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THE GLOBAL IMPLICATIONS OF REGIONAL EXCHANGE RATE REGIMES

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The Global Implications of Regional Exchange Rate Regimes

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Abstract

We examine the implications of a regional fixed exchange rate regime for global exchange rate volatility. We find that the concept of the optimum currency area plays a key role. There are significant effects on the volatility of the remaining flexible parities when the countries participating in the regional peg – the "ins" – are not an optimum currency area. Or, but to a smaller extent, when the "ins" and the "outs" are asymmetric with regard to labor market flexibility and monetary policy conduct. Our analysis also suggests that greater global exchange rate stability would be more likely to be obtained if the U.S. rather than the EU targeted the EUR/USD rate.

JEL Classification: E4, E5, F4

Keywords: Regional exchange rate systems, global exchange rate volatility, optimum currency area

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1. Introduction

The post Bretton Woods international monetary arrangements have been asym-metric. Typically, some countries maintain a system of – more or less – fixed parities among themselves while, at the same time, allowing the external value of their currencies to move freely against currencies that do not belong to their monetary arrangement. We call such a regime a *mixed* system. The EMS (or EMU) is an example of such a system (other examples include unilateral pegs, currency boards and so on).

Although a great deal of attention has been devoted to the study of fixed and flexible exchange rate regimes *in isolation*, to the best of our knowledge, no attempt has been made to study mixed systems. The objective of this paper is to fill this gap. We are mostly interested in the *global* implications of a regional fixed exchange rate regime and, in particular, whether such a regime leads to a global reduction of exchange rate volatility or simply transfers volatility from one part of the global system to another. Also, we examine the factors that determine the type and magnitude of volatility transfer that takes place.

The answers to these questions have practical importance. For instance, they can help evaluate the contribution of the EMS (EMU) to global exchange rate volatility (for instance, its effects on the DM/USD or the DM/GBP rate). They can also form the basis for assessing the implications of EMU for the EURO/USD rate. If the formation of the EMU brings about greater global stability in exchange rates by itself then there may be less of a need for explicit international policy coordination (e.g. the adoption of target zones by major currency blocks) in order to achieve such an objective. Finally, one can use our findings to think about what would happen to the rest of the world (say, China's exchange rate) if the EU, the USA and Japan decided to limit fluctuations in their exchange rates.

The existing literature has not yet provided a concrete framework for thinking about these issues. And a priori, there does not seem to exist any strong presumption concerning the sign of the global effects. Volatility eliminated in one place (say, in the DM/FF rate or in economic activity in Germany) may completely disappear from the system. Alternatively, it may simply resurface elsewhere (say, in the DM/GBP rate and in British macroeconomic activity). Moreover, general arguments of the type that "..if the fixed exchange rate system lowers macroeconomic volatility in the pegging countries then it will also reduce exchange rate volatility.." may not be informative because the direction of volatility changes is not uniform across the main economic variables.

We believe that these questions can be best addressed within the context of a multi-country, general equilibrium model of the type commonly used nowadays in the exchange rate literature (for examples of a two country version, see Chari, Kehoe, and McGrattan, 2000; Collard and Dellas, 2002). We use a three country model whose main features include perfect competition, nominal wage rigidities,[1] active monetary policy (forward looking Taylor rules) and a variety of shocks (supply, fiscal and monetary). We use a generic calibration of the model that relies heavily on parameters commonly used in the literature and serves as a useful benchmark. Its purpose is to illuminate the role played by various types of international asymmetries (labor markets, Taylor rules, and so on).

1 Other sources of nominal rigidities are possible. Our choice of wage rather than price rigidities is motivated by recent empirical work by Christiano, Eichenbaum, and Evans, 2001, that finds that the former dominate.

The key finding is that the extent and type of asymmetries determine the sign – and size – of global effects. In general, the global repercussions are limited when the countries that fix their currencies are sufficiently symmetric. Even in this case, there are some global effects when the "ins" have labor markets that differ in terms of flexibility from those in the countries that are outside the monetary arrangement (the "outs"), or when the "ins" and the "outs" differ in terms of aggressiveness in the pursuit of inflation stabilization objectives. Nevertheless, the strongest global effects emerge when the countries participating in the system of fixed parities do not satisfy the optimum currency area criterion of a similar economic structure. The sign of these effects depends on the characteristics of the country that does the pegging (for instance, France) relative to the "leader"(for instance, Germany). Based on the obtained relationship between country characteristics and volatility, we speculate that global exchange rate volatility under EMU would be more likely to decline were the U.S. – rather than the EU – to target the EUR/USD rate.

The remainder of the paper is organized as follows. Section 2 presents the three country model. Section 3 describes the calibration and section 4 presents the main findings.

2. The model

The three countries are modelled in a similar fashion[2] so we describe only one country, the UK (a technical appendix to this paper, available at our website, offers a detailed description of the other two countries).

