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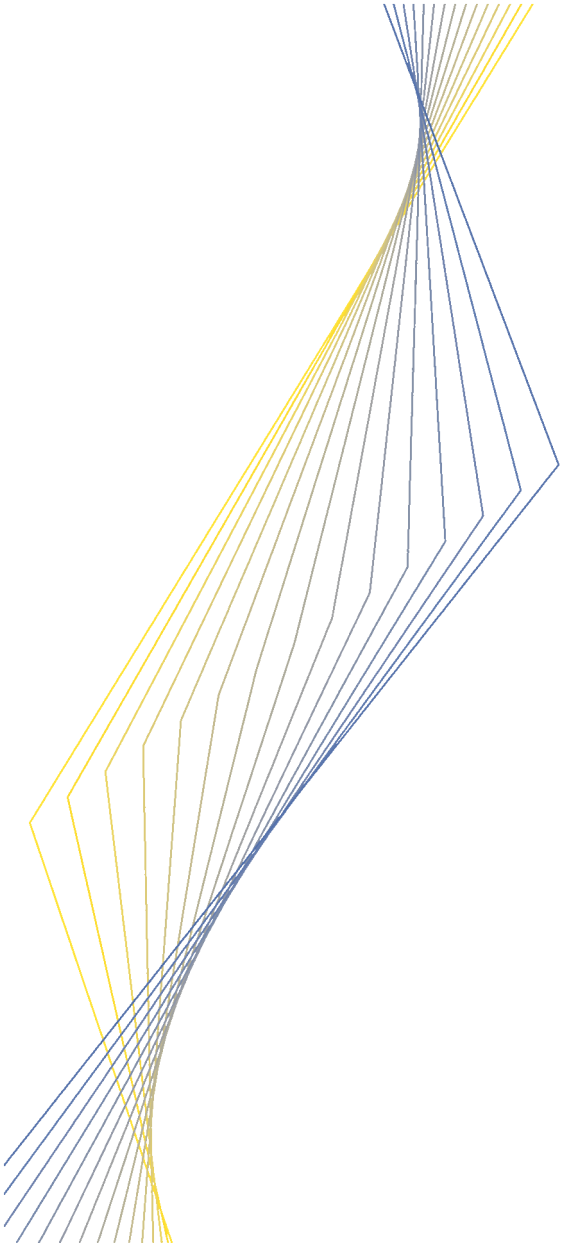

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MAINTAINING PRICE STABILITY UNDER FREE-FLOATING: A FEARLESS WAY OUT OF THE CORNER?[1]

BY CARSTEN DETKEN[2] AND VÍTOR GASPAR[2]

July 2003

1 *Paper presented at the CEPR/Deutsche Bank Research Workshop "Managed floating - an alternative to the two corner solutions?" January 30-31, 2003, Kronberg/Taunus. We would like to thank our discussant Richard Portes as well as Ignazio Angeloni, Hans-Joachim Klöckers, George Pineau, Oreste Tristani and an anonymous referee of the ECB Working Paper series for valuable comments and Ruth Macleod for editorial support. The responsibility for the remaining errors is our own. The opinions expressed herein are those of the author(s) and do not necessarily represent those of the European Central Bank. This paper can be downloaded without charge from http://www.ecb.int or from the Social Science Research Network electronic library at: http://ssrn.com/abstract_id=457308.*

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ISSN 1561-0810 (print)
ISSN 1725-2806 (online)

Contents

Abstract

The behaviour of the exchange rate under a floating exchange rate regime for a small open economy with perfect capital mobility may appear like a managed float or even a firmer peg. We present a canonical new neo-classical synthesis open economy model where the central bank follows a strategy directed at maintaining price stability. It is shown that the behaviour of the exchange rate depends on the structure of the economy and on the nature of the relevant shocks. In the case of very open economies the exchange rate will look quasi-fixed in response to shocks stemming from the international capital markets. It is also shown that the joined endogeneity of the interest rate and the exchange rate has important implications for the empirical testing of uncovered interest rate parity.

JEL classification system: E58, E63, F41

Keywords: price stability, small open economy, flexible exchange rates, managed floating, uncovered interest rate parity

Non-technical summary

It has been argued that in a world of free capital mobility only those exchange rate regimes, which are at the two corners, i.e. flexible exchange rates on the one side and monetary unions, dollar/euroisation and currency boards on the other side, would be sustainable. More intermediate exchange rate regimes would sooner or later collapse under pressure from international financial markets. This view has been supported by empirical evidence of many countries switching from intermediate exchange rate regimes to corner regimes during the 1990s. More recently, however, some doubts about the strength of this empirical evidence have been raised. Frequently, there seems to be some discrepancy between the officially declared exchange rate regime and the regime actually followed. For example, the case of a country, which officially freely floats but actually follows a managed floating regime, has been discussed under the label of "fear of floating". Some countries are said to be afraid of flexible exchange rates due to the mistrust of market forces and/or a high stock of foreign currency denominate debt.

We argue that the conclusion that many countries in practice shy away from a regime of floating exchange rates is not necessarily justified. The reason is that for a small open economy with perfect capital mobility it might be nearly impossible to distinguish a managed floating or even more intermediate exchange rate regime from a free floating exchange rate regime, when the central bank pursues the objective of price stability. Within the framework of a very basic, new neo-classical synthesis, open economy model, the degree of observational equivalence between managed and free floating exchange rate regimes will depend on the shocks and structure of the economy. In particular, a large real exchange rate elasticity of domestic demand and frequent shocks to the risk premium, as well as - under certain conditions - cost-push shocks will produce a strong but spurious resemblance to a managed floating regime. Nothing in the price stability oriented behaviour of the central bank is motivated by fear.

