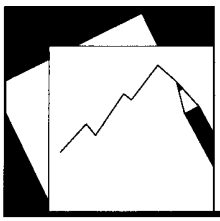
WP/12/73



IMF Working Paper

Exchange Rate Volatility Under Peg: Do Trade Patterns Matter?

Constant Lonkeng Ngouana

INTERNATIONAL MONETARY FUND

 WP/12/73

IMF Working Paper

African Department

Exchange Rate Volatility Under Peg: Do Trade Patterns Matter?

Prepared by Constant Lonkeng Ngouana[1]

Authorized for distribution by Christina Daseking

March 2012

Abstract

This paper assesses the role of trade patterns in shaping the volatility of the effective exchange rate under two alternative peg regimes: a hard peg to a single currency and a peg to a basket of currencies. I link the changes in the nominal effective exchange rate of a pegged currency to the fluctuations of its anchor vis-à-vis other major currencies, with an emphasis on the dynamics of trade patterns. In an application to the WAEMU (West African Economic and Monetary Union), I find that the nominal effective exchange rate of the union was twice as volatile under the hard peg to the euro as it would have been under a hypothetical basket peg over the past decade. This result was driven by the substantial shifts that occurred in WAEMU trade patterns—away from euro area countries and toward the "BICs" (Brazil, India, and China). These findings suggest that policymakers should pay as much attention to the type of peg as to pegging in itself, with a particular focus on the dynamics of trade patterns.

JEL Classification Numbers: F31, F33

Keywords: Basket peg, hard peg, exchange rate volatility, trade patterns, WAEMU

Author's E-Mail Address: CLonkeng@imf.org

[1] I am grateful to Norbert Funke for his valuable input from the early stage of this project. I would like to thank Christina Daseking, Montfort Mlachila, Roger Nord, Philippe Wingender, the WAEMU team (Alexei Kireyev and Christina Kolerus in particular), and seminar participants in the African Department's External Sector Network at the IMF for useful comments and suggestions, and Jenny DiBiase for helpful editorial comments. Thanks are also due to seminar participants at the Central Bank of West African States (BCEAO) in Dakar, and at the WAEMU Commission in Ouagadougou for useful comments on preliminary findings of the paper during the 2011 IMF's multilateral surveillance discussions with WAEMU member countries. The usual caveat applies.

Contents Page

I. INTRODUCTION

The debate over the appropriate exchange rate regime for small open developing economies is very prominent among policymakers. The spectrum of choices is large, expanding from the two "corner solutions"—hard peg and pure floating—to a continuum of intermediate regimes, including basket peg.

In a comprehensive survey that covers 1970–99, Rogoff and others (2003) show that countries that adopted a flexible exchange rate regime outperformed those that opted for a peg: the annual real per capita growth rate averaged 3.6 percent in the former category and only 2 percent in the latter over the sample period. The corresponding figure was 2.8 percent in countries that adopted intermediate regimes. Also, the study shows that the volatility of the real GDP growth was highest in fixed exchange rate countries (4 percent on an annual basis) and lowest (1.6 percent) in countries that adopted intermediate regimes. Although these results may be subject to a selection bias problem, the discrepancy is striking.[2]

Notwithstanding this relatively low performance of fixed exchange rate regimes, the 2010 IMF report on exchange rate arrangements suggests that a non-trivial number of countries still have their currency pegged *de jure* to a major currency. The choice of exchange rate regime ultimately depends on a number of factors, including the level of domestic financial development and the strength of local institutions—e.g., the ability of a country's authorities to manage a currency with credibility. Countries with a weak track record in containing inflation may peg their currency to a major currency to import low inflation and credibility from the anchor country. Also, some countries peg their currency to a basket of major currencies as an intermediate step toward floating.

Although an extensive literature covers the degree of exchange rate flexibility, little attention has been devoted to different types of peg arrangements. This paper attempts to close that gap. The decision of how to peg might in fact be as critical as pegging in itself. The paper discriminates among different types of peg arrangements on the basis of a particular criterion: the volatility of the nominal effective exchange rate (NEER).[3] This is a relevant criterion as Duarte, Restuccia, and Waddle (2007) document, in a panel of developed and developing countries, that real macroeconomic variables—output, consumption, investment, net exports, real exchange rate—co-move significantly with the NEER. In addition, the co-movement is substantially stronger in developing than in developed countries. Bagella, Becchetti, and Hasan (2006) argue that the effective exchange rate should be used, instead of a bilateral exchange rate, in assessing the impact of exchange rate volatility on economic growth. Using the system-

[2] The selection bias may arise from the fact that countries that adopt flexible exchange rate regimes have relatively well-developed financial markets. Now, because financial markets are growth-enhancing and also help smooth-out consumption—through the sale and purchase of financial instruments—countries with flexible exchange rate regimes will tend to display both higher growth rates and lower growth volatility in the data.

[3] The nominal effective exchange rate (NEER) corresponds to the value of a home country's currency compared to the currencies of its trading partners, weighted by their trade shares. The real effective exchange rate (REER) adjusts the NEER by the price differentials between the home country and its trading partners.

GMM estimation method, the authors find that the volatility of the real effective exchange rate (REER) has a significant and negative impact on per capita income growth, after controlling for other traditional growth drivers. In a more recent paper, Aghion and others (2009) find that the volatility of the real effective exchange rate is detrimental for productivity growth, especially for countries with relatively low levels of financial development.[4]

This paper, however, does not aim at deriving an optimal peg. Such an exercise would require taking into account not only considerations related to trade and exchange rate stability, but also the extent of imported inflation, the currency denomination of countries' liabilities, and institutional constraints that countries face.