The economy consists of a large number of identical households and firms, a fiscal authority and a monetary authority.

2.1 The household

The household maximizes expected lifetime utility:

$$E_0[\sum_{t=\infty} \beta^t U(C_t^B, h_t^B)] \tag{1}$$

where $0 < \beta < 1$ is a constant discount factor, C_t^B denotes U.K. consumption[3] in period t and h_t^B is the number of hours worked by the U.K. representative household. $U(C_t^B, h_t^B)$ is a utility function, increasing and concave in its first argument, and decreasing and convex in its last argument. The following utility function will be used:

$$U(C_t^B, h_t^B) = \log(C_t^B) + \theta \log(1 - h_t^B) \tag{2}$$

where θ is a weight for the marginal utility of leisure.

[2] Nevertheless, they may still differ in terms of size, economic structure, shocks and so on.

[3] The superscript B – British – denotes the U.K.

In each and every period the U.K. household faces two budget constraints. The first takes the form:

$$P_t^B C_t^B + P_t^B I_t^B + \int_\ell (\frac{\widetilde{P}_t^F}{e_t^B} B_{S,t+1}^F + \frac{e_t^G}{e_t^B} \widetilde{P}_t^G B_{S,t+1}^G + \widetilde{P}_t^B B_{S,t+1}^B) d\ell + M_{t+1}^B + P_t^B T_t^B$$

$$= W_t^B h_t^B + z_t^B K_t^B + \Pi_t^B + \frac{B_{S,t}^F}{e_t^B} + \frac{e_t^G}{e_t^B} B_{S,t}^G + B_{S,t}^B + M_t^B + N_t^B \tag{3}$$

where P_t^B denotes the price of U.K. consumption and investment goods, I_t^B is investment, e_t^B is the FF/GBP exchange rate, e_t^G is the FF/DM rate (hence e_t^G / e_t^B is the GBP/DM rate), $\widetilde{P}_t^j$ is the price paid for an asset that will deliver 1 unit of country j 's currency (j = *F*, *G*, *B*) next period if state ℓ realizes (that is, we assume complete asset markets). A typical U.K. household owns $B_{S,t}^j$ such assets entering period t. M_t^B is the stock of money held by the U.K. household in period t, T_t^B is *lump-sum taxes*, W_t^B is the nominal wage, z_t^B is the rental rate for capital, K_t^B is the physical capital stock at the beginning of period t, Π_t^B are the profits of the U.K. firms and N_t^B is a per-capita amount of money issued by the Bank of England (BoE) and given to the households in the form of a helicopter drop.

According to the budget constraint, the household enters period t holding an amount of money equal to M_t; it receives income from its financial investments, $B_{S,t}^j$, from its labor services, from renting capital to the firms. It also receives its share of the profits distributed by the firms and its share of the money injection by the BoE. It uses these funds to buy new financial assets, to build its cash reserves, to pay taxes and to purchase goods for consumption and investment purposes.

The household also faces a cash-in-advance (CIA) constraint on consumption purchases:

$$P_t^B C_t^B \leq M_t^B \tag{4}$$

Physical capital accumulates according to

$$K_{t+1}^B = \Phi(\frac{I_t^B}{K_t^B}) K_t^B + (1 - \delta) K_t^B \tag{5}$$

where $0 \leq \delta \leq 1$ denotes the rate of depreciation. The concave function $\Phi(.)$ captures the presence of adjustment costs to investment. It is assumed to be twice differentiable and homogenous of degree 0. Furthermore, we assume the absence of adjustment costs in the steady state: $\Phi(\gamma + \delta - 1) = \gamma + \delta - 1$, $\Phi'(\gamma + \delta - 1) = 1$ and $\frac{\Phi''(\gamma+\delta-1)(\gamma+\delta-1)}{\Phi'(\gamma+\delta-1)} = \varphi$.

Finally, we will assume that – at least a fraction of – the nominal wage is fixed one period in advance at a level that is equal to the expected labor market clearing wage. In particular, the fixed nominal wages are set using labor contracts of the form $W_t^j = (1 - \vartheta)\widetilde{W}_t^j + \vartheta E_{t-1}\widetilde{W}_t^j$ where $\widetilde{W}_t^j$ is the nominal wage that would clear the labor market in a Walrasian framework, and $0 \leqslant \vartheta \leqslant 1$ is the share of labor contracts in the economy.

The households that have signed labor contracts must then supply whatever quantity of labor is demanded by the firms.

2.2 The firms

There are two types of firms, those that produce an intermediate good, Y, and those that produce a final good, Q.