We also show that in the very same framework assuming white noise shocks to the risk premium, uncovered interest rate parity (UIP) will be wrongly rejected in standard test regressions. We derive a result previously obtained for monetary regimes characterised explicitly by managed floating and interest rate smoothing for a free floating, price stability oriented central bank. The implication is that many of the previously reported empirical failures of UIP cannot be used as evidence for irrational market behaviour under flexible exchange rates.

1. INTRODUCTION

The so called "corner solution", "bipolar" or "hollowing-out" view of exchange rate regimes claims that due to the impossible trinity[1] (independent monetary policy, free capital mobility and fixed exchange rates) and the trend towards growing international financial and trade integration only hard pegs, like currency boards, dollar/euroisation and monetary unions or flexible exchange rate regimes can be sustainable in the long run. This view has been supported by empirical evidence of many countries switching from intermediate exchange rate regimes to corner regimes during the 1990s (see Fischer (2001). Since about the time of the collapse of the Argentinian currency board the discussion on exchange rate regimes tends a) to de-emphasise the normative aspects of the "corner solution" view[2] and b) to question the strength of the empirical evidence. One reason is the discrepancy between the official, "de jure" exchange rate regime classification and the actual, "de facto" regime, which has been reported by many observers[3]. For example, Calvo and Reinhart (2002) coined the term "fear of floating" to describe a situation where a country is officially floating independently, but actually experiences an unusually low degree of exchange rate volatility. Exceptionally smooth exchange rate developments in comparison to other free-floating currencies are considered as evidence that the "de facto" exchange rate regime is more intermediate then free floating. The "fear of floating" is supposed to have its roots in expectations that a free floating exchange rate would deviate for prolonged periods of time from its equilibrium value and/or experience excessive volatility, which would burden the domestic real economy with avoidable adjustment and hedging costs, respectively. Furthermore, foreign currency denominated debt increases the fear of a significant exchange rate depreciation.

In the following we will use a new neo-classical synthesis, open economy model to show that the free floating exchange rate regime of a price stability oriented, small open economy with perfect capital mobility can easily appear observationally equivalent to a managed floating or even more intermediate exchange rate regime. This point has been made by Calvo and Reinhart (2002) in a less standard macro model and more informally by Edwards (2002) and Eichengreen (2002). We will show how the degree of observational resemblance will depend on the shocks and structure of the economy. There is

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[1] The proposition was already well known in the 1960s. It can be regarded almost as a "folk theorem" in international macroeconomics (see, for example, Wyplosz (1987) or Frankel (2001), which include references to the earlier literature). However the practical implications, in the form of constraints on feasible policies and institutional arrangements, are often overlooked. The argument was made forcefully, in the context of European integration, in Padoa-Schioppa (1982).

[2] Stanley Fischer (2001, p. 5) admitted that the view had been "exaggerated for dramatic effect".

[3] See e.g. Calvo and Reinhart (2002), Levy-Yeyati and Sturzenegger (1999), Reinhart and Rogoff (2002), Bofinger and Wollmershäuser (2003) and Poirson (2001).

no reason to attribute observed smooth exchange rate behaviour to fear (of floating), as it could simply be the result of the natural central bank reaction in pursuit of price stability.
Using "fearlessly" a domestic anchor, i.e. the domestic inflation rate, as objective for monetary policy is thus no way out of the corner exchange rate regime of free-floating, but might still lead to low volatility in exchange rates.
We also show that with price stability oriented monetary policy and white noise shocks to the risk premium, uncovered interest parity will be wrongly rejected in standard UIP test regressions. In our model the size of the bias in the test regressions will positively depend on the ratio of the interest rate to the exchange rate elasticity of domestic demand. This latter is the equivalent to McCallum's (1994) result for a managed floating cum interest rate smoothing central bank for an independent floating, price stability oriented central bank.

The formal analysis in this paper assumes perfect capital mobility and thus excludes the possibility to employ capital controls in order to circumvent the impossible trinity. Evidence on the effectiveness of capital controls is generally ambiguous, especially as means and ways to circumvent them increase with time. Building the exchange rate regime on the effectiveness of capital controls does not seem to be a promising approach for countries aiming at economic and political integration with the industrialised world.
Our discussion applies to the current debate on EU acceeding countries, where most countries have already abandoned capital controls and are bound to follow monetary policy aiming at price stability. As a matter of fact, already ten years ago, the 1993 Copenhagen European Council stated that EU membership required, as a pre-condition, *inter alia,* "(…) the ability to take on the obligations of membership including the adherence to the aims of political, economic and monetary union". In this context it is important to recall that article 4 prescribes that economic policies of Member States (including exchange rate policies) must comply with the principles of "stable prices, sound public finances and monetary conditions and a sustainable balance of payments. " The economic policies of all Member States are a matter of common concern (article 99). The same applies to exchange rate policies (article 124). In this respect it is noteworthy that the three large acceeding countries, Poland, Czech Republic and Hungary are now all following inflation targeting monetary policy regimes with flexible exchange rates. Only Hungary has officially announced a +/- 15% fluctuation band for the Forint/euro exchange rate.

Our discussion will show how exchange rate volatility will depend on the parameters and the shocks hitting the small open economy. These results cast some doubt on the various attempts to identify "de facto" exchange rate regimes in terms of comparisons of unconditional volatility of variables like