In examining the volatility of the effective exchange rate across peg regimes, the paper emphasizes the role of shifting trade patterns. In principle, when the domestic country carries most of its trade with a single major country, pegging the local currency to that country's currency limits the volatility of the effective exchange rate. This is because the effective exchange rate precisely captures the average value of the local currency vis-à-vis the currencies of its trading partners, weighted by partners' trade shares. However, as the domestic country's trade patterns diversify, the hard peg to an anchor may at some point cease to be the most appropriate regime in stabilizing the NEER.[5] This is because—as shown in Section III—the fluctuations of the effective exchange rate depend on the behavior of the anchor vis-à-vis other trading partners' currencies, to an extent that decreases with the trade share of the anchor country.

In the application, I use a sample of eight West African countries that have had their common currency—the CFA franc—pegged to the French franc since the mid-40s and to the euro since its introduction in 1999. These countries now constitute a substantial part of the world sample of fixed exchange rate countries and form the West African Economic and Monetary Union (WAEMU).[6] I consider these countries as a group instead of analyzing them separately because their monetary policy is implemented at the union level. Moreover, although one should expect some heterogeneity in the volatility of the effective exchange rate across these countries, the difference is likely to be small because they have similar production structures and virtually trade with the same set of countries.

At the time of the initial peg arrangement, France accounted for most of the external trade of WAEMU countries. Since then, particularly since the early 2000s, the trade patterns of

[4] Although the authors focus on the REER, their findings are also relevant for this paper, which focuses on the NEER, given that Duarte, Restuccia, and Waddle (2007) document a very strong co-movement between the NEER and REER, with the correlation ranging from 0.76 for developing countries to 0.92 for developed countries. See Section II.B for detailed WAEMU-related evidence.

[5] The diversification of trade patterns is a positive development in general, as it may allow the domestic country to partially edge against trading partners' idiosyncratic shocks.

[6] The WAEMU includes eight countries in West Africa: Benin, Burkina Faso, Côte d'Ivoire, Guinea Bissau (which joined the union only in 1998), Mali, Niger, Senegal, and Togo.

WAEMU countries shifted briskly away from France and other euro area countries and toward Brazil, India, and China ("the BICs")—China in particular. This paper addresses the following two questions: (i) What are the implications of the above trade patterns' shifts on the volatility of the NEER of the WAEMU?; and (ii) Would pegging their currency to a basket of currencies in lieu of the current hard peg arrangement have resulted in a more stable NEER?

I gauge the current hard peg to the euro against a simple benchmark basket peg: the SDR (Special Drawing Rights), which is a weighted average of the main worldwide trading currencies: the US dollar, the euro, the Japanese yen, and the British pound.[7] This basket of currencies, although not used directly in trade (at least not yet), is easy to monitor, compared to an export or import-based basket. In addition, it has three nice features for the set of countries under consideration. First it directly embeds the currencies of most WAEMU's major trading partners. Second, although the weights in the SDR basket may not fully reflect the trade shares of WAEMU partners, they do reflect—to some extent—the shares in the world demand for intermediate goods of the largest economies with fully convertible currencies. The SDR benchmark is therefore compatible with the fact that WAEMU countries mainly export commodities used as intermediate inputs. Third, the SDR peg might be more transparent and convenient in promoting intraregional trade than the alternative trade-weighted basket peg, which may pose the issue of harmonizing unilateral basket pegs at the union level.

Using monthly bilateral exchange rates data and annual trade data from 1980 to 2010, I find that the volatility of the effective exchange rate of the CFA over the past decade was partly driven by the combination of the hard peg to the euro and the shifts of WAEMU's trade patterns away from euro area's countries. In fact, given the shifts that occurred in the trade patterns, a peg to the SDR would have resulted in an effective exchange rate half as volatile over the same episode. On the other hand, with trade patterns at their 1980 configuration, the SDR peg would have resulted in a substantially more volatile effective exchange rate than what was observed under the hard peg.

The remainder of the paper is organized as follows. I end this section with a brief review of the literature. Section II presents some background elements of the analysis, including the evolution of the institutional CFA peg's arrangement, exchange rate developments in the WAEMU, and the shifts in the trade patterns of the union. Section III derives the analytical result that is the basis for the application in Section IV. Section V concludes and draws policy implications.

A. Related Literature

This paper is a contribution to the literature that examines the volatility of the NEER across alternative regimes, most of which follows the Southeast Asian financial crisis during 1997–98. Bird and Rajan (2002) find that the pre-crisis soft peg to the US dollar was suboptimal, and argue that Southeast Asian countries would have avoided the third currency

[7] The weights were 41.9 percent for the US dollar, 37.4 percent for the euro, 11.3 percent for the pound, and 9.4 percent for the Japanese yen, as of December 2010.

phenomenon[8]—which may have contributed to the crisis—had they pegged their currencies to a basket of composite currencies. In addition, the authors find that Southeast Asian countries would be better off with a common basket peg rather than each individual country adopting its own basket. In a related paper,Williamson (1996) and Azis and Puttanapong (2008) also build the case for a common basket peg—as opposed to unilateral pegs—in Southeast Asia.