The production of the intermediate good is done according to:

$$Y_t^B = a_t^B (K_t^B)^\alpha (\Gamma_t h_t^B)^{1-\alpha} \tag{6}$$

where K_t denotes the physical capital stock at the beginning of period t. Γ_t represents Harrod neutral, deterministic, technical progress evolving according to $\Gamma_t = \gamma \Gamma_{t-1}$. $\gamma \geq 1$ denotes the deterministic rate of growth. a_t^B is a stationary, exogenous, stochastic technology shock.[4]

The representative intermediate good firm chooses the quantity of capital and labor to lease in period t in order to maximize its current profits

$$\pi_t = P_{Yt}^B Y_t^B - W_t^B h_t^B - z_t^B K_t^B \tag{7}$$

where P_{Yt}^B is the price of the U.K. intermediate good.

The country specific intermediate goods are then combined to produce the final goods in the three countries.

$$Y_t^B = Y_{Ft}^B + Y_{Gt}^B + Y_{St}^B \tag{8}$$

where $Y_{j,t}^B$ denotes the amount of U.K. intermediate good that is used as an input to produce country j 's final good in period t.

2.3 Production of the final domestic good

The production of the final good in the U.K., Q_t^B, takes place according to:

$$Q_t^B = [\varpi_4^{1-\rho} (Y_{S,t}^F)^\rho + \varpi_5^{1-\rho} (Y_{S,t}^G)^\rho + \varpi_6^{1-\rho} (Y_{S,t}^B)^\rho]^{\frac{1}{\rho}} \tag{9}$$

[4] The stochastic properties of the technology shock will be specified later.

The level of production is selected in order to maximize profits:

$$\pi^B = P_t^B Q_t^B - \frac{P_{Yt}^F}{e_t^B} Y_{S,t}^F - \frac{e_t^G}{e_t^B} P_{Yt}^G Y_{S,t}^G - P_{Yt}^B Y_{S,t}^B \tag{10}$$

where ϖ_4, is the weight of the French goods in the U.K. final good basket, ϖ_5, is the weight of German goods in this basket and ϖ_6 denotes the weight of U.K. goods in the domestic (U.K.) basket. Recall that $Y_{F,t}^j$ is the amount of the intermediate good of country $j = F, G, B$ used in the production of the U.K. final good. $\frac{1}{\rho-1}$ is the elasticity of substitution between the domestic and foreign intermediate goods. This way of modelling import and export activities is called the *Armington aggregation* and implies that the imported goods have to be transformed into a domestic good, Q_t^B, before they can be consumed or used for investment. It follows that the three countries will have different price levels for their final goods, P_t^i, as these goods are not perfect substitutes.

Clearing of the U.K. final good market requires:

$$Q_t^B = C_t^B + I_t^B + G_t^B \tag{11}$$

where G^B is U.K. government expenditure.

2.4 The government

In each period the government acquires an amount G_t of the final good. The cyclical component of government expenditures $(g_t = G_t/\Gamma_t)$ is exogenously determined by a stationary AR(1) process such that:

$$\log(g_t) = \rho_g \log(g_{t-1}) + (1-\rho_g)\log(g) + \varepsilon_{gt} \tag{12}$$

with $|\rho_g| < 1 \text{ and } \varepsilon_{gt} \rightsquigarrow \mathcal{N}(0, \sigma_g)$.
These expenditures are financed by means of lump–sum taxation

$$P_t^B G_t^B = P_t^B T_t^B \tag{13}$$

2.5 The monetary authorities

The behavior of the monetary authorities depends on the international monetary arrangement in place. Under a flexible exchange rate regime, we assume that monetary authorities pursue active monetary policy. In particular, central banks are assumed to follow a Taylor rule. For instance, in the U.K. this rule takes the form[5]

[5] We have also experimented with Taylor rules that include an exchange rate target. As it is commonly reported in the literature, such specifications do not find much of an independent role for exchange rate policy.

$$\widehat{R}_t^B = \rho^B \widehat{R}_{t-1}^B + (1-\rho^B)(K_y^B E_t(\widehat{Y}_{t+1}^B) + K_\Pi^B E_t(\widehat{\Pi}_{t+1}^B)) + \zeta_{r,t}^B \tag{14}$$

where R_t^B is the gross nominal interest rate, ρ^B denotes the degree of interest rate smoothing, $E_t(\widehat{Y}_{t+1}^B)$ is expected output (relative to target), $E_t(\widehat{\Pi}_{t+1}^B)$ is expected CPI inflation (relative to target) and $\zeta_{r,t}^B$ is an exogenous policy shock (for instance, a change in the inflation target or variation in the nominal interest rate that is not due to a response of BoE to deviations of inflation or output growth from their target levels). K_y^B and K_Π^B are fixed weights.

The supply of money then evolves according to

$$M_{t+1}^B = \mu_t^B M_t^B \tag{15}$$

where μ_t is the gross rate of growth. This is selected endogenously in order to deliver the nominal interest rate dictated by the Taylor rule above. Note that per capita $(\mu_t^B - 1)M_t^B$ is equal to N_t^B (see the household's budget constraint).