exchange rates, interest rates and foreign exchange reserves[4]. For example Calvo and Reinhart (2002) report that within their group of 39 countries, the probability to observe large changes in foreign exchange reserves and interest rates between 1970 and 1999 has been largest for the group of officially floating countries, which they interpret as "fear of floating" [5]. But we do not know whether some countries float exactly because they know about their high probability to experience large asymmetric shocks, which they have to counter by changing domestic interest rates in order to stabilise the domestic economy. Whether the officially declared exchange rate regime (of independent floating) is accurate or whether a managed float is followed cannot be settled by simply observing the volatility of exchange rates and interest rates. We will illustrate this point in the following section by means of a very stylised small open economy model. The identification of a managed floating regime is particularly difficult. The standard "de jure" distinction according to the IMF of independent floating relies on the intentions of possible foreign exchange market interventions. If the latter are intended to change the level of the exchange rate (without being explicit about it), this is called managed floating. If interventions are simply meant to smooth the volatility of exchange rates without any concern for the level as such - simply with the goal to maintain orderly market conditions - this qualifies as an independent or free-floating regime[6]. This distinction does not - in our view - make much sense for two reasons. First of all, the intentions of the central bank are unobservable. Second, even if intentions were observable, sterilised interventions are no independent monetary policy instrument. A general policy concerning sterilised interventions is, in our view, not useful when describing a monetary policy regime. As a monetary policy regime exactly determines the corresponding exchange rate regime, intervention policy cannot be used to classify exchange rate regimes. Intervention policy is therefore ignored in the formal analysis of the paper. A better definition of managed floating would dwell on the existence of an independent exchange rate smoothing objective for the central bank.[7] In this context independent means that low volatility of the exchange rate is an objective as such, over and above the exchange rates role for the inflation forecast.

Section 2 will provide a theoretical foundation for the claim that independent and managed floating exchange rate regimes can be observationally equivalent. It will also illustrate the difficulty in

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[4] See studies cited in footnote 3.

[5] Fear of floating describes a situation in which a country publicly declares it follows a free-floating exchange rate regime but empirical evidence shows that the variance of the exchange rate is actually very low and where it appears that the exchange rate is smoothed by means of interest rate policy or interventions.

[6] Note that this is our interpretation of the IMF classification. It is possible to slightly shift the dividing line between managed and free floating, see e.g. Von Hagen and Zhou (2002). This leeway reinforces our argument below about the difficulty and eventual usefulness of this classification.

[7] Allthough also this might not always be observable.

classifying exchange rate regimes when the central bank of a small open economy pursues a price stability-oriented monetary policy strategy. Section 3 will discuss the bias for standard tests of uncovered interest parity resulting from the price stability objective and the endogeneity of the exchange rate. Section 4 will discuss some caveats against the feasibility of using an internal anchor for monetary policy, which cautions against applying such a simple model without scrutinising the specific circumstances, case by case. Finally section 5 concludes.

2. A STYLISED NEW NEOCLASSICAL SYNTHESIS (NEW KEYNESIAN) SMALL OPEN ECONOMY MODEL

To characterise the stylised behaviour of the exchange rate in a floating exchange rate regime and the difficulty of exchange rate regime classification mentioned above, it is helpful to consider the following simple open economy model. Our ambition was to use the simplest possible model allowing for the derivation of the optimal targeting rule as a closed-form solution. The analysis is very much in the spirit of Ball (1998), Gerlach and Smets (2000) and Svensson (2000).

$$(1)\quad L = E_t\left(\sum_{n=0}^{\infty}\beta^n\left[\pi_{t+n}^2 + \alpha x_{t+n}^2\right]\right)$$

$$(2)\quad \pi_t = \lambda x_t + \beta E_t \pi_{t+1} + u_t$$

$$(3)\quad x_t = -\varphi\left[i_t - E_t \pi_{t+1}\right] + E_t x_{t+1} + \nu\left[e_t - p_t\right] + g_t$$

$$(4)\quad i_t = E_t e_{t+1} - e_t + f_t$$

with $u_t = \rho u_{t-1} + \upsilon_t$ *and* $g_t = \mu g_{t-1} + \varepsilon_t$ where f_t, υ_t and ε_t are mean zero, white noise random variables, which are mutually uncorrelated with $0 \leq \rho \leq 1$ and $0 \leq \mu \leq 1$.[8]

We consider a small open economy in which the central bank minimises a standard loss function (1)[9]. E_t denotes expectations in period t, β is the discount factor, π represents inflation, x the output gap (actual minus potential) and α depicts the relative weight of the output gap relative to the price stability objective in the loss function. All economic variables are expressed as deviations from trend and except for interest rates are expressed in logarithms.

The differences with the above cited approaches are that Ball (1998) investigates a purely backward-looking economy, Gerlach and Smets (2000) have no forward-looking expectations in the Philipps

[8] See also Bofinger and Wollmershäuser (2003) for a very similar model, solved numerically.

[9] Svensson (1997) and Ball (1999) have shown, in the context of small theoretical models, a correspondence between the Central Bank's time horizon and the weight of output gap stabilisation in the central bank's objective function.

curve and no expected future output gap in the IS curve but consider informational asymmetries. Svensson (2000) has forward-looking expectations, a sophisticated lag structure and a direct inflation effect of real exchange rate changes in the Philipps curve, which significantly complicates his analysis. The structure in (1) to (4) is thus best compared to a simplified Svensson (2000) model.

A loss function like in equation (1) has been shown to be approximately compatible with a utility-based welfare function by e.g. Woodford (1999) for a closed economy. Here we are less interested in the exact welfare function specification for an open economy but simply assume that equation (1) captures the preferences of the central bank.

Equation (2) is the basic New Keynesian Philipps curve derived from firms staggered nominal price setting (here "Calvo pricing"). Inflation depends on the current output gap and expected future inflation. The shock u_t is commonly referred to as a cost-push or markup shock and captures everything affecting expected marginal costs, which is not associated with excess demand shocks. The cost-push shock follows a stationary autoregressive process.

The closed economy version of equation (3) can be derived from a consumption Euler equation, where the g_t shock is best thought of as an excess demand shock. It captures expected changes in government spending and potential output. The demand shock is also assumed to follow a stationary autoregressive process. The current output gap depends negatively on the real interest rate and positively on the expected future output gap. The latter is the consequence of agents' consumption smoothing objective. To extend the closed economy model as presented in Clarida, Gali and Gertler (1999) to an open economy setting we add the real exchange rate to this IS curve in the standard fashion[10]. e_t is the domestic currency price of foreign currency and p_t the domestic price level. The (logs of the) foreign price level and the foreign interest rate are normalised to zero. Equation (4) then depicts foreign exchange market equilibrium, assuming perfect capital mobility and a white noise currency risk premium, f_t. The nominal domestic interest rate is labelled i_t.

