Monetary policy in open economies under imperfect information

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Abstract

We compare international monetary arrangements that differ in the degree of both policy activism and exchange rate flexibility in a model with policy credibility, nominal wage rigidities and *unobservable* shocks. Three results stand out. First, the selection of the exchange rate regime is less important than the choice of the degree of activism. Second, unlike conventional wisdom, activistic policies tend to fare worse than passive ones. And third, a *passive, fixed* exchange rate system has good properties for macroeconomic stability. The results suggest that when the monetary authorities operate under conditions of incomplete information, a passive, fixed exchange rate regime represents a good overall choice.

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Introduction

There has been considerable variation in international monetary practices both over time and across countries. Some of this variation has been associated with the establishment –and subsequent demise– of global systems of fixed parities (the Gold Standard and the Bretton Woods agreement), or large regional monetary systems (EMS, EMU). But much of the variation is related to individual countries' desire to select an exchange rate arrangement that best suits their particular needs. As economic structures, domestic and international economic conditions and policy objectives differ across countries, it is not surprising that different countries opt for different international monetary arrangements[1]. A good example of this are the monetary practices of Hong Kong and Singapore. Hong Kong has a currency board, while Singapore has a managed float. While this difference may seem puzzling given the similarities between these two economies, there exist important differences across the two countries that may justify the observed differences in policy preferences. Namely, Singapore has a large manufacturing (electronics) sector while Hong Kong does not. There is a presumption in the literature that a large manufacturing sector requires activistic policy in order to manage the real exchange rate.

The objective of this paper is to offer a general evaluation of the presumption in favor of an activistic flexible exchange rate regime in the presence of plausible, practical limitations to the conduct of monetary policy[2]. Namely, when the monetary authorities do not have perfect information about the nature of the disturbances that hit the economy under consideration. Under such circumstances, it is quite plausible that a key attribute of the flexible regime that has been identified in the literature, namely that it can help eliminate –partly or completely– the effects of various existing distortions (Devereux and

[1] The last few years have witnessed a proliferation of research on the properties of alternative exchange rate regimes (Bacchetta and van-Wincoop, 2000, Benigno and Benigno, 2000, Collard and Dellas, 2001, Devereux, 1999, Devereux and Engel, 2000, Duarte, 2000, Gali and Monacelli, 2000, Pappa, 2001, Obstfeld and Rogoff, 2000, Stockman and Ohanian, 1994, Taylor, 1993)

[2] It should be noted that the recent literature has identified a presumption in favor of the *f*ixed regime under conditions of imperfect competition and local currency pricing; see Devereux and Engel, 2000.

Engel, 2000, Obstfeld and Rogoff, 2000), is not present.

Without "omnipotent" policy, we find that indeed there is no longer a presumption in favor of the flexible regime. And that the choice of the degree of exchange rate flexibility is less important than the domestic dimension of the central bank operating procedure. In general, simple monetary targeting (domestic or global) generates the highest level of welfare. The standard Taylor rule –with or without exchange rate flexibility– fares significantly worse and its performance decreases with the degree of inflation targeting. As expected, given the source of nominal frictions, nominal wage targeting does much better than inflation targeting but it still falls –slightly– short of monetary targeting. Finally, a fixed exchange rate regime with global money targeting generates the most stable level of real economic activity.

These findings have implications for the issue of international policy coordination raised in a recent paper by Obstfeld and Rogoff, 2001. Obstfeld and Rogoff argue[3] that in situations where global monetary policy can replicate the flexible wage equilibrium, "...lack of coordination in rule setting is a second-order problem compared to the gains from macroeconomic stabilization.." Neither of these elements seems essential for the –un–importance of policy coordination. Namely, the lack of international coordination is not costly in our model, in spite of the fact that the monetary authorities cannot replicate the flexible price equilibrium. And, moreover, international coordination is a second order problem in spite of the fact that activistic domestic policies are dominated by passive rules.

The rest of the paper is organized as follows: Section 1 presents the model. Section 2 reports the main findings.

[3] See, however, Canzoneri, Cumby and Diba, 2001, for reasons that may make international policy coordination matter.

1 The model

We use a fairly standard two country model[4]. The main differences from the models typically employed in this literature are the following: First, we assume that the shocks are not observable. Second, we allow for a general specification of preferences because the commonly used assumption of a logarithmic, or in general, separable, utility has critical -and implausible- implications for the key price in the model, the nominal exchange rate (see Bacchetta and van Wincoop, 2000, or Devereux, 1999) as well as for the properties of monetary policy (Gali, 2001). And third, we rely on perfect rather than imperfect competition in goods markets[5].