In addition to the flexible exchange rate system we consider a unilateral peg by France. Under this regime, France selects the growth rate of its supply of money, μ_t, in order to maintain a fixed DM/FF rate (while the Bundesbank pursues its Taylor rule). This policy is implemented by solving for the exchange rate as a function of the state variables of the system (a set that includes μ_t) and then selecting a value for μ_t that satisfies the exchange rate target, e. Our framework can be easily adapted to deal with bilaterally pegged systems. We abstract from them because they seem to be of limited practical relevance.

2.6 The equilibrium

We now turn to the description of the equilibrium of the economy. Recall that capital is perfectly mobile across countries while labor is not.

Definition 1 *An equilibrium of this economy is a sequence of prices*

$$\{\mathcal{P}_t\}_{t=0}^\infty = \left\{W_t^j, z_t^j, P_t^j, P_{Yt}^j, P_{bt}^j(s'), R_t^j, e_t^G, e_t^B\right\}_{t=0}^\infty \quad j \in (F,G,B)$$

and a sequence of quantities

$$\{\mathcal{Q}_t\}_{t=0}^\infty = \left\{\left\{\mathcal{Q}_t^1\right\}_{t=0}^\infty, \left\{\mathcal{Q}_t^2\right\}_{t=0}^\infty\right\}$$

with

$$\left\{\mathcal{Q}_t^1\right\}_{t=0}^\infty = \left\{\left\{C_t^j, I_t^j, \left\{B_{it+1}^j\right\}_{i\in(F,G,B)}, K_{t+1}^j, M_{t+1}^j\right\}_{j\in(F,G,B)}\right\}_{t=0}^\infty$$

and

$$\left\{\mathcal{Q}_t^2\right\}_{t=0}^{\infty} = \left\{\left\{K_t^j, h_t^j, Y_t^j, \left\{Y_{it}^j\right\}_{i\in(F,G,B)}, Q_t^j\right\}_{j\in(F,G,B)}\right\}_{t=0}^{\infty}$$

such that:

(i) *given a sequence of prices* $\{\mathcal{P}_t\}_{t=0}^{\infty}$ *and a sequence of shocks,* $\{\mathcal{Q}_t^1\}_{t=0}^{\infty}$ *is a solution to the representative household's problem;*

(ii) *given a sequence of prices* $\{\mathcal{P}_t\}_{t=0}^{\infty}$ *and a sequence of shocks,* $\{\mathcal{Q}_t^2\}_{t=0}^{\infty}$ *is a solution to the representative firm's problem;*

(iii) *given a sequence of quantities* $\{\mathcal{Q}_t\}_{t=0}^{\infty}$ *and a sequence of shocks,* $\{\mathcal{P}_t\}_{t=0}^{\infty}$ *clears the goods markets*

$$Q_t^F = C_t^F + I_t^F + G_t^F \tag{16}$$

$$Q_t^G = C_t^G + I_t^G + G_t^G \tag{17}$$

$$Q_t^B = C_t^B + I_t^B + G_t^B \tag{18}$$

$$Y_t^F = Y_{Ft}^F + Y_{Gt}^F + Y_{St}^F \tag{19}$$

$$Y_t^G = Y_{Ft}^G + Y_{Gt}^G + Y_{St}^G \tag{20}$$

$$Y_t^B = Y_{Ft}^B + Y_{Gt}^B + Y_{St}^B \tag{21}$$

as well as the financial, money and capital markets.

(iv) *Nominal wages are set using labor contracts of the form* $W_t^j = (1-\vartheta)\widetilde{W}_t^j + \vartheta E_{t-1}\widetilde{W}_t^j$ *where* $\widetilde{W}_t^j$ *is the nominal wage that would clear the labor market in a Walrasian framework, and* $0 \leqslant \vartheta \leqslant 1$ *is the share of labor contracts in the economy.*

3. Model parameterization: Calibration

We have solved the model under two sets of parameters. The first one is employed in order to provide clear insights on the role of particular parameters. It imposes perfect symmetry across countries in all but a single dimension. The asymmetric dimension regards either the labor markets where we allow different degrees of wage rigidities across countries, or the conduct of monetary policy where we allow different countries to follow different Taylor rules, or, finally, the properties of the exogenous shocks. The symmetric parameter values used[6] are similar to those typically used in the open economy literature (see Backus, Kehoe, and Kydland, 1995) shown in Table 1.