[10] Clarida, Gali and Gertler (2001) have shown that the general representation of the IS curve and the Philipps curve must not change for an open economy as compared to a closed economy. The real exchange rate can be shown to be proportional to marginal costs and can thus be captured by the output gap term, as long as permanent purchasing power parity and uncovered interest parity hold (where π has to be interpreted as domestic inflation). Here we do not impose permanent PPP. The neglect of the exchange rate in the Philipps curve could still be justified by the assumption of a perfect pass-through as in Monacelli (2003). If p is domestic inflation, one could still justify some real exchange rate term in the IS curve, although most likely it would have to be in expected future terms instead of the current real exchange rate used he (See Monacelli (2003), De Fiore and Liu (2002)). It is unlikely though that any of our results would be qualitatively changed, as the exchange rate would remain an endogenous variable, responding to the current shocks in a very similar way.

Similar to Gerlach and Smets (2000) we simplify the analysis by excluding a direct influence of the exchange rate on inflation in equation (2). One way to interpret this is that the central bank only focuses on domestic and not CPI inflation. The loss function (1) precludes the classic Barro/Gordon inflation level bias as there is no incentive to deviate from a zero output gap (if not compensated by a gain with respect to the inflation objective).

The central bank uses the interest rate as its policy instrument. As shown in Clarida, Gali and Gertler (1999) the first order condition valid for optimal policy under discretion, i.e. when the central bank takes expectations as given is derived by minimising loss function (1) subject to (2) with respect to x_t and π_t. The first order condition is[11]

(5) $x_t = -\frac{\lambda}{\alpha}\pi_t$

Forward substitution of (2) using (5) determines inflation and the output gap under optimal policy as functions of the state variable u_t as shown in (6) and (7).

(6) $\pi_t = \Phi u_t$

(7) $x_t = -\frac{\lambda}{\alpha}\Phi u_t$

with $\Phi = \frac{\alpha}{\alpha(1-\beta\rho)+\lambda^2}$ and $\alpha > 0$

Note that only cost-push shocks trigger a deviation of inflation (and expected future inflation) and the output gap (and expected future output gaps) from their trend levels[12]. If equations (6) and (7) are substituted into the IS curve (3) one obtains an expression, which can be interpreted as a (demand-effect weighted) monetary condition index (MCI) like in Gerlach and Smets (2000) and Ball (1998).

(8) $\varphi i_t - \nu e_t = \left(\varphi\rho + \frac{\lambda}{\alpha}(1-\rho) - \nu\right)\Phi u_t + g_t - \nu p_{t-1}$

Equation (8) shows that although the interest rate is the single monetary policy instrument of the central bank, eventually it is the combined demand effects of the interest rate and the exchange rate, which will have to adjust optimally to the shocks hitting the economy. Optimal policy requires the MCI to adjust the output gap whenever the inflation rate deviates from trend according to (5)[13]. A

[11] Brousseau and Detken (2001) show that due to the possible indeterminacy of this model, one has to exclude certain type of sunspot equilibria in order to obtain the correct first order condition (5) from the standard Bellman equation. See also De Fiore and Ziu (2002) for a discussion of indeterminacy in an open economy.

[12] If α is equal to zero cost-push shocks would also not affect inflation as they would be completely offset by monetary policy. The output gap would bear all the adjustment burden according to $x_t = u_t / \lambda$.

[13] The commitment solution would require the MCI to adjust the output gap whenever the price level deviates from trend. See Clarida, Gali and Gertler (1999) and the appendix.

demand shock will trigger an exactly corresponding tightening of monetary conditions in order to maintain a zero output gap. The excess demand shock g_t can and will be fully offset by the central bank. A risk premium shock in our model leads, eventually, to a combined effect on the interest rate and the exchange rate such that both the MCI and the output gap are unchanged[14]. The risk premium shock does not directly affect the output gap nor inflation so that the optimal policy is to keep the output gap balanced at zero. To do so the monetary authority must keep the MCI constant[15].

In the model the only shocks that cannot be fully offset in terms of their effects on inflation and the output gap are the cost-push shocks. In such a case a trade-off between inflation and output gap deviations from trend levels is unavoidable in the short run (see (6) and (7)). The optimal reaction to a cost-push shock could be a tightening or a loosening of monetary conditions as measured by the MCI in (8). Below we will show that interest rates will unambiguously rise, but that the exchange rate could either depreciate or appreciate. According to (7), monetary policy has to create an output gap following a cost-push shock. But in case the price elasticity of demand for domestic output, v, is very large, the rise in domestic prices will already have such a large negative influence on the output gap that the optimal size of it will only be achieved by a decrease in the (nominal) MCI, which would imply a depreciation of the nominal exchange rate. This shows some limitations of the MCI as defined in (8). Being defined in nominal terms the MCI itself cannot be used to judge monetary conditions when the shocks hitting the economy have a direct effect on inflation, as cost-push shocks do. Using an MCI as an intermediate target, is sometimes claimed to be a much simpler and equally optimal policy strategy than a broader based price stability orientation. But our example shows that it is possible that the MCI would signal a loosening of monetary conditions while the latter are actually tightened[16].

Obviously the exchange rate and the interest rate are jointly endogenous in this model. In order to determine the interest rate reaction function consistent with equation (8), we have to solve the model using the foreign exchange market equilibrium represented by (4) and by imposing rational expectations. We guess that the solution for e will be a linear function of the four state variables u_t, g_t, f_t, and p_{t-1}. Using the method of undetermined coefficients we find the following solution for the nominal exchange rate (9) and the interest rate reaction function (10).