The study most related to this paper is perhaps Crockett and Nsouli (1977). The authors find—using data from 1970 to 1975—that the NEER of the CFA franc was significantly less volatile under the French Franc peg than it would have been under the hypothetical peg to the SDR. The authors, however, keep—as do most of the papers in the existing literature—trade patterns unchanged throughout the sample period, an innocuous hypothesis for their analysis given the relatively short time covered in their study.

II. BACKGROUND

A. Institutional Arrangement of the CFA Franc's Peg

The peg arrangement between France and WAEMU countries dates back to 1945. The introduction of the euro in 1999, and the subsequent withdrawal of the French franc from circulation, did not have major institutional implications in the CFA zone.

One of the major changes in the history of this institutional arrangement is the devaluation of the CFA franc that occurred in January 1994. This devaluation, which aimed at restoring the CFA zone's external balances, brought the value of a unit of CFA franc down to 0.01, from 0.02 French francs.

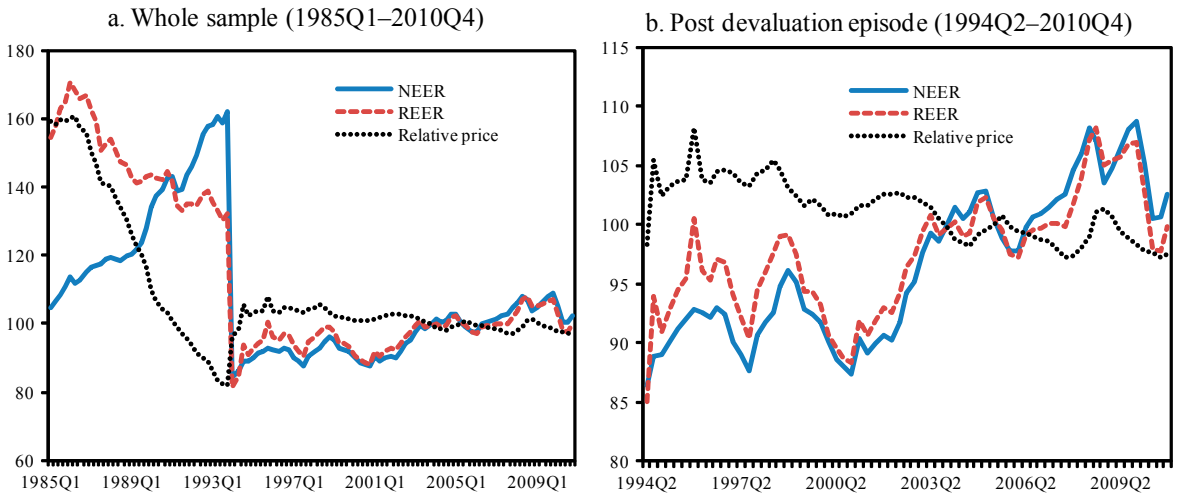
The entire CFA zone now includes fourteen countries grouped in two monetary unions: the WAEMU (eight countries) and the Central African Economic and Monetary Community (CEMAC) (six countries).[9] Although the currencies of these two unions share the same acronym—CFA—they are technically different and cannot be exchanged one for another.

[8] The third currency phenomenon is a situation whereby changes in the exchange rate of the anchor vis-à-vis other currencies translate into changes in the domestic currency's effective exchange rate.

[9] The CEMAC (Central African Economic and Monetary Community) includes Cameroon, Chad, Equatorial Guinea, Gabon, the Central African Republic, and the Republic of Congo.

B. Exchange Rate Developments in the WAEMU

Figure 1. WAEMU: Real and Nominal Exchange Rates and Relative Price
(Index, 2005=100)



Source. Information Notice System and author's computations.

The real and nominal effective exchange rates of the WAEMU have been trending up since the devaluation of the CFA franc in January 1994 (see Figure 1),[10] eroding part of the competitiveness gains of the devaluation.

Figure 1 also shows that the WAEMU relative price made a one-shot jump right after the devaluation, and then stabilized at a higher level. This stability of the price differential has caused the REER to move in tandem with the NEER in the post devaluation episode.

In fact, from the definition of the REER: $Q = \frac{P}{P^*}E$,[11] one has $\Delta q = \Delta[p - p^*] + \Delta e$, where lowercase variables represent logarithm of upper case variables. Any change in the REER is thus triggered by either a change in the NEER, a change in the relative price (ratio of domestic to foreign prices), or both.

[10] The upward trend in the NEER and the REER appears more clearly when one portrays the post-1994 episode separately (see right panel).

[11] P and P^* represent the domestic and foreign prices respectively, and E is the nominal effective exchange rate.

Table 1. Cumulative Percentage Changes in the REER and Sources

	ΔREER	ΔNEER	Δ(Relative price)
1985Q1–1993Q4	-14.2	43.6	-65.1
1994Q2–2000Q4	8.5	3.7	5.1
2001Q1–2010Q3	10.5	14.1	-3.4

Table 1 indeed shows that while the relative price was the main source of changes in the REER in the pre-devaluation episode, the NEER has become the main driver of REER appreciation during the past years, as inflation differentials with trading partners narrowed. This evidence that inflation differentials were small allows me to focus on the NEER—even though the REER may be more relevant for competitiveness. Also, the stability of the NEER of a pegged currency is as relevant as the stability of a flexible exchange rate prominent in policy dialogues.