This calibration is probably more insightful and useful for discerning systematic relationships than the second calibration. With the second calibration we simply aim at evaluating the effects of a specific arrangement on a particular exchange rate, namely, the effects of EMS on the volatility of the DM/GBP rate. In this calibration, we rely on parameter values that reflect the actual structure of the three economies. A subset of these parameters (namely, β, γ, δ, α, ρ, φ, ϖ_{ii} and ϖ_{ij}) is assumed to take common values across countries,[7] and in particular, the values given in Table 1. The remaining parameters, describing mostly the stochastic structure of the three economies under consideration, were estimated. It must be noted that disagreements regarding the particular values employed do not pose any problem. It is straightforward to use the results from the first calibration to see how the findings would differ under an alternative set of parameter values.

The supply shocks are constructed as follows. We use data on employment and the capital stock as well as the assumed value of α to build Solow residual series for the three economies. The resulting series are detrended using a deterministic trend. We then estimate a VAR(1) model of the form:[8]

$$\begin{pmatrix} a_t^F \\ a_t^G \\ a_t^B \end{pmatrix} = \begin{pmatrix} \rho_{a^F a^F} & \rho_{a^F a^G} & \rho_{a^F a^B} \\ \rho_{a^G a^F} & \rho_{a^G a^G} & \rho_{a^G a^B} \\ \rho_{a^B a^F} & \rho_{a^B a^G} & \rho_{a^B a^B} \end{pmatrix} \begin{pmatrix} a_{t-1}^F \\ a_{t-1}^G \\ a_{t-1}^B \end{pmatrix} + \begin{pmatrix} \varepsilon_t^C & \varepsilon_t^F \\ \varepsilon_t^C & \varepsilon_t^G \\ \varepsilon_t^C & \varepsilon_t^B \end{pmatrix} \tag{22}$$

Note that the productivity shocks for France, Germany and the U.K. are decomposed into two different components: a common and a country specific shock, ε_t^C and ε_t^i respectively. Nevertheless, as it turned out that the non-diagonal elements in the estimated matrix were close to zero, and that the common shock made a negligible contribution, we set the non-diagonal elements as well as the common shock to zero:

$\rho_{a^F a^F}$	$\rho_{a^G a^G}$	$\rho_{a^B a^B}$
0.96	0.93	0.93

6 We assume a common average rate of money supply growth for simplicity. For the flexible exchange rate regime we can easily allow for long–term differences in money supply and inflation. This does not matter for the results, as we work with deviations from the steady state.

7 There are some *small* differences across the three economies concerning trade shares, trade interdependence, labor income shares, the share of government expenditure and so on. Such – small – differences do not matter for the results reported below.

8 The estimation of the technology and fiscal shocks is done over the period 1970:1–1989:4 in order to avoid the break associated with German unification. Nevertheless, the results do not differ when we carry out the estimation using the 1970-1999 sample. Note, also, that this period corresponds more or less to a period of freely floating exchange rates even for France as the exchange rate did not serve as a restriction on French monetary policy until German unification.

The volatility (sd) of the supply shocks is given by

$\sigma(\varepsilon_{\xi}^{F})$	$\sigma(\varepsilon_{\xi}^{G})$	$\sigma(\varepsilon_{\xi}^{B})$
0.003	0.0044	0.01

As can be seen, volatility is much higher in the U.K. relative to France and Germany.

We use data on government consumption to estimate the fiscal process. The persistence parameters are

ρ_g^F	ρ_g^G	ρ_g^B
0.977	0.856	0.837

and the volatilities (sd)

σ_g^F	σ_g^G	σ_g^B
0.0205	0.025	0.023

The parameters of the Taylor rules are given by[9]

ρ^F	K_y^F	K_Π^F	ρ^G	K_y^G	K_Π^G	ρ^B	K_y^B	K_Π^B
0.807	0.191	1.88	0.791	0.068	1.22	0.92	0.18	1.03

The shocks to the Taylor rules, z, evolve according to

$$z_t^i = \rho_z^i z_{t-1}^i + \varepsilon_{z_t}^i \text{ for } i{=}F, G, B \tag{23}$$

with

ρ_z^F	ρ_z^G	ρ_z^B
0.00524345	0.0135731	0.02193531

and volatilities given by

$\sigma(\varepsilon_z^F)$	$\sigma(\varepsilon_z^G)$	$\sigma(\varepsilon_z^B)$
0.00082	0.0011	0.0021

9 Data availability together with the restriction that the estimation is done during a single exchange rate system led to the use of different time periods for the estimation of the Taylor rules in individual countries: 1983:1 to 1991:4 for France and Germany (as argued earlier, the exchange rate target did not serve as a restriction on French monetary policy until after German unification) and 1980.1-1999.4 for the U.K.

The estimated Taylor rules exhibit several interesting features. First, they indicate a great deal of interest rate smoothing. The degree of smoothing is considerably higher in the U.K. than in the other two countries. Second, the Bank of France was the most aggressive and the Bank of England the least aggressive in meeting its inflation target.[10] And third, the estimated monetary volatility in the U.K. is much higher than that in Germany or France. This feature is the main factor behind the much higher volatility of the DM/GBP rate relative to the DM/FF rate under flexible exchange rates.