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[14] This result has also been derived and discussed in Gerlach and Smets (2000).

[15] The MCI would change in response to risk premium shocks once the exchange rate would be allowed to affect inflation directly in the Philipps curve.

[16] Using a real definition of the MCI (like in Ball (1999) and Gerlach and Smets (2000)) would circumvent this problem but create others, e.g the usefulness as a readily observable intermediate target would have to be questioned. See ECB (2001) for further arguments against using an MCI as a summary variable of the monetary policy stance.

$$(9)\quad e_t = \left[1 - \frac{\lambda(1-\rho)}{\alpha[\varphi(1-\rho)+\nu]}\right]\Phi u_t - \frac{1}{\varphi(1-\mu)+\nu} g_t + \frac{\varphi}{\varphi+\nu} f_t + p_{t-1}$$

$$(10)\quad i_t = \left[\frac{\lambda(1-\rho)^2}{\alpha[\varphi(1-\rho)+\nu]} + \rho\right]\Phi u_t + \frac{1-\mu}{\varphi(1-\mu)+\nu} g_t + \frac{\nu}{\varphi+\nu} f_t$$

an alternative way to present the interest rate reaction function (10) would be (11) where it is evident that the Taylor principle holds[17]:

$$(11)\quad i_t = \left[1 + \frac{\lambda(1-\rho)}{\alpha[\varphi(1-\rho)+\nu]}\right] E_t \pi_{t+1} + \frac{1-\mu}{\varphi(1-\mu)+\nu} g_t + \frac{\nu}{\varphi+\nu} f_t$$

Thus the central bank will increase interest rates when expected inflation[18] rises as a consequence of a positive cost-push shock and when there is a positive shock to excess demand or a rise in the risk premium. At the same time the nominal exchange rate will depreciate following an excess demand shock and a rise in the risk premium. Whether the nominal exchange rate will appreciate or depreciate following a cost-push shock depends on the structural parameters of the economy. But a cost-push shock will always lead to a real appreciation, which can be seen from (6), which implies that $p_t = p_{t-1} + \Phi u_t$. Thus while the immediate rise of the price level to a cost-push shock is Φ, the nominal exchange rate will depreciate by Φ times a factor smaller than one (for the case it depreciates) as follows from (9). Equation (9) also shows that purchasing power parity holds in steady state when there are no shocks to the economy.

Equations (9) and (10) are useful to underline the previous argument that in a floating exchange rate regime with a price stability-oriented central bank, the exchange rate and the interest rate are jointly endogenously determined. The volatility of the exchange rate will depend on the structure of the economy and the shocks hitting the economy. Despite an independent floating regime, the exchange rate might actually turn out to be smoothened by interest rate policy, without the latter being a final or even intermediate goal of the central bank.

[17] Note that if risk premium shocks would not be white noise but also follow a stationary autoregressive process, the only difference to equations (9)-(11) would be that the denominator of the coefficient for f_t would be $\varphi(1-\gamma)+\nu$ instead of simply $\varphi+\nu$, where γ is the respective autoregressive coefficient.

[18] Note that expected inflation here is unconditional, i.e. after taking into account the optimal monetary policy reaction.

The example of an increase in the risk premium f_t will demonstrate this effect. The nominal exchange rate will depreciate and the interest rate will rise. This simultaneous change in e and i could easily be interpreted as a "leaning against the wind" behaviour or "fear of floating". But effectively the central bank is only trying to maintain price stability according to its loss function (1). The central bank is successful in smoothing the change in the exchange rate. Keeping interest rates fixed, the increase in the risk premium would be one to one reflected in a depreciation of the domestic currency. But as $\varphi / (\varphi + v)$ in (9) is smaller than 1, the side effect of maintaining price stability is to dampen the effect on the exchange rate. In extreme cases of openness, i.e. a very large real exchange rate elasticity of demand, v, the exchange rate might actually be quasi-fixed, while the interest rate changes are large[19]. Of course this argument is well known. Calvo and Reinhard (2002) point out that a strong commitment to an inflation target might explain the fear of floating. Also Eichengreen (2002) has argued along these lines. The model can nicely illustrate Eichengreen's (2002, p. 19) argument that fear of floating will be reduced when there is a strong liability dollarisation in the economy. It is reasonable to assume that a strong liability dollarisation will reduce the positive demand effects of a real depreciation as domestic balance sheets get weaker. In the model this translates into a smaller exchange rate elasticity of demand, v. In such a case, counter-intuitively, the nominal exchange rate will adjust more in response to shocks to the risk premium and also to demand shocks. On the other hand the exchange rate would depreciate less or appreciate more, depending on the structural parameters, the smaller v, ceteris paribus, i.e. the more dollarised the liabilities when the economy is hit by a cost-push shock.

We tend to agree with Edwards (2002) that labelling the successful policy of a central bank in a small open economy, which manages to maintain price stability in a floating exchange rate regime as "fear of floating" is not a fortunate choice of terms. There is nothing fearful or suboptimal in this policy, which is why Edwards (2002, p. 20) introduces the term "optimal floatation".

Actually the model allows us to qualify the inflation target commitment explanation given by Calvo and Reinhart (2002). They generally claim that a strong commitment to inflation targeting (as opposed to a seigniorage objective in their case) will reduce both the variances of the nominal exchange rate and the variance of the nominal interest rate[20]. In their model the variance of the nominal interest rate

[19] In case the risk premium shock follows a stationary autoregressive process, the argument remains valid. Under optimal policy the exchange rate depreciates by a factor of $\varphi/ (\varphi (1-\gamma)+ v)$, while with unchanged interest rates it would depreciate at a faster rate, i.e. by a factor of $(\varphi+ v) / (\varphi (1-\gamma)+ v)$.