C. The Dynamics of the WAEMU's Trade Patterns (1980–2010)

Table 2 summarizes the trade (sum of imports and exports) patterns of the WAEMU (including intraregional trade) over the past three decades. It calls for several observations. First and most striking, France's trade share dropped threefold during the sample period. From one third of WAEMU's trade in 1980, it went down to only about 10 percent in 2010. More generally, the euro area became less of an important trading partner during the sample period: while it accounted for more than half of the WAEMU's external trade in 1980, its trade share had dropped by half by 2010.

Table 2: Shift in WAEMU Trade Patterns, 1980–2010

WAEMU: Partners' Shares (Percent of total trade)

	1980	1995	2005	2010
Euro area	54.2	45.4	35.4	26.1
Of which: France	31.2	24.1	20.0	10.4
USA	5.2	4.3	6.3	4.9
BICs	2.1	5.7	7.6	15.2
Of which: China	1.4	1.6	3.5	10.8
India	0.3	2.9	2.9	3.3
Intra-WAEMU	7.5	8.3	10.5	10.9
Other selected countries				
Nigeria	3.9	5.2	10.5	8.4
Ghana	0.2	1.2	1.3	2.6

Source: IMF Direction of Trade Statistics and author's calculations.

These shifts away from France and the euro area were mainly counterbalanced by a more prominent role of the BICs, and China in particular. A breakdown of the table into imports and exports shows similar shifts. China has indeed become a more attractive market for imports (its imports share rose from a low 2 percent in 1980 to 19 percent in 2010). As for exports, the US and Indian markets have attracted an increasing share of WAEMU exported goods. Their export shares went up from 6 to 11 percent and from 0 to 6 percent respectively over the past three decades. Similar shifts in trade patterns were observed in individual WAEMU countries.

III. ANALYTICS

In this section, I derive a relationship between the changes in the domestic NEER and the fluctuations of the anchor currency vis-à-vis the currencies of the local country's trading partners.

The NEER of the domestic country (currency) j is defined as follows, where time subscripts have been dropped for clarity:

$$NEER_j = \prod_{i=1}^{N} \left(E_{i/j}\right)^{w_i}$$

Where

- N is the number of country j's main trading partners;
- $E_{i/j}$ is the bilateral exchange rate between currency i and currency j, defined here as the number of units of currency i per unit of currency j; and
- w_i is the share of country i in country j's total trade, normalized so that: $\sum_{i=1}^{N} w_i = 1$.

Because the paper focuses on alternative peg regimes (hard peg vs. basket peg), I denote by i^* the anchor currency—the currency to which the domestic currency (j) is pegged. Noting that $E_{i/j} = E_{i/i^*}.E_{i^*/j}$ for any currency i, and using the relation $\sum_{i=1}^{N} w_i = 1$, the previous equation yields

$$NEER_j = E_{i^*/j}.\prod_{i=1}^{N} \left(E_{i/i^*}\right)^{w_i}$$

It is straightforward to show that the following transformation—which redefines trade shares—holds.[12]

$$\ln\left(NEER_j\right) = \ln\left(E_{i^*/j}\right) + (1 - w_{i^*}).\sum_{i=K+1}^{N} \emptyset_i \ln\left(E_{i/i^*}\right)$$

Where

[12] The steps of the proof are the following: (i) take the logarithm of the above expression; (ii) split the sample of trading partners into two groups: one group made of countries that share the anchor currency i^*, and another group with the remainder countries; and (iii) use the relation $\sum_{i=1}^{N} w_i = 1$ exploiting (ii).

- K is the number of countries that share currency i^*, which is the currency to which the local currency j is pegged;
- $w_{i^*} = \sum_{i=1}^{K} w_i$; and
- $\emptyset_i = \frac{w_i}{1-w_{i^*}}, i = K+1, .., N$, are adjusted trade shares[13] in the set of countries that do not have i^* as currency.

The month-to-month changes in the NEER are therefore summarized by the following key relationship:[14]

$$\Delta \ln(NEER_j) = \Delta \ln(E_{i^*/j}) + (1 - w_{i^*}). \sum_{i=K+1}^{N} \emptyset_i \Delta \ln(E_{i/i^*}) \qquad (*)$$

Equation (*), which is dynamic,[15] is central to the analysis in the next section. The first term on the right hand side of the equation is policy-related. Changing it indeed requires a policy action, namely an amendment to the institutional peg arrangement (e.g., through devaluation). This term can mistakenly be perceived as being the only term that affects the effective exchange rate of a currency under a fixed exchange rate regime. This would in fact be equivalent to saying that the effective exchange rate of a pegged currency coincides with its nominal exchange rate, which is indeed not valid. Equation (*) precisely highlights that potential misperception. A country's effective exchange rate is in fact subject to fluctuations among major currencies—through the third currency phenomenon in the case of fixed exchange rate regimes. This channel is exogenous to the country and is represented by the second term of Equation (*).

Under a fixed exchange rate regime, the fluctuations of the anchor vis-à-vis the currency of the domestic country's trading partners translates into changes in the NEER of the domestic country to an extent that is decreasing with the trade share of the anchor country. In fact, as trade patterns shift away from the anchor country, the domestic country becomes more vulnerable to the behavior of the anchor currency vis-à-vis the currencies of its other trading partners. In this context, a peg to a basket of currencies more reflective of the country's trade patterns could insulate its NEER from fluctuations in major currencies. To see this, consider the following two extreme cases:

---

[13] One has: $\sum_{i=K+1}^{N} \emptyset_i = 1$.