3.1 Solution

The solution to the model involves four steps:

1. Adjusting the variables for both technological progress and nominal growth (that is, making the model stationary)

2. Calculating the deterministic steady state

3. Log–linearizing the system around the steady state

4. Solving the resulting dynamic system

These steps are standard. Their details appear in the technical appendix to this paper.

4. The results

The solution to the model is used to generate artificial time series for the main variables of interest. These series are then detrended using the Hodrick-Prescott filter and the resulting series are used to compute the various moments. We focus exclusively on the issue of volatility, but other properties of the solutions can be easily computed. Tables 2–5 report the results obtained using the first calibration and table 6 the results associated with the second calibration. In Tables 2–5 we vary

- the degree of nominal wage rigidity
- the weight on the inflation target in the Taylor rule
- the volatility of the supply shock
- the volatility of the money shock

in the three countries.

[10] Note that greater aggressiveness implies smaller deviations of inflation from target but not necessarily a lower *average* rate of inflation.

The key finding is that the extent and type of asymmetries determine the sign – and size – of global effects. In general, the global repercussions are limited when the countries that fix their currencies – the "ins" – are sufficiently symmetric (when they satisfy the optimum currency criteria). There are some global effects in the presence of asymmetries between the "ins" and "outs" and, in particular, when they differ in terms of labor market flexibility, or inflation stabilization aggressiveness. Nonetheless, the strongest global effects emerge when the countries participating in the system of fixed parities do not satisfy the optimum currency area criterion of a similar economic structure. The sign of these effects depends on the characteristics of the country that does the pegging (for instance, France) relative to the "leader"(for instance, Germany).

Based on the obtained relationship between country characteristics and volatility, we draw two conclusions concerning the *EUR/USD* rate. First, as the U.S. and the EU do not satisfy the optimum currency area criteria, an attempt to target the *EUR/USD* under EMU is likely to have global implications (the world in this case consists of the EU, the U.S., and the rest). And second, we speculate that global exchange rate volatility would be more likely to decline were the U.S. – rather than the EU – to target the *EUR/USD* rate. We base this on the fact that volatility decreases when the exchange rate targeting is done by the country with: a) the more flexible labor market (penultimate block in Table 2); b) the more volatile supply shocks (Table 4); c) the more aggressive reaction to deviations of inflation from target (Table 3); and, d) the lower the volatility[11] of the random variation in monetary policy (5). Concerning point (c), the estimate of the inflation reaction coefficient in the Taylor rule for the U.S. is around 1.5, a value that is close to the average value we estimated for France and Germany. We do not have any presumption concerning how element (d) compares across the U.S. and the Euro zone. Hence, based on (a) and (b) it appears that global exchange rate volatility can get more help from the U.S. than from the EU.

Finally, we use the second calibration to examine the effects of the formation of the EMS (EMU) on the *GBP*. There exist no estimates of the degree of labor market flexibility, η^i, so we report results using two arbitrary sets of values for the $\eta's$ (see Table 6). Under either parameterization, EMS (EMU) has a negligible effect on the volatility of the GBP/ECU(EUR) rate. This is due to the fact that France and Germany are quite similar in terms of the processes of the exogenous disturbances[12] and also to our assumption that the degree of labor market flexibility is the same in the two countries (that is, they satisfy optimum currency area criteria). Note that the large differences in exchange rate volatility between the U.K. on the one hand, and Germany and France on the other hand, are due to the differences in the estimated volatility of the monetary policy rule shock. The U.K. shock is much more volatile than those in France and Germany. We speculate that the higher volatility in the U.K. reflects greater uncertainty about the inflation target, more frequent changes in the target and, perhaps, problems of policy credibility.

[11] Monetary policy is more stable the higher the policy credibility, the less frequent the change of inflation targets and so on.

[12] They differ, though, in terms of inflation aggressiveness.

5. Conclusions

A great deal of attention has been devoted to the study of fixed and flexible exchange rate regimes but no attempt has been made to study mixed systems. In this paper we have investigated the implications of a regional fixed exchange rate system for global exchange rate volatility.

The main finding is that the familiar concept of the optimum currency area[13] plays an important role in determining whether volatility eliminated somewhere disappears or simply reappears somewhere else. In general, the global repercussions are limited when the countries that fix their currencies are similar (they are an optimum currency area). If not, there can be significant global effects. Based on the obtained relationship between country characteristics and volatility we speculate that global exchange rate volatility under EMU would be likely to decline were the U.S. – rather than the EU – to target the EUR/USD rate.

[13] For a survey, see Tavlas, 1993.