[20] Calvo (2001, p. 325) mentions that inflation targeting is equivalent to pegging to a basket of goods. If the basket of goods is composed of tradable goods only, then inflation targeting is "essentially equivalent to fixed exchange rates".

is reduced because shocks to money demand[21] are more vigorously offset, the stronger the commitment to price stability. In the more conventional model presented here, we can show that the standard deviation of the exchange rate is actually reduced the larger the relative weight on the inflation as opposed to the output gap target, i.e. the smaller α. But this holds only in the presence of cost-push shocks. This result is evident as the first bracket and the following fraction of the right hand side of (12) increase with α. The way in which the variance of excess demand and the variance of risk premium shocks affect the variance of the exchange rate does not depend on the relative weight to the price stability objective, because these shocks do not create a short-run trade-off between inflation and output variability. Whether the standard deviation of the interest rate increases or decreases for a given variance of the cost-push shock is ambiguous as can be seen in (13) as the first term in brackets on the right hand side declines while the following fraction increases with α.

$$(12)\quad \sigma_e = \left[1 - \frac{\lambda(1-\rho)}{\alpha[\varphi(1-\rho)+\nu]}\right]\frac{\alpha}{\alpha(1-\beta\rho)+\lambda^2}\sigma_u + \frac{1}{\varphi(1-\mu)+\nu}\sigma_g + \frac{\varphi}{\varphi+\nu}\sigma_f$$

$$(13)\quad \sigma_i = \left[\frac{\lambda(1-\rho)^2}{\alpha[\varphi(1-\rho)+\nu]} + \rho\right]\frac{\alpha}{\alpha(1-\beta\rho)+\lambda^2}\sigma_u + \frac{1-\mu}{\varphi(1-\mu)+\nu}\sigma_g + \frac{\nu}{\varphi+\nu}\sigma_f$$

In general it is worth noting that by observing realised interest rates and exchange rates, it might be impossible to distinguish a free floating country in which the central bank follows a loss function like (1) and a country where the central bank follows a more intermediate exchange rate regime. From equations (9) and (10) one can derive a positive correlation between *e* and *i* when shocks to the risk premium and cost-push shocks dominate, given for the latter that the structure of the economy is such that cost-push shocks depreciate the nominal exchange rate. As mentioned above such a positive correlation could easily and mistakenly be interpreted as an exchange rate smoothing objective of the central bank. Thus the regimes of two identical countries following the same policy rule except that in one country excess demand shocks dominate while in the other shocks to the risk premium dominate could be classified as free and (falsely) as managed floating, respectively.

Recently Gali and Monacelli (2000) derive a similar point in a new open economy stochastic general equilibrium model. They show that under optimal policy the interest rate of the small country is highly positively correlated with the world interest rate. This has nothing to do with an exchange rate

[21] Calvo and Reinhart only consider two types of shocks: to money demand and to the risk premium. They also obtain the result that the variance ratio of *e* to *i* decreases the higher the commitment to price stability. This result does not follow in the model presented here. The ratio's relation to α will depend on the specific shock and, e.g. the persistence of the cost-push shock, ρ.

smoothing objective but arises from optimising behaviour by independent central banks under flexible exchange rates.

3. UNCOVERED INTEREST PARITY AND FEARLESS FLOATING

The reaction of a price stability-oriented central bank to various kind of shocks has also important consequences for standard tests of uncovered interest parity. McCallum (1994) has pointed out that in case the central bank follows an (arbitrary) reaction function in which it smoothes interest rates and past exchange rate changes, the regression coefficient b in equation (14) where ξ_t is the error terms is negative.[22]

(14) $e_{t+1} - e_t = a + b\, i_t + \xi_t$

Equation (14) is often used to test for UIP[23]. The null hypothesis of UIP would be $a=0$ and $b=1$. Thus McCallum showed that even if UIP is valid (f_t in equation (4) is white noise), the econometric test according to (14) might falsely reject it and produce a negative regression coefficient. The reason is that the central bank follows a managed floating exchange rate regime *and* has some preference for a smooth development of interest rates.

The simple economy analysed in this paper extends this argument to an explicitly price stability oriented central bank. Equation (9) allows computing the future exchange rate change in our model. With no loss of generality with respect to our argument, we assume that u_{t+1}, g_{t+1}, and f_{t+1} equal the value expected in period t, thus v_{t+1} , ε_{t+1} and f_{t+1} are all equal to zero, so that $E_t e_{t+1} = e_{t+1}$.

$$(15)\quad e_{t+1} - e_t = \left[\frac{\lambda(1-\rho)^2}{\alpha[\varphi(1-\rho)+\nu]} + \rho\right]\Phi u_t + \frac{1-\mu}{\varphi(1-\mu)+\nu} g_t - \frac{\varphi}{\varphi+\nu} f_t$$

Comparing equation (15) with equation (10), which determines the interest rate allows us to see, which coefficient we would obtain for the different shocks in the UIP test regression (14). It is immediately evident that $e_{t+1} - e_t$ and i_t move exactly the same for cost-push and excess demand shocks. The general nature of this result for the cost-push shock is at first sight surprising as for some structural parameter constellations it is possible that one obtains a positive correlation between i_t and e_t. But as the cost-push shock in such a case will also lead to an expected future depreciation this will not lead to a coefficient different from 1 in the UIP test regression. Things are different for risk-premium shocks. A rise in the risk premium leads to appreciation expectations while at the same time domestic interest rates rise in order to keep the MCI constant. Thus the b coefficient in equation (14) [$=cov(e_{t+1}-e_t;\, i_t)/var(i_t)$] would be negative or more precisely $-\varphi/\nu$ in case the economy is only subject

[22] McCallum uses the following policy reaction function $i_t = \psi(e_t - e_{t-1}) + \tau i_{t-1} + \zeta_t$ where ζ_t is the error term. Combined with UIP, i.e. equation (4), he found the b coefficient to be equal to $-\tau/\psi$.