1.1 The household

We describe the behavior of the domestic agents. That of the foreign agents' is completely analogous. The household's problem is given by:

$$\max \sum_{\tau=0}^{\infty} \sum_{s^{t+\tau}} \beta^t \pi \left(s^{t+\tau} | s^t\right) \frac{1}{1-\sigma} \left[\left(\left(C(s^{t+\tau})^{\eta} + \zeta_t \left(\frac{M(s^{t+\tau})}{P(s^{t+\tau})} \right)^{\eta} \right)^{\frac{\nu}{\eta}} \ell(s^{t+\tau})^{1-\nu} \right)^{1-\sigma} - 1 \right]$$

subject to

$$\ell(s^t) + h(s^t) = 1$$

and

$$\sum_{s^{t+1}} (P^b \left(s^{t+1} | s^t\right) B(s^{t+1}) + e(s^t) P^{b*} \left(s^{t+1} | s^t\right) B^*(s^{t+1})) + M(s^t) \leq$$
$$B(s^t) + e(s^t) B^*(s^t) + M(s^{t-1}) + N(s^t) + \Pi(s^t) + W(s^t) h(s^t) - P(s^t) C(s^t) - T(s^t)$$

where $\pi(s^{t+\tau}|s^t)$ denotes the conditional probability of occurrence of state $s^{t+\tau}$ conditional on the current state being s^t. $C(s^t)$ is consumption, $M(s^t)$ is money and

[4]We use a two country model instead of a small open economy one in order to be able to directly compare our results to those in the existing literature. The recent exchange rate regime comparison literature which has been almost exclusively conducted within the context of two country models.

[5]The assumption of imperfect competition is valuable when one wants to model goods price setting in an optimal fashion. It would not contribute much here because the nominal friction is in wages, while at the same time introducing unnecessary –for the purposes of this paper –complications; see Woodford, 2000.

$M(s^t)/P(s^t)$ is real balances, $\ell(s^t)$ is leisure and $h(s^t)$ work, $P(s^t)$ denotes the price of the domestic consumption good, $e(s^t)$ is the exchange rate (number of domestic units per unit of foreign currency), P_t^b (P_t^{b*})is the price paid for an asset that will deliver 1 unit of the domestic (foreign) country's currency next period if state s realizes. A typical domestic household owns $B(s^t) + e(s^t)B^*(s^t)$ such assets entering period t. $M(S^{t-1})$ is the stock of domestic money the household enters period t with, $T(s^t)$ is *lump-sum taxes*, $W(s^t)$ is the nominal wage, $\Pi(s^t)$ are the profits of the domestic firms and $N(s^t)$ is a per-capita amount of domestic money received by the domestic agent.

With this specification we can introduce "money -demand- shocks" by allowing the weigh of the real balance term in the utility function, ζ_t, to vary stochastically.

The optimal behavior of the household is then characterized by

$$\nu C_t^{\eta-1}\Psi_t^{\nu(1-\sigma)-\eta)}\ell_t^{(1-\nu)(1-\sigma)} = \Lambda_t P_t \tag{1}$$

$$(1-\nu)\Psi_t^{\nu(1-\sigma)}\ell_t^{(1-\nu)(1-\sigma)-1} = \Lambda_t W_t \tag{2}$$

$$\Lambda_t P_t = \nu\zeta_t\left(\frac{M_t}{P_t}\right)^{\eta-1}\Psi_t^{\nu(1-\sigma)-\eta)}\ell_t^{(1-\nu)(1-\sigma)} + \beta E_t\left[\Lambda_{t+1}\right]P_t \tag{3}$$

$$P^b(s_{t+1}|s^t) = \beta\pi(s^{t+1}|s^t)\frac{\Lambda_{t+1}(s^{t+1})}{\Lambda_t(s^t)} \tag{4}$$

where Λ_t is the Lagrange multiplier associated with the budget constraint and $E_t(.)$ denotes mathematical conditional expectations, such that $E_t(Z_{t+\tau}) = \sum_{s^{t+\tau}}\pi(s^{t+\tau}|s^t)Z(s^{t+\tau})$. Note that

$$\Psi_t = \left(C_t^\eta + \zeta_t\left(\frac{M_t}{P_t}\right)^\eta\right)^{\frac{1}{\eta}}$$