[14] The equation assumes no month-to-month changes in trade shares because trade data is not available at monthly frequency. This is somewhat innocuous for the analysis because a country's trade shares are unlikely to change substantially in such a short time. The trade shares ($\emptyset_i$, w_{i^*}) in a given month are set at the corresponding annual figure. Although trade weights do not change on a monthly basis, their levels do affect the volatility of the effective exchange rate and are accounted for in the set-up (second term in the right hand side).

[15] Time subscripts have been dropped for clarity.

- $w_{i^*} = 1$: The domestic country trades exclusively with the anchor country. Equation (*) suggests that the NEER of the domestic currency in this case would be equal to $E_{i^*/j}$, which is constant in the absence of policy intervention, given the hard peg. This is intuitive given that the domestic country would not be exposed to the third currency phenomenon.

- $w_{i^*} = 0$: The country does not trade at all with the anchor country, and yet has its currency pegged to that country's currency. The fluctuations of the "anchor currency" vis-à-vis currencies of the domestic country's trading partners are therefore fully passed through to its effective exchange rate by the third-currency phenomenon.

Pegging to a composite basket of main trading partners' currencies ensures in particular that the underlying hypothetical weight w_{i^*} would always be large, thus minimizing the exogenous term. In general, a weighted average of currencies would by construction be less volatile than a single currency. This argument is similar to that of portfolio diversification prominent in the finance literature.

IV. Application: The WAEMU's Nominal Effective Exchange Rate

A. Data Sources and Computations

I use annual trade data for WAEMU countries, and monthly bilateral exchange rate data of trading partners for 1980M1–2010M12. The list of trading partners is compiled to reflect the imports' origin and exports' direction of individual WAEMU countries.[16] The list includes fourteen countries. Six countries are in the euro area: Belgium, France, Germany, Italy, Netherlands, and Spain; the others are Japan; the United Kingdom; United States; the BICs: China, Brazil, India; and two non-WAEMU African countries: Ghana and Nigeria.

The main trading partners of individual countries are obtained from the "IMF Exchange Rate Facility." In the exchange rate facility, however, trade weights are updated only every 5 to 10 years. Although this is generally enough to capture the overall dynamics of trade patterns—existing studies on effective exchange rate typically rely on these weights—it is less appropriate for this study, which precisely emphasizes the role of trade patterns.

I therefore gather annual exports and imports data by trading partner for all individual WAEMU countries from the "IMF Direction of Trade Statistics." Countries' data are then aggregated into union-wide data, from which regional trade weights are computed. These trade weights are used, together with bilateral exchange rate figures to evaluate Equation (*).[17] This

[16] Partner countries on the list cover on average three-quarters of individual WAEMU countries' trade.

[17] In evaluating Equation (*), I netted out intraregional trade and recomputed partner countries trade shares accordingly. This is because, as explained above, the monetary union is treated as a whole in this paper.

gives a time-series of monthly changes in the NEER from which the volatility is computed as the standard deviation of NEER changes over different sub periods. I consider sub periods reflective of the evolution of the institutional CFA peg arrangement as described in Section II.A. In particular one needs to distinguish pre and post devaluation episodes. In fact the first term of Equation (*) shifts dramatically upon any parity change, which would distort the picture. Also, the introduction of the euro in 1999 was a significant step in the peg arrangement, and I split the sample accordingly. I also consider 2001, which is the year the euro officially replaced the currencies of individual euro area countries in daily transactions. Finally, I consider the recent global financial crisis separately given the induced uncertainty on financial markets and exchange rates.

B. Quantitative Analysis

I evaluate the volatility of the nominal effective exchange rate under two peg arrangements: the actual peg to the euro and the hypothetical peg to the SDR. This corresponds to setting $i^* \in \{€, SDR\}$ in Equation (*). For the episodes prior to the adoption of the euro, however, the CFA franc was pegged to the French franc (FF), so that $i^* \equiv €$ is replaced by $i^* \equiv$ FF (the fluctuations of the FF vis-à-vis the currencies of the other countries which are now part of the euro area then also had an impact on the volatility of the effective exchange rate of the WAEMU as per Equation (*)). It is also worth noticing that, similar to the computations under euro peg, trade shares are used in evaluating the volatility of the effective exchange rate under SDR peg,[18] and not the currencies' weights in the SDR basket.

The results using the actual trade patterns are first presented. I next perform a counterfactual experiment to gauge the role of shifting trade patterns on the volatility of the NEER. This is achieved by re-computing the volatilities, keeping trade shares at their 1980 level throughout the sample period.

Results

Table 3 presents the monthly volatility of the nominal effective exchange rate under the current euro peg and under a hypothetical basket peg (peg to the SDR). The figures displayed are monthly standard deviations over the corresponding sub periods—quarterly and annual volatility figures would be substantially higher. The sub periods are set to match different phases of the evolution of the CFA peg arrangement presented in the background section, except that I further split the past decade between the pre- and post crisis episodes, to highlight the structural break in volatility brought about by the recent global financial crisis.

Computations suggest that for any sub periods before 2001, the NEER of the CFA seems equally volatile under the hard peg and the SDR peg.[19] Formal tests of variance difference

[18] This corresponds technically to setting $w_{i^*} = 0$ (which also implies that $\emptyset_i = w_i$) in Equation (*).