[23] Obviously i_t is the domestic-foreign interest rate differential.

to f shocks. Thus the stronger the interest relative to the real exchange rate elasticity of domestic demand, the stronger will be the apparent rejection of UIP with regard to shocks to the risk premium. The intuition is that a large φ means a strong negative demand effect of a given rise in the interest rate. According to the optimal policy rule, the MCI has to be kept unchanged after a shock to the risk premium. For this purpose the exchange rate has to depreciate more the larger φ. Thus the corresponding appreciation expectations are larger, and the violation of UIP more significant, the larger φ. The negative influence on the bias of v is simply due to the smaller slope of the regression line the higher the variance of interest rates, everything else equal. The variance of the interest rate positively depends on v as can be seen from equation (13). That a time varying risk premium is one reason for UIP failure needs no mention. But for a price stability oriented central bank minimising loss function (1), even white noise risk premium shocks will lead to a spurious rejection of UIP, although of course equation (4) holds by definition in the model. This feature of this simple model is also able to explain the stylised facts cited by McCallum (1994), i.e. the negative b coefficients and the unbiasedness of the forward rate in level regressions, where the future spot rate is regressed on the respective current forward rate[24]. This is the McCallum result but obtained under price stability oriented free floating as opposed to an ad hoc kind of smooth floating[25].

Thus simple inflation targeting could not only lead to various degrees of observable exchange rate smoothing but also to a spurious break down of UIP. The latter could then even erroneously be used as an ex-post justification why the central bank "rightly' prefers managed floating to free floating, along the lines that exchange rates are determined by irrational behaviour[26].

[24]The fact that the level regression involves non-stationary variables cannot explain the difference for the b estimates, as the future spot rate and the current forward rate should be co-integrated.

[25] See also Kugler (2000) on the relationship between tests for UIP and the expectations hypothesis using a reaction function like in footnote 22. See also Barnhart et al. (2002) concerning problems of simultaneity in standard UIP test regressions and Goodhart et al. (1992) and (1997) for further explanations for negative b estimates.

[26] This might at times be true, but it does not necessarily follow from rejections of UIP from the standard test regressions when the central bank pursues a price stability oriented policy strategy. The conclusions drawn from the empirical evidence presented in Bofinger and Wollmershäuser (2003) are likely to be due to this spurious UIP breakdown. Our conclusions are also consistent with the positive results for UIP derived by Cincibuch and Vavra (2003) by means of a non-parametric test using implied FX option distributions for the US dollar/yen exchange rate.

4. IMPORTANT CAVEATS

We have argued that the characterisation of the monetary policy regime and of the exchange rate regime is not separable. In section 2 we have shown that, for a small open economy under floating, a monetary policy oriented to maintaining price stability over the medium term, will imply different behaviour for the exchange rate according to the parameters characterising the structure and the origin of the shocks driving the economy. The previous analysis could lead to the premature conclusion that all the discussions about an appropriate exchange rate regime can easily be discarded. A price stability oriented central bank within a floating exchange rate regime will automatically produce the optimal degree of exchange rate variation or stability. The optimal behaviour of the exchange rate will most likely not be constant in time nor the same for different countries. Why then ponder about other solutions, like soft or hard pegs, which can only be sub-optimal within the framework of the previous section? For obvious reasons such a conclusion is too simple and neglects some important elements. We will briefly discuss the most important caveats and will briefly refer to some arguments in the literature suggesting reasons why the exchange rate may be used as a nominal anchor for monetary policy.

4.1 Credibility

The model presented in section 2 allows us to structure the discussion on credibility issues. First of all, the central bank might lack the necessary credibility to adhere to maintaining price stability over the medium run. The classical Barro/Gordon inflation level bias can arise when the central bank is expected at times to be willing to increase output by means of surprise inflation. Such a situation could for example occur when the independence from government authorities striving for re-election is not guaranteed. The inflation bias has been defined away in the model presented in section 2 by assuming the central bank considers output above potential as a loss and not a gain, but otherwise it would be of particular relevance when we describe optimal policy under discretion. Thus, in a situation, where the central bank loss function, e.g. comprises $-x$ instead of x^2, it can make sense to tie the central bank's hands to an exchange rate target, attempting to increase the political and reputational costs of violating this commitment.

Second, even if the inflation level bias is not present, one could argue that the commitment to an exchange rate level could possibly reduce the so-called inflation stabilisation bias[27]. In our model the stabilisation bias can be defined as a suboptimal reaction to cost-push shocks due to the fact that the central bank cannot influence - and thus make use of - the public's expectations concerning future reactions of the central bank. One of the characteristics of this model is that the optimal policy under commitment produces a stationary price level compared to the stationary inflation rate obtained under

[27] In the same vein Gali and Monacelli (2000) argue that commitment to nominal exchange rate stability allows the central bank to improve on the outcome feasible by means of a simple Taylor rule.

discretion. It could thus be perceivable that committing to a fixed exchange rate level could approximate the optimal commitment outcome for a cost-push shock more than the discretionary policy under floating exchange rates. The issue, though, should not be overrated. The stabilisation bias is of second order relevance as compared to the inflation bias.

Rogoff (1985) showed that it is possible to improve on the equilibrium solution under discretion through the appointment of a conservative central bank (i.e. someone with a higher degree of inflation aversion than the general public). An alternative to finding your own domestically grown conservative central banker is to rely on the reputation of some foreign central bank through a commitment to the exchange rate. Giavazzi and Pagano (1988) and Giavazzi and Giovannini (1989) claim that some European countries with histories of high inflation followed such a strategy in the 1980s. By joining the Exchange Rate Mechanism of the European Monetary System (ERM of the EMS) they were, according to the authors, buying some credibility and reducing the output losses associated with disinflation.