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Table 1: Calibration I

Discount factor	β	0.988
Rate of real growth	γ	1.0069
Depreciation rate	δ	0.020
Labor share	$1-\alpha$	0.64
Substitution between domestic and foreign goods	ρ	0.25
Adjustment cost	φ	-0.174
Weight of home goods in home GDP	ϖ_{ii}	0.80
Trade interdependence between i and j	ϖ_{ij}	0.10
Persistence of technology shock	ρ_a	0.93
Volatility (sd) of technology shock	σ_a	0.008
Persistence of government spending shock	ρ_g	0.90
Volatility (sd) of government spending shock	σ_g	0.02
Money supply gross rate of growth	μ	1.0228
Persistence of money shock	ρ_m	0.0
Volatility (sd) of money shock	σ_m	0.014

Table 2: Asymmetries in labor market flexibility and volatility

	y^F	y^G	y^B	p^F	p^G	p^B	e^{FG}	e^{FB}	e^{GB}
$\vartheta^F = 1,\ \vartheta^G = 1,\ \vartheta^B = 1$									
FL	1.02	1.04	1.02	1.20	1.20	1.18	2.84	2.91	2.87
FX	1.13	0.99	1.02	1.01	1.08	1.20	0.00	2.85	
$\vartheta^F = 0.5,\ \vartheta^G = 0.5,\ \vartheta^B = 1$									
FL	1.38	1.40	1.03	2.41	2.40	1.19	5.69	4.47	4.43
FX	1.08	1.17	1.03	1.74	1.96	1.22	0.00	4.14	
$\vartheta^F = 0.1,\ \vartheta^G = 0.1,\ \vartheta^B = 1$									
FL	1.92	1.93	1.03	3.48	3.45	1.21	8.01	5.82	5.79
FX	1.34	1.53	1.04	2.50	2.75	1.24	0.00	5.23	
$\vartheta^F = 1,\ \vartheta^G = 1,\ \vartheta^B = 0.5$									
FL	1.03	1.04	1.37	1.21	1.21	2.36	2.84	4.46	4.43
FX	1.12	1.00	1.40	1.02	1.09	2.43	0.00	4.56	
$\vartheta^F = 1,\ \vartheta^G = 1,\ \vartheta^B = 0.1$									
FL	1.03	1.04	1.89	1.21	1.22	3.39	2.84	5.82	5.78
FX	1.12	1.00	1.96	1.03	1.11	3.50	0.00	6.00	
$\vartheta^F = 0.5,\ \vartheta^G = 1,\ \vartheta^B = 1$									
FL	1.37	1.04	1.02	2.40	1.21	1.19	4.38	4.47	2.87
FX	1.19	1.00	1.01	1.25	1.15	1.17	0.00	2.85	
$\vartheta^F = 1,\ \vartheta^G = 0.5,\ \vartheta^B = 1$									
FL	1.03	1.39	1.02	1.21	2.39	1.18	4.39	2.91	4.43
FX	1.24	1.14	1.04	1.58	1.88	1.26	0.00	4.14	

The reported numbers are standard deviations. y^i is GDP in country i, $i = F, G, B$. p^i is inflation in i. e^{ij} is the nominal exchange rate between i and j. *FL* has all three countries in a flexible exchange rate system while *FX* has F pegging unilaterally its currency to G's currency. ϑ^i is the degree of nominal wage rigidity in country i ($\vartheta^i = 1$ denotes perfect wage rigidity).

Table 3: Asymmetries in the conduct of monetary policy and volatility

	y^F	y^G	y^B	p^F	p^G	p^B	e^{FG}	e^{FB}	e^{GB}
				$K_\Pi^F = 1.05,\ K_\Pi^G = 1.05,\ K_\Pi^B = 1.5$					
FL	1.09	1.10	1.04	2.22	2.23	1.21	5.95	4.82	4.81
FX	1.38	1.09	1.07	1.86	1.96	1.30	0.00	4.71	
				$K_\Pi^F = 1.05,\ K_\Pi^G = 1.5,\ K_\Pi^B = 1.5$					
FL	1.03	1.09	1.03	1.22	2.23	1.19	4.75	2.91	4.81
FX	1.38	1.09	1.07	1.86	1.96	1.30	0.00	4.71	
				$K_\Pi^F = 1.5,\ K_\Pi^G = 1.05,\ K_\Pi^B = 1.5$					
FL	1.08	1.05	1.03	2.22	1.22	1.20	4.73	4.82	2.87
FX	1.13	0.99	1.02	1.01	1.08	1.20	0.00	2.85	
				$K_\Pi^F = 1.5,\ K_\Pi^G = 1.5,\ K_\Pi^B = 1.05$					
FL	1.03	1.05	1.07	1.22	1.22	2.17	2.84	4.84	4.74
FX	1.13	1.00	1.07	1.03	1.10	2.19	0.00	4.70	

The reported numbers are standard deviations. y^i is GDP in country i, $i = F; G; B$. p^i is inflation in i. e^{ij} is the nominal exchange rate between i and j. *FL* has all three countries in a flexible exchange rate system while *FX* has F pegging unilaterally its currency to G's currency. K_Π^i is the inflation reaction coefficient in the Taylor rule in country i.

