance term in order to control for some internal shocks included in the bank accounts.

$$B_s=1*(NF_a-\alpha f(d))+1*(ND_a+\epsilon) \quad (8)$$

ϵ is a stationary noise, that to say net domestic asset evolution follow a means reverting process. In a pure (PSF) and (AMBP) model, the difference between the base money and net domestic asset should be stationary, meaning by the way that external flux are not sterilized. In an orthodox currency board where the (Nda) are supposedly forbidden in central bank account the model should hold. In the classical (PSF), the fall in price is proportional to the fall in money, the adjustment is thus immediate. The inclusion of real variables, as real income, changes the path of convergence (Berdell, 1995). However, the currency drain continues until the price converge toward the PPP equilibrium defined in (1).

$$\Delta M_s=k*(\Delta B_s=-\alpha f(d))\rightarrow\Delta M_s^* \quad (9)$$

$$(\Delta P_t=-k\alpha f(d))\rightarrow\Delta P_t^* \text{ and } d\rightarrow 0 \quad (10)$$

The mechanism rests on money supply reduction until the exchange rate real appreciation implying currency drain stopped. The efficacy of the mechanism resides in the size of the global external position belonging to monetary authorities (α), that to say included in the

adjustment mechanism and the base money multiplier (k) which sizes the reaction of global money supply to base money variations.

We may thus find in the two regimes, currency boards and the Franc Zone, 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 reserve and the flux of foreign reserve. 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*, and its specificities.

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

three times 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 three times 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 Empire¹ 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 changes 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 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 Banks 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%.

¹ Expected Indochina.

- 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 addition, an other feature had in the zone a first order importance, recently stressed by some researches of IMF (Oral and ali 2001), the *CO* is used to gather 65%² of the foreign exchange of the zone members. The account has thus a function of reserve pooling. This mode of arrangement smoothes the variability of reserve in each country and it works as a security for idiosyncratic shocks. The pooled management of net foreign assets has the advantage to give a clear homogeneity to our panel.

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 *compte d'opération* mechanism presents however significant differences with the orthodox passive monetary policy presented in (6)-(10). In particular, the monetary authorities conserve the ability to run active monetary policy that to say $\Delta NDa_t > 0$ even if $d_t > 0$. This feature maintains the exchange rate over-valuation and thus the currency drain. In consequences, the drain would persist until the *CO* attains its limit and the restriction on money supply take place.

$$BP_t = -f(d_t) \quad (11)$$

$$B_{s_t} = 1*(NF_{a_t} - af(d_t)) + 1*(D_{a_t} + \Delta CO) \quad (12)$$

The *CO* guaranties the non covered part of the base money, that to say the *NDa*. As previously specified, the PPP equilibrium of (PSF) and (AMBP) model in case of fixed exchange rate hold in the long run if *NDa* are a stationnarity base money conterpart. For the franc zone, this is equivalent to test the *CO* stationnarity.

$$\Delta M_s = k*(\Delta B_{s_t} - \Delta CO - af(d_f)) \quad (13)$$

If *CO* is stationary, that to say mean reverting, the external unbalance should continue until the drain overpass the mean of *CO* advances.

$$(\Delta P_t = -kaf(d_t) + \Delta CO) \rightarrow \Delta P_t^* \quad \text{and} \quad d_t \rightarrow 0 \quad (14)$$

² The figure of 65% is the present rate of required pooled reserves.

Forward the critical point of currency drain, the drop in money supply continue until money supply converge toward anchor money supply. The convergence of money supply unable the PPP equilibrium (1), that to say local prices converge toward international prices.

The equilibrium of the model would depend on the stationnarity of *CO*. Two different results could be meet following two rival assumptions : as supported by one's the *CO* mechanism is an unlimited funding for external unbalance, that to say it permits long run real appreciation and currency drain. In this case, *CO* is a free variable, negatively correlated with the external position. In consequences, the base money supply should be insensible to or independent of external position variations. As supported by other's, the *CO* maintains a clear link between the external position and the base money supply despite some flexibility in the adjustment process in comparison to the pure and strict version of the external balance monetary adjustment. In that case, we should note a significant long run relation between base money and the external position and a non zero sensibility of base money supply to external position variations. 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. The presence of significant co-integration relation and error correction process should give some evidences about the effective *modus operatis* of the *CO*.