The nominal interest rate can be written

$$\Lambda_t^b = \beta R_t E_t\left[\Lambda_{t+1}^b\right] \tag{5}$$

Using the definition of the interest rate in the money demand, and making use of (1), the money demand equation takes the form

$$\zeta_t\left(\frac{M_t}{P_tC_t}\right)^{\eta-1} = \frac{R_t-1}{R_t} \tag{6}$$

We will assume that nominal wages get fixed one period in advance at the level w ($w^\star$ in the foreign economy) that corresponds to the expected market clearing wage[6]. That is, nominal wages are set using labor contracts of the form $W_t = E_{t-1}\widetilde{W}_t$, where $\widetilde{W}_t$ is the nominal wage that would clear the labor market under flexible wages. The fixed wage then replaces equation (2) as the workers must supply the quantity of labor demanded by the firms and they are no longer on their labor supply schedule.

The problem of the foreign household is completely analogous to that of the domestic one.

1.2 The firms

1.2.1 Intermediate good firms

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

The first type of firms specializes in the production of a homogeneous intermediate good according to:

$$X_t = A_t(h_t)^\alpha \tag{7}$$

where A_t is a stationary, exogenous, stochastic technology shock.

The representative firm chooses how much labor to lease in period t in order to maximize current profits

$$\pi_t^I = P_{Xt}X_t - W_t h_t \tag{8}$$

where P_{Xt} is the price of the domestic intermediate good.

[6]We could have instead allowed for multi-period wage rigidity a la Calvo, as in Collard and Dellas, 2002. We chose not to do so for a simple reason. Most of the related literature uses one period contracts. Making the same assumption here allows us to uncover the distinct role played by incomplete information. This is an important consideration because multi-period price setting generates a complicated relationship between the degree of price (or wage) staggering and the properties of the exchange rate regimes. While this is an interesting issue, it has been dealt with elsewhere (see Collard and Dellas, 2001). Finally, note that we could have alternatively postulated that wages are set at a level that maximizes utility rather than at a level that is expected to clear the future labor market. This would not alter the results.

Each intermediate good is then used in the production of final goods in both countries according to the following restriction:

$$X_t = X_{Ht}^H + X_{Ft}^H \tag{9}$$

where X_{Ft}^H denotes the amount of domestic intermediate good that is used in the production of the foreign final good in period t and so on.

1.2.2 Final good firms

The domestic final good Y_t is produced according to

$$Y_t = [s^{1-\rho}(X_{Ht}^H)^\rho + (1-s)^{1-\rho}(X_{Ht}^F)^\rho]^{\frac{1}{\rho}} \tag{10}$$

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

$$\pi_t^F = P_t Y_t - P_{Xt} X_{Ht}^H - e_t P_{Xt}^* X_{Ht}^F \tag{11}$$

where s, is the weight of the domestic intermediate good in the domestic final good basket. Recall that X_{it}^j is the amount of the intermediate good of country j used in the production of the domestic final good i. $\frac{1}{\rho-1}$ 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, Y_t, before they can be consumed or used for investment. It follows that the two countries can have different price levels for their final goods, P_t, as these goods are not perfect substitutes.

The FOC are:

$$X_{Ht}^H = \left(\frac{P_{xt}}{P_t}\right)^{\frac{1}{\rho-1}} sY_t \tag{12}$$

$$X_{Ht}^F = \left(\frac{e_t P_{xt}^\star}{P_t}\right)^{\frac{1}{\rho-1}} (1-s)Y_t \tag{13}$$

Clearing of the domestic final good market requires:

$$Y_t = C_t + G_t \tag{14}$$

where G is domestic government expenditure.

The problem of the foreign firms is completely analogous. The foreign final good market clears when:

$$Y_t^* = C_t^* + G_t^* \tag{15}$$

where G^* is foreign government expenditure.

1.3 The government

In each and every period, the home government acquires an amount G_t of the final good. Government expenditure follows an exogenously determined stochastic, stationary process:

$$\log(G_t) = \rho_g \log(G_{t-1}) + (1 - \rho_g) \log(G) + \varepsilon_{gt} \tag{16}$$

with $|\rho_g| < 1$ and ε_{gt} $\mathcal{N}(0, \sigma_g)$.

Expenditures are financed by means of lump–sum taxation:

$$P_t^S G_t^S = P_t^S T_t^S \tag{17}$$

Similar equations characterize the behavior of the foreign government.

1.4 Monetary policy

We study combinations of two "domestic" and two international monetary arrangements. The two domestic procedures are monetary targeting and a Taylor rule. That is,

$$\frac{M_t - M_{t-1}}{M_{t-1}} = constant$$

and

$$R_t = k_p P_t + k_y Y_t$$

where M_t is the money supply and P_t and Y_t represent deviations from the inflation and output targets respectively.