[19] The SDR peg, however, yields a slightly lower NEER volatility than the current euro peg during the first two decades of the sample period.

confirm that the volatilities under both peg regimes are not statistically different in any sub period before 2001.[20] A test for the period from January 1980 to December 2000 as a whole yields a similar result. However, because of substantial shifts in the trade patterns over the past decade, the actual nominal effective exchange rate is nearly twice as volatile under the euro peg as it would have been under the SDR peg.[21] This volatility differential is highly significant—at 1 percent significance level.[22]

Table 3. The Volatility of the NEER Under the Euro Peg and the SDR Peg

	Euro Peg (1)	SDR Peg (2)	Ratio (1/2)
Jan 1980–Dec 1993	1.14	1.11	1.0
Feb 1994–Dec 1998	1.06	0.92	1.2
Jan 1999–Dec 2000	1.42	1.25	1.1
Jan 2001–Dec 2007	0.86	0.44	2.0 ***
Jan 2008–Oct 2010	1.88	0.91	2.1 ***

*** The volatilities under the two peg arrangements are different at 1% significance level.

The previous result also holds when the post-2000 episode is further split into pre- and post crisis episodes. This distinction brings an additional insight: the volatility of the effective exchange rate of the WAEMU doubled under both peg arrangements during the recent global financial crisis (2008–2010)—as uncertainty about the expected level of major currencies' exchange rate increased substantially.

It is important to gauge the implications of the two types of peg arrangements for the level of the effective exchange rate in itself. Figure 2 portrays the dynamics of the NEER under the current peg to the euro and a hypothetical peg to the SDR post-2000.[23] The level of the

[20] The Figures presented in Table 3 are standard deviations, and the statistical tests are based on differences in the corresponding variances.

[21] In principle, the dynamics of trade patterns would have been different from what was observed, had the WAEMU pegged its currency to a basket. Assuming that one advantage of hard peg is to enhance trade flows with the anchor country (all else being equal), the shifts in trade patterns would probably have been more substantial under a basket peg. Table 3 therefore provides a lower bound to the volatility differential between the euro peg and the SDR peg.

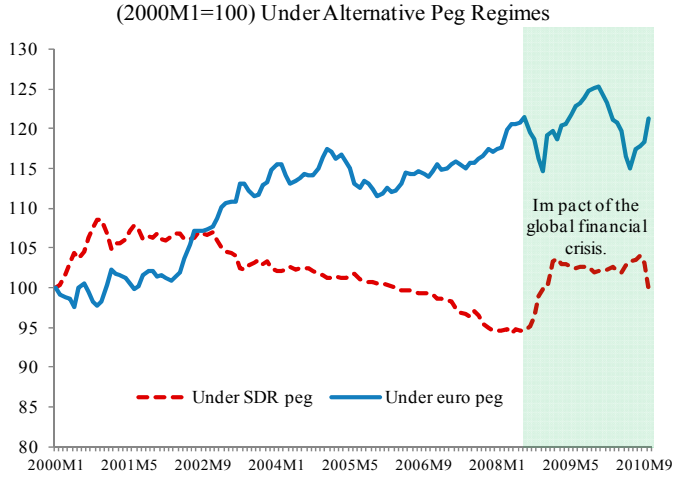
[22] The results are robust to the frequency at which the volatilities are computed, within the above-identified sub-periods.

[23] I restrict the focus to that episode for three main reasons: (i) results in Table 3 suggest that before 2001, the volatilities under the two alternative peg arrangements were not significantly different; (ii) this prevents us from dealing with the structural break caused by the devaluation that occurred earlier in 1994; and (iii) the appreciation of the effective exchange rates has become a source of concern since the devaluation, particularly since the early 2000s.

nominal effective exchange rate is obtained simply by taking the cumulative sum—starting from a base year—of changes in the NEER computed from Equation (*).

The chart clearly indicates the SDR peg would have led to a more depreciated exchange rate over the past decade—the difference between the NEER under the two regimes has risen to more than 25 percent over the past years—suggesting potential competitiveness gains. Now, a more depreciated exchange rate, by making imports more expensive locally, would induce higher domestic prices. The strength of this channel obviously depends on the degree of exchange rate pass-through. Another channel one should consider in comparing the competitiveness of the union under the two peg arrangements is the price differentials between the euro area—current anchor—and the countries that form the SDR basket, per the "imported inflation" argument. It is likely, taking into account those two channels, that part (and perhaps all) the competitiveness gains under the SDR peg—owing to a more depreciated NEER—would be offset by higher inflation. A more elaborated analysis would require a framework in which the endogenous response of inflation and other macroeconomic variables—including trade flows and other balance of payments components which are increasingly important—to changes in the nominal effective exchange rate are accounted for. This could be achieved, e.g., through a full-fledged dynamic general equilibrium model.

Figure 2. Implied Nominal Effective Exchange Rate Indexes (2000M1=100) Under Alternative Peg Regimes



Source: Information Notice System (IMF) and author's estimates.

Counterfactual Analysis

The above result that the NEER was more volatile under the euro peg than it would have been under the SDR peg is reversed in the counterfactual experiment (Table 4) in which trade shares are kept at their 1980 level. The peg to the SDR now leads to a substantially more volatile NEER than the euro peg over the last decade. The results remain the same in sub periods before 2001—the two peg arrangements do not lead to significantly different volatilities of the effective exchange rate during these episodes.[24]

[24] The results are not very sensitive to the choice of sub periods. It is also worth noticing that, although the ratio of volatilities during Jan 1999–Dec 2000 is close to the corresponding ratio during Jan 2001–Dec 2007, the former is not found to be statistically different from 1, whereas the latter is. This is because a larger sample size provides more confidence for rejecting the null hypothesis of equal volatilities.