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 1st 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 model presented above, a devaluation, if it is not compensated by an inflation boost, should punctually reduce the real misalignment of exchange rate and consequently lower the currency drain. In the case of the CFA zone the convertibility regime imposes to implement a real adjustment of the numerous external equilibrium appeared in the 80's and peaking in the early 90's. This strategy despite some achievement, it imposes deflation and thus reduce real appreciation, seems to be limited. In consequences, in December 1994, the countries of the zone and France allowed the devaluation in order to "finalize" the structural adjustment. In the following section, we test the impact of devaluation on monetary policy and the nature of the regime. Our assumption is that devaluation supports the external adjustment in reducing non corrected over-valuation.

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 CFA Franc Zone rules.

The Franc Zone is quite a long experience (1956-2002). The Zone is composed of fifteen countries in Western and Central Africa. We select the complete sample, except Comoros, which belongs today to the Zone³. We use annual data for the period (1956 – 2002). Monthly data are available, but they don't bring more information than annual frequency and they are subject to seasonal disturbances. The panel is balanced except for the three countries gathering the zone after 1956, that to say Equatorial Guinea, Guinea Bissau and Mali.

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

$$Bs_{i,t} = \beta.NFa_{i,t} + NDa_{i,t} \quad (15)$$

$Bs_{i,t}$, 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 nominal base money (Bs) aggregate and the nominal GDP. Such a ratio allows us to have a more homogenous indicator to compare $Bs_{i,t}$ variations between countries and it eliminates the disturbances due to price variations.

$NFa_{i,t}$ 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 reserve are extracted from IFS December 2001. We use the ratio of the external position in nominal CFA Franc to the GDP in nominal CFA Franc. As long as the absolute PPP hold this ratio permit to eliminate nominal variations disturbances and to get a more homogenous variable. $Fa_{i,t}$ 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. We assume that the ratio reserve/external position is fixed.

β 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 reserve except the 20% minimum. 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 stable long-term equilibrium. We could not, therefore, pre-determine the value of β . We assume, however, that the coefficient has to be strongly significant and inferior to one: significant, because the reserve have to converge toward a stable portion of the base money counterpart; inferior to one, because the reserve is only a part of the Central Bank base money counterpart. It exists also the stock of public and private counterpart. The constraint impose by the fixed exchange rate, and thus the balance of payment adjustment mechanism, rests on the base money counterpart evolution that to say the dynamic of the model. In facts, government advances and private re-funding are not free as their evolution influence the real appreciation and, in consequences the external position. In conclusion, public advances and bank re-funding are free as long as productivity growth and/or nominal under-valuation compensate potential real overvaluation. In consequences, the residual $Nda_{i,t}$ should be stationary in a (PSF) context. $Nda_{i,t}$ is, also the disturbance term for

³ Appendix A: countries belonging to the Franc Zone.

country i at time t of the long run relation which stand for the CO advances on the 1956-2002 period.

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

Unit root tests.

The unit root tests have been criticized because of their low power. But in maximizing 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 or Phillips and Perron 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:

$$\Delta y_{i,t} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^k \theta_j \Delta y_{i,t-j} + e_{i,t} \quad (16)$$

ρ_i are the unit root parameters estimated for each country.

The p-values of ρ_i (π_i) are computed to obtain the MW statistic⁴:

$$\text{MW stat} = -2 \sum_1^n \ln(\pi_i) \mapsto \chi^2(2n) \quad (17)$$

The test gives the significance for all ρ_i . If the MW statistic reveals that the ρ_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.

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

MacKinnon distribution	M0/GDP (n°obs)	NFa/GDP (n°obs)
Benin	0.31 (38)	0.88 (38)
Burkina Faso	0.11 (37)	0.24 (37)
Cameroon	0.17 (37)	0.19 (37)
Chad	1.00 (29)	1 (29)
Congo	0.45 (41)	0.002 (41)
Equatorial Guinea	1 (15)	0.07 (16)
Gabon	0.28 (40)	0.23 (32)
Ivory Coast	0.7 (39)	0.88 (39)

⁴ $2n$ is the degree of freedom, with n the number of individuals in the sample.