Table 4: Asymmetries in the volatility of the supply shocks and volatility

	y^F	y^G	y^B	p^F	p^G	p^B	e^{FG}	e^{FB}	e^{GB}
				$\sigma(\varepsilon_\xi^F) = 0.004,\ \sigma(\varepsilon_\xi^G) = 0.008,\ \sigma(\varepsilon_\xi^B) = 0.008$					
FL	0.62	1.04	1.02	0.80	1.20	1.18	2.49	2.55	2.87
FX	0.73	0.99	1.02	0.89	1.08	1.20	0.00	2.85	
				$\sigma(\varepsilon_\xi^F) = 0.008,\ \sigma(\varepsilon_\xi^G) = 0.004,\ \sigma(\varepsilon_\xi^B) = 0.008$					
FL	1.02	0.62	1.02	1.20	0.80	1.18	2.50	2.91	2.52
FX	1.09	0.62	1.02	0.84	0.72	1.20	0.00	2.51	
				$\sigma(\varepsilon_\xi^F) = 0.004,\ \sigma(\varepsilon_\xi^G) = 0.004,\ \sigma(\varepsilon_\xi^B) = 0.008$					
FL	1.08	1.05	1.03	2.22	1.22	1.20	4.73	4.82	2.87
FX	1.13	0.99	1.02	1.01	1.08	1.20	0.00	2.85	

The reported numbers are standard deviations. y^i is GDP in country i, $i = F, G, B$. p^i is inflation in i. e^{ij} is the nominal exchange rate between i and j. *FL* has all three countries in a flexible exchange rate system while *FX* has F pegging unilaterally its currency to G's currency. $\sigma(\varepsilon_\xi^i)$ is the standard deviation of the supply shock in country i.

Table 5: Asymmetries in monetary policy instability and volatility

	y^F	y^G	y^B	p^F	p^G	p^B	e^{FG}	e^{FB}	e^{GB}
				$\sigma(\varepsilon_z^F) = 0.024,\ \sigma(\varepsilon_z^G) = 0.014,\ \sigma(\varepsilon_z^B) = 0.014$					
FL	1.03	1.09	1.03	1.21	1.45	1.19	3.36	2.91	3.38
FX	1.20	1.08	1.04	1.25	1.31	1.24	0.00	3.40	
				$\sigma(\varepsilon_z^F) = 0.014,\ \sigma(\varepsilon_z^G) = 0.024,\ \sigma(\varepsilon_z^B) = 0.014$					
FL	1.07	1.04	1.03	1.46	1.21	1.19	3.33	3.42	2.87
FX	1.13	0.99	1.02	1.01	1.08	1.20	0.00	2.85	
				$\sigma(\varepsilon_z^F) = 0.014,\ \sigma(\varepsilon_z^G) = 0.014,\ \sigma(\varepsilon_z^B) = 0.024$					
FL	1.03	1.04	1.07	1.21	1.21	1.43	2.84	3.42	3.39
FX	1.13	1.00	1.07	1.02	1.09	1.45	0.00	3.37	

The reported numbers are standard deviations. y^i is GDP in country i, $i = F, G, B$. p^i is inflation in i. e^{ij} is the nominal exchange rate between i and j. FL has all three countries in a flexible exchange rate system while FX has F pegging unilaterally its currency to G's currency. $\sigma(\varepsilon_z^i)$ is the standard deviation of the monetary shock in country i.

Table 6: Calibration II: The actual economies

	y^F	y^G	y^B	p^F	p^G	p^B	e^{FG}	e^{FB}	e^{GB}
					$\vartheta^B = 1$				
FL	0.75	0.86	2.04	1.01	1.18	5.66	1.75	11.94	11.94
FX	0.81	0.84	2.05	1.06	1.12	5.69	0.00	11.78	
					$\vartheta^B = 0.5$				
FL	0.86	0.95	3.99	1.21	1.35	13.22	1.75	23.63	23.62
FX	0.92	0.94	4.01	1.26	1.31	13.30	0.00	23.35	

The reported numbers are standard deviations. y^i, $i = F, G, B$ is GDP in country i. p^i, $i = F, G, B$ is inflation in i. e^{ij} is the nominal exchange rate between i and j. FL and FX are a flexible and unilateral (by France) exchange rate system respectively. ϑ^B is the degree of nominal wage rigidity in the U.K. ($\vartheta = 1$ denotes perfect wage rigidity).