Table 4. Counterfactual Analysis: Euro Peg vs. SDR Peg Using 1980's Trade Patterns

	Euro Peg (1)	SDR Peg (2)	Ratio (1/2)
Jan 1980–Dec 1993	0.90	1.13	0.8
Feb 1994–Dec 1998	0.75	0.84	0.9
Jan 1999–Dec 2000	0.95	1.33	0.7
Jan 2001–Dec 2007	0.45	0.72	0.6 ***
Jan 2008–Oct 2010	0.80	1.48	0.5 ***

*** The volatilities under the two peg arrangements are different at 1% significance level.

The results obtained in this paper contrast Crockett and Nsouli's (1977) findings. The authors show—using data from 1970 to 1975—that the NEER of the CFA franc was significantly less volatile under the French franc peg than it would have been under the hypothetical peg to the SDR. The difference with results in this paper is that, unlike in Crockett and Nsouli (1977), I allow trade patterns to shift overtime, consistent with the longer time span (three decades) covered here. It is fair, however—as mentioned earlier—to note that the assumption of unchanged trade patterns was very reasonable in the above study which covers only a six-year episode over which substantial structural changes are less likely to occur. Table 4 indeed confirms the finding that the peg to the French franc would have been volatility reducing with trade patterns at their level 30 years ago.[25] More importantly, I find that the peg to the SDR would have been significantly more effective in containing the volatility of the NEER of the WAEMU over the past decade, owing to substantial shifts in trade patterns—away from the euro area.[26]

C. Sensitivity Analysis

It has been assumed until now that the currency composition of trade exactly matches trade patterns, which is clearly not the case in practice. In fact, the price of some commodities is quoted in $US on international markets and it shouldn't really matter for the nominal effective exchange rate whether the domestic country exports those commodities to China or to the U.S., as the invoice would be denominated in $US in both cases. This assumption, however, is not unique to this paper[27] and reflects data availability. In fact, unlike bilateral trade data, data on

[25] Note, however, that the difference is only statistically significant in the latter part of the sample (2000–10).

[26] I also make all the above computations with imports weights separately, and the volatility differential between the two types of peg arrangements appears to be even larger.

[27] It is also made in the standard computation of the NEER and the REER.

trade invoicing is very limited across countries, and covers only a short period of time where available.[28]

Conceptually, proceeds from WAEMU commodity exports are still subject to the fluctuations in the euro even when international prices are quoted in $US—instead of in the actual trade partners' currencies. This is because exports proceeds will be converted in CFA after all, using the exchange rate of the euro vis-à-vis the $US. It is interesting, however, to check how robust the above quantitative results—on the volatility of the NEER—are to alternative countries' weights. To achieve that goal, I first consider import and export trade shares separately. Second, and most importantly, I distort actual countries' exports shares to account for the fact that the price of some commodities (which forms the bulk of WAEMU exports) are quoted in $US. Given the data limitation on the currency composition of trade, I re-evaluate Equation (*) assuming that WAEMU exports are done either in euro (with euro area countries), or in $US (with the remainder of trading partners). This is clearly a simplifying assumption. In fact, some WAEMU exports to euro area countries may also be paid in $US—which could be counter-balanced by the fact that some of the union's exports to non-euro area countries may also occur in euro. Also, some WAEMU exports probably involve other currencies than the euro and the $US. Notwithstanding these limitations, the assumption does not seem extreme and should allow us to gauge the impact of currency composition on the volatility of the NEER across peg arrangements.

Table 5. Sensitivity Analysis on Countries' Weights in the NEER

	Total trade-based weights	Import-based weights	Export-based weights	Hypothetical exports' currency-based weights
Jan 1980–Dec 1993	1.0	1.1	0.9	1.1
Feb 1994–Dec 1998	1.2	1.2	1.1	1.1
Jan 1999–Dec 2000	1.1	1.1	1.1	1.3
Jan 2001–Dec 2007	2.0 ***	2.1 ***	1.6 ***	2.0 ***
Jan 2008–Oct 2010	2.1 ***	2.2 ***	1.5 ***	2.4 ***

*** The volatilities under the two peg arrangements are different at 1% significance level.

Table 5 reports the ratio of the NEER volatility[29] between the euro peg and the SDR peg for the sub-periods identified in the previous section. The first column reports the results in Table 3 (last column) for reference. Several observations emerge from the table: (i) the results

[28] Slavov (2008) reports a similar data issue.

[29] As in the previous subsection, the figures reported in Table 5 are standard deviations and the statistical tests are based on differences in the corresponding variances.

based on import weights are very close to those based on total trade weights. This is because imports are much higher than exports for the set of countries that we are considering, so that the sum of imports and exports is mostly driven by imports; (ii) the volatility differential between the peg to the euro and the hypothetical peg to SDR is higher under import-based weights than under export-based weights. This is consistent with the results obtained in the counterfactual experiment (see Section IV.B), and reflects the fact that the shifts in WAEMU trade patterns have generally been more pronounced for imports than for exports; and (iii) more interestingly, the NEER is still found to be twice as volatile under the euro peg as it would have been under the SDR peg over the past decade in the last scenario in which the currency composition of exports is (partially) accounted for. The results are even stronger compared to the case in which actual export weights are used (the volatility ratio rises from about 1.5 to more than 2). Intuitively, the findings obtained in this application would still be valid as long as most of the WAEMU trade is not euro-invoiced.