Guinea Bissau	..(4)	.. (4)
Mali	0.35 (16)	0.89 (16)
Niger	0.67 (38)	0.44 (38)
Central African Republic	0.21 (41)	0.41 (39)
Senegal	0.13 (38)	0.22 (38)
Togo	0.63 (38)	0.49 (38)
MW F-test	26.2	35.4
H0 : all ρ_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 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:

$$Bs_{i,t} = \alpha + \delta.t + \beta.NFa_{i,t} + NDa_{i,t} \quad (18)$$

- (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: In the following table (table 2) we present a specification allowing for heterogeneity across countries in the long run relation.

$$Bs_{i,t} = \alpha_i + \delta_i.t + \beta_i.NFa_{i,t} + NDa_{i,t} \quad (19)$$

- (3) In the last case, the panel structure is less appropriate: the use of the panel supposes some homogeneity among country behaviours in order to enable the estimation. In the case of the ZF, 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. Specifically, the zone imposes a pooled management of the net foreign asset, that supposes a certain homogeneity in the relation between base money and net foreign asset across countries belonging to the unions. Our specification assumes, thus, the homogeneity of the slope β 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 *CO* 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). The sustainability of the exchange rate regime supposes not only a co-integration relationship, but also a negative

or non-significant δ_i (equation 5). Indeed, in the opposite case, a positive and significant trend, we would observe a deterministic deviation between the two aggregates.

$$Bs_{i,t} = \alpha_i + \delta_i t + \beta.Fa_{i,t} + NDa_{i,t} \quad (20)$$

The following table gives the estimation of the equation (20) and it presents the result of Phillips Perron unit root test on residuals stationary⁵.

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

Equation (25)	Pooled estimation	NDa (CO) stationary		
Fa_t	0.58 (0.0)	$\epsilon_{i,}$	Benin	0.003
			Burkina Faso	0.077
			Cameroon	0.006
			CAR	0.068
			Chad	0.000
			Congo	0.000
			Ivory Coast	0.001
			Equatorial Guinea	n.a.
			Gabon	0.044
			Mali	0.271
			Niger	0.050
			Senegal	0.040
			Togo	0.180
Before 94	0.0463 (0.0)			
Time trend	0.0013 (0.0)			
R^2	0.70			

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 existence of a long run stable relation between monetary aggregate, especially base money, and the external position approached here by reserve. In addition, we note that the model explains 70%-80% of the base money supply variance. Indeed, reserve are not the only base money counterpart in the Zone. In the long run, reserve and base money meet a stable equilibrium. The role play by the external position in base money creation seems to be quite high, in most of cases the equilibrium is significantly above the minimum 20% of base money required.

Some individual specific time trends are significant. These trends, positive or negative, constitute deviation from the panel long-run equilibrium: we obtain a stochastic co-integration with deterministic deviations.

Finally the dummy variable “before 1994” reveals a significant impact of the devaluation on the monetary policy of the zone. The control for the period before 1994 increase the fit of the model and tighten the long run relation between base money and reserve. Specification allowing for dummy heterogeneity, shown that the same events, the

⁵ As the specification included trends and fixed effects, we exclude from the specification of the tests trend and intercepts.

1994 devaluation, has quite distinct effects on the long run relation across the countries of the zone⁶.

A basic test of the validity of a co-integration relation consists in checking the stationarity of the long run relation residuals. Here, the test also checks the validity of the PSF model, we recall that a stationary residuals indicate stationary (NDA) or CO. We presented the unit root test done on residual for each individuals of the sample. By the way, in a MW like interpretation, if all or a great majority of individual get stationary residuals, we assume that the panel converge toward a panel co-integration. The test gives ambiguous results in the cases of Mali and Togo; however the (PSF) and co-integration hold in the remainder of the Unions. How could some countries diverge of the model and other not in the same zone and unions? One explanation is that some countries of the zone benefit of the polling management of the (NFa) more than others.

4.2 Short-term dynamics.

The previous test give some evidence about the presence of a reserves/base money target among the Franc Zone members. This was an unavoidable previous testing the monetary adjustment mechanism, that to say the short run dynamic of the model. In other words, in this part, we will check that it exists a force, the monetary adjustment linked to the CO, which makes the base money converge toward its long run equilibrium with the external position.. 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 (8). 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 sample⁷. 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 characteristics⁸.