The two international arrangements are a flexible system and a bilateral peg [7]. In the latter case, the monetary authorities either jointly target the "world" money supply subject to the constraint that the exchange rate must remain fixed. Or, they are allowed to operate a Taylor rule again but under the constraint that the exchange rate must remain fixed.

Finally, for the sake of completeness, we also consider a Taylor type of rule that targets the nominal wage, under both a flexible and a fixed exchange rate regime. This rule takes the form

$$R_t = k_w W_t$$

where W_t is the nominal wage rate.

1.5 The equilibrium

We will assume that both economies are of the same size, and that initial wealth is equally distributed across countries, so that $\Lambda_t = e_t \Lambda_t^\star$

The equilibrium is characterized by the following conditions together with the equations describing the conduct of monetary policy.

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

$$\{\mathcal{P}_t\}_{t=0}^{\infty} = \{W_t, P_t, P_{xt}, P_{bt}, R_t, W_t^\star, P_t^\star, P_{xt}^\star, P_{bt}^\star, R_t^\star, e_t\}_{t=0}^{\infty}$$

and a sequence of quantities

$$\{\mathcal{Q}_t^H\}_{t=0}^{\infty} = \{C_t, \ell_t, B_{it+1}, M_{t+1}, C_t^\star, \ell_t^\star, B_{it+1}^\star, M_{t+1}^\star\}_{t=0}^{\infty}$$

and

[7] We have also computed welfare in the case of a unilateral peg when the anchor country follows a Taylor rule. The results are available upon request.

$$\left\{\mathcal{Q}_t^F\right\}_{t=0}^{\infty} = \left\{h_t, Y_t, X_i, X_i^j, h_t^\star, Y_t^\star, X_i^\star, X_i^j\right\}_{t=0}^{\infty}$$

such that:

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

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

$$Q_t = C_t + G_t \tag{18}$$

$$Q_t^\star = C_t^\star + G_t^\star \tag{19}$$

$$X_t = X_{Ft}^H + X_{Ht}^H \tag{20}$$

$$X_t^\star = X_{Ht}^F + X_{Ft}^F \tag{21}$$

$$\tag{22}$$

as well as the financial, money and capital markets.

(iv) Nominal wages are set using labor contracts of the form $W_t = \widetilde{W}_t$, $W_t^\star = \widetilde{W}_t^\star$ *where* $\widetilde{W}_t$ *is the nominal wage that would clear the labor market in a Walrasian framework.*

(v) Monetary policy is conducted according to the procedures described in section 1.4

1.6 The solution

We log-linearize the model around the deterministic steady state. For simplicity we assume that there is no growth in the economy (real or nominal) and set the inflation and output target equal to zero[8]. Moreover, we assume that the two countries are perfectly symmetric. The structure of the shocks is as follows[9]:

The technology shock in each country follows the process[10]:

$$\log(A_t) = \rho_a \log(A_{t-1}) + (1 - \rho_a) \log(A) + \varepsilon_{at} \tag{23}$$

with $|\rho_a| < 1$ and $\varepsilon_{at}\ \mathcal{N}(0, \sigma_a)$.

The money demand shock follows:

$$\log(\zeta_t) = \rho_z \log(\zeta_{t-1}) + (1 - \rho_z) \log(\zeta) + \varepsilon_{zt} \tag{24}$$

with $|\rho_z| < 1$ and $\varepsilon_{zt}\ \mathcal{N}(0, \sigma_z)$.

And finally, the government spending shock is given by

$$\log(G_t) = \rho_g \log(G_{t-1}) + (1 - \rho_g) \log(G) + \varepsilon_{gt} \tag{25}$$

with $|\rho_g| < 1$ and $\varepsilon_{gt}\ \mathcal{N}(0, \sigma_g)$.

The model parameters are taken from Backus, Kehoe and Kydland, 1995 and Chari, Kehoe and McGrattan[11], 2000 except for those of the Taylor rule that are taken from Taylor. In particular: $\beta = 0.988$, $\alpha = 0.65$, $\eta = -1.5$, $\sigma = 2$, $\nu = 0.33$, $\rho = 0.25$, $s = 0.8$, $\kappa_y = 0.5$, $\kappa_\pi = 1.5$, $\rho_a = \rho_g = \rho_z = 0.95$. In order to minimize the role played by real balances in the welfare comparisons we set $\zeta = 0.0005$ rather than $\zeta = 0.05$, which is the value used by Chari, Kehoe and McGrattan[12]. We selected $k_w = 1000$, that is, perfect wage stabilization. The share of government expenditure in GDP is set equal to

[8] There is no violation of the non-negative nominal interest rate restriction for the –small– shocks considered here.