Having said this, we hasten to mention that committing to an exchange rate level, possibly creates other credibility problems. Garber and Svensson (1995) provide a survey covering all types of credibility problems for fixed or target bands exchange rate regimes. In particular they discuss various forms of speculative attacks these regimes might face, which can be both related to fundamentals and self-fulfilling expectations.

4.2 Information requirements

A strategy focused on price stability under floating exchange rates is more demanding both in terms of analysis and data. First of all, we so far assumed that the central bank and the public are able to correctly identify all shocks hitting the economy. In practice every central bank faces a large signal extraction problem as analysed in Gerlach and Smets (2000). The signal extraction problem is worse for central banks with little experience and in a changing economic environment. A large signal extraction problem would bias the optimal exchange rate regime towards a more fixed regime as long as the dominant shocks would not affect the equilibrium real exchange rate. Second, we assumed that shock identification and reaction of the central bank takes place contemporaneously. And third we neglected any time delay in the transmission mechanism. All these assumptions are likely to bias the evaluation in favour of a floating regime.[28]

Furthermore, it is likely that the transmission mechanism in many emerging market economies is less known and less stable than would be required to conduct a monetary policy strategy as spelt out in section 2. Note also that the optimal reaction to the various kinds of shocks, always depends on the

[28] Hunt, Isard and Laxton (2002) stress the importance of identifying shocks to the risk premium (and the persistence of these shocks) in order to derive a robust simple interest rate reaction function.

persistence of the shocks, information which is particularly difficult to estimate[29]. Another important issue is the timeliness with which information becomes available. It could be the case that it is not possible to observe inflation and output in a timely fashion in order to monitor compliance with the domestic policy objective(s). In such circumstances it might be more appropriate, i.e. disciplining and thus credibility-enhancing to cast the monetary policy strategy in terms of a variable which is available instantaneously. This is certainly the case for the nominal exchange rate[30].

Another complication might be the lack of deep and liquid financial markets, which would be an additional complication in identifying the nature of shocks. The conditions to derive a reasonably trustworthy projection of future inflation could simply not be fulfilled. The choice of an appropriate exchange rate regime different than floating, would then actually prove to be of utmost importance.

4.3 Endogenous institutional and behavioural changes

Some economic institutions (e.g. the institutional arrangements for wage negotiations or the importance attributed to sustainability by the fiscal authorities) might actually not be independent of the choice of the exchange rate regime. The exchange rate regime can trigger institutional or behavioural changes, which in themselves are so important that they influence the best choice for the exchange rate regime. For example, Lipschitz, Lane and Mourmouras (2000) mention the moral hazard argument related to pegged exchange rate systems. This argument became popular after the Asian crisis. A pegged system might mislead investors to neglect the risks of possible exchange rate changes. It could create a false sense of security so that cross border investments are based on the assumption that the central bank will keep the exchange rate fixed forever. A peg could thus increase financial fragility.

On the other hand, a peg imposes constraints on the behaviour of fiscal authorities. These include strict limits to monetary financing (thereby directly strengthening central bank independence) and a concern about sustainability of the external balance of the economy. These considerations imply controls on excessive deficit spending as long as maintaining the peg takes precedence. Thus a more fixed exchange rate regime could be a useful tool to discipline profligate governments. Moreover, fixed exchange rates imply that domestic adjustment will have to take place through domestic prices and wages. Therefore it may make the case for labour and product market flexibility more apparent.

There is a downside risk to such a strategy. In case the disciplinary effect fails to lead to the necessary reforms or adjustments, the exchange rate regime will not be sustainable. Depending on the orderliness of the exit, the false judgement concerning the effectiveness of the disciplinary incentives might result in tears.

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[29] See Rich (1997, p. 132).

[30] Calvo (2001) makes this point explicitly referring to inflation targeting versus more fixed exchange rate regimes.

4.4 Communication

Depending on the individual history of a country it can make a difference whether the monetary policy strategy is communicated in terms of domestic price stability objectives or in terms of exchange rate targets. The final goal might always be price stability and as we have argued above if the economy is open enough it might not make a huge difference for actual monetary policy. The path dependency of optimal communication depends on the history of successful and failed monetary regime experiences and whether threats of inflation or currency depreciation (or money growth for this sake) are better able to trigger public support for monetary tightening and anchor expectations of low and stable inflation.

5. CONCLUSIONS

We have used a basic, new neo-classical synthesis, open economy model to show that the free floating exchange rate regime of a price stability oriented, small open economy with perfect capital mobility can easily appear observationally equivalent to a managed floating or even more intermediate exchange rate regime. Within this framework, the degree of resemblance will depend on the shocks and structure of the economy. In particular, a large real exchange rate elasticity of domestic demand and frequent shocks to the risk premium, as well as - under certain conditions - cost-push shocks will produce a strong but spurious resemblance to a managed floating regime. Nothing in the price stability oriented behaviour of the central bank is motivated by fear (of floating). The analysis confirms that exchange rate regimes at the flexible end are notoriously difficult to identify as has been pointed out by Clarida (2001), Calvo and Reinhart (2002) and Edwards (2002). We also show that with price stability oriented monetary policy and white noise shocks to the risk premium, uncovered interest parity will be wrongly rejected in standard UIP test regressions. In our model the size of the bias in the test regressions will positively depend on the ratio of the interest rate to the exchange rate elasticity of domestic demand. This latter is the equivalent to McCallum's (1994) result for a managed floating cum interest rate smoothing central bank for an independent floating, price stability oriented central bank.

The feasibility of using a domestic anchor for monetary policy is subject to a few caveats. There can be issues of credibility, communication strategy, specific informational requirements and regime dependent endogenous structural changes, leading to a situation in which the operation of the monetary policy strategy with an external anchor, like the exchange rate, could be helpful to attain the final objective of the central bank, which is price stability.

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