The dynamic short-run relationship could be written as:

$$\Delta Bs_{i,t} = a_i + b\Delta Bs_{i,t-1} + c_1.\Delta Fa_{i,t} + c_2.\Delta Fa_{i,t-1} + \sigma.(\epsilon_{i,t-1}) + e_{i,t} \quad (21)$$

The constraint of the regime are bidding in term of base money counterparts evolution. In facts, government advances and private re-funding are not free as their evolutions influence the real appreciation and, in consequences the external position. Public advances and banks re-funding are free as long as productivity growth and/or nominal under-valuation compensate potential real overvaluation. In absences of such phenomenon, the external position should fully lead base money issue at the re-funding enabled by the CO advances. c_1 and c_2 give the dynamic between the base money supply and the reserve variations. b is considered to be constant across countries. It gives the inertia of base money variations In particular, as we control for lagged reserve variations, the lagged base money supply gives the other counterparts than reserves inertia that to say government and private advances inertia.

⁶ The specification allowing for the dummy variables heterogeneity is not presented in this document.

⁷ For the present study, we have at our disposal quite a wide panel: 392 annual observations.

⁸ 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.

σ 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 σ is significantly $-1 < \sigma < 0$, the model is convergent on the long-run equilibrium defined in (7). If σ 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 σ is thus the indicator of a correct co-integration specification

The following table presents the short term dynamics for the period 1956-2001.

Table 4.
Engle Granger short-run dynamics. Equation (8).

Model 1	Pooled estimation	Model 2		Individual effect
$E_{i,t-1}$	-0.23 (0.0)	$E_{i,t-1}$	Benin	-0.31 (0.0)
			Burkina Faso	-0.17 (0.17)
			Cameroon	-0.14 (0.41)
			CAR	-0.23 (0.0)
			Chad	-0.49 (0.13)
			Congo	-0.43 (0.0)
			Ivory Coast	-0.42 (0.0)
			Equatorial Guinea	NA
			Gabon	-0.08 (0.22)
			Mali	-0.85 (0.0)
			Niger	-0.20 (0.0)
			Senegal	-0.26 (0.0)
			Togo	-0.14 (0.17)
ΔFa_t	0.47 (0.0)	ΔFa_t		0.48 (0.0)
ΔFa_{t-1}	0.02 (0.6)	ΔFa_{t-1}		0.01 (0.74)
ΔBs_{t-1}	0.0	ΔBs_{t-1}		0.09 (0.2)
Before 94	0.0068 (0.0)	Before 94		0.008 (0.0)
Time trend	0.0	Time trend		0.0
Durbin Watson	1.91	Durbin Watson		1.92
R ²	0.43	R ²		0.46

Both coefficients are strongly significant. 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: 23% of the deviation is corrected each period. As we use annual data, it takes three and half years to completely adjust a deviation. The slowness of the adjustment process could, again, support the inefficiency of the Zone's institutions to run monetary policy. The error correction term exhibits a certain heterogeneity meaning that the monetary policy of the zone is the subject to important local appreciation as, for example, the role played by the national committee of credit. Most of them, except Cameroon and Gabon, have a significant error correction mechanism. This mechanism could be influenced by local considerations as openness and/or the size of each member.

In addition, the reserve variations are significant in both specifications. As specified in the "commodity model" the variation of the external position seems to effectively have a significant and quite high impact on base money issue. In comparison, the lagged base money growth which stand for the inertial effect of the other base money supply counterparts different from external reserve, have a quite moderate importance. In consequences, the *CO* could not be taken as a means to compensate the consequences of external position variations

on local money in a nominal fixed exchange rate context. In other word, the *CO* advances are subject to an implicit constraint and are free of banks or governments discretionary powers. If the limitation is not in quantitative terms, the *clause de sauvergades* and the zone status had been empowered in order to avoid the currency drain due to real appreciation in fixed exchange context. In that respect, the zone meet certain achievements as our test reveals the presence of an overall balance monetary adjustment. Finally, as in the long run relation, the addition of a dummy variable controlling for “before 1994” improves the fit of relation. By the way we conclude that our model (PSF) suit better to the zone after than before the devaluation. The main effect of the devaluation should be to ease the external adjustment by lowering real over-valuation. In consequences, the currency drain should by less important and thus the monetary adjustment easier.

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 in a (PSF) and (AMBP) manner. 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
Comoros	1979	..	727,000
Benin	1960	BCEAO	6,300,000
Burkina Faso	1960	BCEAO	11,300,000
Cote d’Ivoire	1960	BCEAO	15,800,000
Guinea-Bissau	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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