[9] As Taylor (1993) remarks, "...policy evaluation results cannot be obtained from pure theoretical considerations. They depend on the empirical nature of the economic relations and on the size and correlation of the shocks to these relations..."

[10] Allowing for cross country correlation of the shocks is straightforward. While such correlation favors a fixed regime, the value used in the literature is too small to make much of a difference.

[11] These models differ somewhat from the model used here. One should then view these values as suggestive rather than as values selected to maximize the empirical fit of the particular model.

[12] Using $\zeta = 0.05$ strengthens further the main conclusion of this paper on the relative importance of the domestic targeting dimension relative to the degree of exchange rate flexibility.

0.2. Finally, the standard deviation (sd) of the shocks is: $sd_a = 0.008$, $sd_g = 0.02$ and $sd_z = 0.016$. The last number is borrowed[13]from Collard and Dellas, 2002.

In the steady state we have $p = p^\star = s = 1$. From the price indexes, we get $p_x = p_x^\star = 1$ and $R = R^\star = \frac{1}{\beta}$.

2 The results

We solve the log-linearized model and then use the computed variance-covariance matrix of C, ℓ, M/P and ζ in a quadratic approximation of the utility function (the approximation is taken around the deterministic steady state; see Collard and Dellas, 2001). The top row in table 1 reports the level of welfare associated with each shock for each of the six monetary arrangements (for the benchmark case). The row immediately below reports the cost of volatility in terms of steady state consumption.

Several features stand out. First, conditional on a particular *domestic* policy procedure, there are no significant welfare differences across exchange rate regimes. There exist significant differences across activistic and passive policies, though, specially for supply shocks. Second, the highest welfare score for supply and fiscal shocks is achieved with M-targeting under a flexible regime but M-targeting also does quite well under a fixed regime. And third, wage targeting also does well while a standard inflation targeting rule a la Taylor rule results in significantly lower welfare.

Gali, 2001, reports that money targeting has good properties (relative to interest rate targeting) under supply and fiscal shocks in a closed economy. We find that this good performance is also present in an open economy and that it is independent of the exchange rate regime in place.

As stressed by Woodford, 2000, welfare comparisons require a lot of faith in the chosen model specification-parameterization. Comparisons based on macroeconomics performance, on the other hand, tend to be considerably more robust. Consequently,

[13] Ireland, 2001, uses an almost identical value for the standard deviation of the money demand shock, namely, $sd_z = 0.0178$.

we have also used the model solution to compare the various policy regimes in terms of a more traditional criterion, namely macroeconomic volatility. Table 2 reports the standard deviation of output, employment, the CPI, the terms of trade and the nominal interest rate. Several results are worth reporting.

First, with the exception of employment, the global monetarist peg and the wage targeting regimes produce the best results. Second, the differences across monetary regimes are quite substantial (for output, for instance, they are as high as 15%). Third, unlike the welfare comparisons, the differences can now be large both across international regimes (the fixed performing better) and across "domestic" policy rules. Based on both the welfare and the volatility results, one could claim that a global monetarist, fixed regime represents a good choice under conditions of incomplete information.

Table 3 reports the variance decompositions of h, y and p at various time horizons under monetary targeting and a flexible regime. This table provide some information about which shocks are important (when none of the shocks is inhibited). While the assumed stochastic structure assigns supply shocks a prominent role in the generation of macroeconomic fluctuations, this role is not excessive. In the short term, 90% of employment and 40% of output volatility is attributed to demand factors. The fact that employment is driven mostly by money shocks explains why activistic rules –which eliminate the influence of money demand shocks– are so successful in stabilizing employment.

What do these findings suggest for the optimal choice of the monetary policy rule (internal and external) and how do they compare to the results found in the existing literature? As far as the standard criteria of macroeconomic (output and inflation) volatility are concerned the results are fairly unambiguous. A passive (money targeting) peg or a nominal wage target produces significantly superior performance[14]. Moreover,

[14] We do not think, however, that the real world properties of a nominal wage targeting rule are as good as they appear here because the sources of nominal rigidities as well as their relative size are in practice unknown. It can be shown that, in our model, a policy that stabilizes nominal wages when it is mostly goods prices that are sticky or stabilizes goods prices when it is mostly wages that are sticky has very bad properties.

the differences across exchange rate regimes are much less significant than those across domestic procedures within the same regime.