V. CONCLUSION

Notwithstanding that more flexible exchange rate regimes potentially increase countries' resilience to shocks, the so-called "fear of floating" (Calvo and Reinhart, 2002) is quite prominent among developing countries, and a non-trivial number of countries around the world still have their currency pegged *de jure* to a major currency. This paper attempts to find whether trade patterns matter for the choice of the type of peg arrangement—hard peg to a single currency versus peg to a composite basket of currencies. The paper therefore emphasizes a particular aspect of choosing a peg: the volatility of the effective exchange rate. I show analytically that the volatility of the NEER of the domestic currency—under a peg—depends on the volatility of the anchor vis-à-vis currencies of the domestic country's trading partners.

To gauge the extent of the above relationship, I consider a set of eight African countries, members of the West African Economic and Monetary Union (WAEMU) that have had their currency—the CFA franc—pegged to the French franc since the mid-1940s and to the euro since its introduction in 1999. Computations suggest that the hard peg to the euro—French franc—would have been more volatility-reducing compared to a basket peg, had trade patterns remained at their level in the early stages of the peg arrangement because WAEMU countries traded mostly with France and other euro area countries. However, given the substantial shifts in trade patterns that occurred overtime, and especially over the past decade, pegging to the SDR would have resulted in a substantially lower volatility of the NEER of the CFA franc lately, compared to the current peg to the euro.

The results obtained in this paper suggest that policymakers should pay as much attention to the type of peg as to pegging in itself, with a particular focus on trade pattern dynamics. The paper, however, does not derive an optimal currency arrangement for the WAEMU. Such an exercise would require taking into account not only exchange rate volatility, but also the extent of imported inflation, the currency composition of countries' assets and liabilities, and institutional constraints faced by policymakers.

This paper could be extended to examine the same question for other fixed exchange rate countries. For instance, CEMAC countries have witnessed substantial shifts in their trade patterns comparable to the WAEMU. CEMAC countries also have their common currency pegged to the euro, making it a natural candidate for the type of questions analyzed here. Also, future research could examine the optimal currency arrangement for the CFA zone in a general equilibrium set-up that would properly account for the endogenous response of inflation and trade flows to changes in the nominal exchange rate, among many other factors.

REFERENCES

Aghion P., P. Bacchetta, R. Ranciere, and K. Rogoff, 2009, "Exchange Rate Volatility and Productivity Growth: The Role of Financial Development," *Journal of Monetary Economics*, 56, pp. 494–513.

Azis, I.J., and N. Puttanapong, 2008, "A Regional Trend Towards a Basket Peg System," *Trade and Global Markets*, Vol. 1, No. 2, pp.144–162.

Bagella M., L. Becchetti, and I. Hasan, 2006, "Real effective exchange rate volatility and growth: A framework to measure advantages of flexibility vs. costs of volatility," *Journal of Banking & Finance,* 30, pp. 1149–1169.

Bird, G., R. Rajan,2002, "Optimal Currency Baskets and the Third Currency Phenomenon: Exchange Rate Policy in South East Asia," *Journal of International Development*, 14, 1053–1073.

Branson, W., L. Katseli, 1981, "Currency Baskets and Real Effective Exchange rates," NBER Working Paper 666 (Cambridge, MA: National Bureau of Economic Research).

Calvo, G., C. Reinhart, 2002, "Fear of floating," *The Quarterly Journal of Economics*, CXVII, Issue 2, pp. 379–408.

Crockett, A. D., and S. M. Nsouli, 1977, "Exchange Rate Policies for Developing Countries," *Journal of Development Studies*, 13:2, 125–143.

Duarte, M., D. Restuccia, and A. Waddle, 2007, "Exchange Rates and Business Cycles across Countries," Federal Reserve Bank of Richmond, *Economic Quarterly*, Volume 93 (1), pp. 57–76.

Gunther, S., 2007, "Exchange Rate Volatility and Growth in Small Open Economies at the EMU Periphery," The ECB Working Paper Series No. 773 (Frankfurt: European Central Bank).

Ito, T., E. Ogawa, and S. Nagataki, 1998, "How Did the Dollar Peg Fail in Asia?" *Journal of the Japanese and International Economies,* 12, 256–304.

Mohtadi, S., 1988, "The Stabilization of the Effective Exchange Rates of the Less Developed Countries under Alternative Exchange Rate Arrangements," *Journal of Economic Development*, Vol. 13, No. 1.

Rey, S., 2006, "Effective Exchange Rate Volatility and MENA Gountries' Exports to the EU," *Journal of Economic Development*, 23, Vol. 31, No. 2.

Rogoff, K., A. Hussain, A. Mody, R. Brooks, and N. Oomes, 2003, "Evolution and Performance of Exchange Rate Regimes," IMF Working Paper No. 03/243 (Washington: International Monetary Fund).

Slavov, S.T., 2008, "Should Small Open Economies in East Asia Keep All Their Eggs in One Basket: The Role of Balance Sheet Effects," *The Journal of the Korean Economy*, Vol. 9, No. 1, pp. 1–43.

Williamson, J., 1996, "The Case for a Common Basket Peg for East Asian Currencies," *Exchange Rate Policies in Emerging Asian Countries: Domestic and International Aspects*, Association for the Monetary Union of Europe and the Korea Institute of Finance.