The results reported above concerning the properties of the various combinations of policy activism and exchange rate management are very robust to the parameterization of the model. Changes in the degree of risk aversion, the elasticity of substitution between domestic and foreign goods and so on do not affect the main patterns reported above. Neither does the use of a Taylor rule that includes an exchange rate target.

3 Conclusions

The recent literature on the welfare properties of exchange rate regimes typically favors activistic flexible rates over fixed parities. In this paper we have argued that this result hinges critically on the commonly made assumption that the monetary authorities know a lot about the state of the economy (that is, that they can perfectly observe current shocks). This assumption induce a bias in favor of activistic policies. As the flexible exchange rate system is more suitable to the pursuit of activistic policies, these assumptions also induce a bias in favor of this type of exchange rate system.

We find that welfare comparisons are not very conclusive in the sense that the differences tend to be small. When the comparison is done on the basis of the standard output volatility criterion, though, a doubly passive regime (money targeting plus a fixed regime) comes on top. Moreover, in this case the differences across regimes are quite substantial for all degrees of policy activism.

Our analysis has also bearing for the recent claims on the unimportance of international policy coordination (Obstfeld and Rogoff's, 2001). We find that this remains the case even when monetary policy does not undo the effects of the nominal distortions and even when policy activism is not welfare enhancing.

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Table 1: Welfare comparisons

shock	FLEX-M	FLEX-R	FIX-M	FIX-R	FLE-W-R	FIX-W-R
Supply	-67.113838	-67.114797	-67.113928	-67.115287	-67.113968	-67.113966
	-0.009803	-0.011595	-0.009971	-0.012511	-0.010045	-0.010042
Fiscal	-67.109912	-67.110048	-67.109935	-67.110097	-67.109955	-67.109952
	-0.002465	-0.002720	-0.002508	-0.002812	-0.002547	-0.002540
Money	-67.108849	-67.108807	-67.108780	-67.108807	-67.108807	-67.108807
	-0.000480	-0.000400	-0.000350	-0.000400	-0.000400	-0.000400
All	-67.115413	-67.116467	-67.115457	-67.117006	-67.115544	-67.115539
	-0.012747	-0.014715	-0.012828	-0.015722	-0.012992	-0.012982

Note: For each shock, the first line gives the level of welfare. The line below gives the corresponding steady state consumption equivalent of the cost of fluctuations. FLEX-M and FLEX-R correspond to a flexible regime and FIX-M and FIX-R to a bilateral peg under –world– money and a Taylor rule, respectively. FLE-W-R and FIX-W-R are flexible and fixed regimes with nominal wage targeting.

Table 2: Macroeconomic volatility: All shocks

	FLEX-M	FLEX-R	FIX-M	FIX-R	FLE-W-R	FIX-W-R
y	2.29	2.13	2.00	2.14	2.01	2.01
h	1.46	0.99	0.96	0.97	0.85	0.85
p	2.92	0.82	2.89	1.31	2.16	2.23
q	4.01	3.85	3.72	3.72	3.74	3.74
R	0.11	0.25	0.03	0.31	0.06	0.06

Note: Standard deviation of output, y, employment, h, CPI, p, terms of trade, q, and nominal interest rate, R.

Table 3: Variance Decomposition: Flexible Exchange Rate and M-Targeting

k	a	g	ζ	a^*	g^*	ζ^*
			h			
1	0.0006	20.1085	70.5711	5.9779	2.8654	0.4766
4	4.2047	17.0307	71.9234	3.9818	2.4002	0.4592
8	5.6292	15.9879	72.3815	3.3055	2.2426	0.4533
20	6.5919	15.2831	72.6912	2.8484	2.1361	0.4493
			y			
1	51.6800	23.0592	17.2649	6.6407	0.5924	0.7628
4	62.1190	15.1554	9.5169	11.0306	1.7624	0.4157
8	63.7480	13.9221	8.3079	11.7157	1.9449	0.3615
20	64.6182	13.2632	7.6619	12.0816	2.0425	0.3326
			p			
1	73.7356	1.3137	13.4237	9.4886	0.8081	1.2303
4	64.8656	3.6629	17.6044	11.5582	1.8439	0.4649
8	63.8931	3.9205	18.0627	11.7852	1.9575	0.3810
20	63.4048	4.0499	18.2929	11.8991	2.0145	0.3389