# Reply to Referee Report #2 on Economics MS 764
Guillermo J. Escudé, Central Bank of Argentina

I thank my second anonymous referee for evaluating my paper. After describing its content and stating that it "makes an important contribution to the literature on modeling monetary policy in emerging markets" she/he discusses 5 issues. I address each of these issues below. I place all the Referee's comments in italics.

## 1. The 5 issues

**1.1. Economic intuition.** *The paper would benefit from providing additional economic intuition on the reasons behind the superiority of the managed exchange rate regime... The two instruments/policy rules can help tackle both distortions through different channels. The interest rate rule helps address issues with nominal rigidities, through the standard interest rate channel of monetary policy. The exchange rate rule, on the other hand, helps partially insulate the economy against external shocks through the endogenous risk premium.*

I agree that one can view the interest rate rule as basically addressing nominal rigidity and the exchange rate depreciation rule as basically addressing the external sector, including here both trade in assets and goods. Each of them has a more direct impact on one of the two most important relative prices in any open economy model: the real interest rate and the real exchange rate, respectively. But the fact that the model is quite rich and there are so many possible cases makes it difficult to present clear cut intuitions on why the use of two simultaneous rules is normally to be preferred in terms of diminishing an ad hoc policymaker loss function. I think that Table 18 and the illustration in section 4 in general point strongly to the fact that whenever the endogenous risk premium is sufficiently elastic policymakers have leverage on capital flows, and can hence influence them to suit their purposes. Such changes in household foreign debt are a particular case of more general portfolio shifts. The paper shows that, even in a linearized DSGE model such policy-induced portfolio shifts can be easily represented in the case of a small open economy. A more general portfolio model would need higher than first order approximations for obtaining solutions. In Escudé (2007) and Escudé (2009), it was banks that changed the level and composition of their liabilities, through the deposit vs. foreign debt funding of their domestic loans. Below I try to obtain some further intuition using IRFs.

*The exchange rate rule, on the other hand, helps partially insulate the economy against external shocks through the endogenous risk premium. The latter mechanism is simple: an increase in reserve accumulation—that keeps the interest rate constant, ceteris paribus —initially results in an offsetting decrease in the private sector's net foreign assets.*

Naturally, in general equilibrium there is no way of implementing the *ceteris paribus* assumption. And the existence of a policy rule that has the nominal interest rate as an operational target does not imply that the interest rate is kept constant. To gain some intuition on what the second policy rule may add to the traditional interest rate rule, I show below, for each of the 4 most significant shocks in the model, the IRFs for a FER regime where the interest rate rule responds only to the lagged interest rate and inflation (with nonzero coefficients $h_0 = 0.2$, $h_1 = 1.2$) and for a MER regime that adds to this rule a nominal rate of depreciation rule that responds only to the lagged depreciation, GDP ($Y$), and the CB's reserves ratio

($\gamma^R$) (with nonzero coefficients $k_0 = 0.2$, $k_2 = -0.5$, $k_4 = -0.02$). A new variable has been defined to capture the response of the (size of the) CB's balance sheet: $CBbalsheet = e * r$ $(= m + b)$. In log deviations from the non-stochastic steady state (NSS) the two policy rules are:

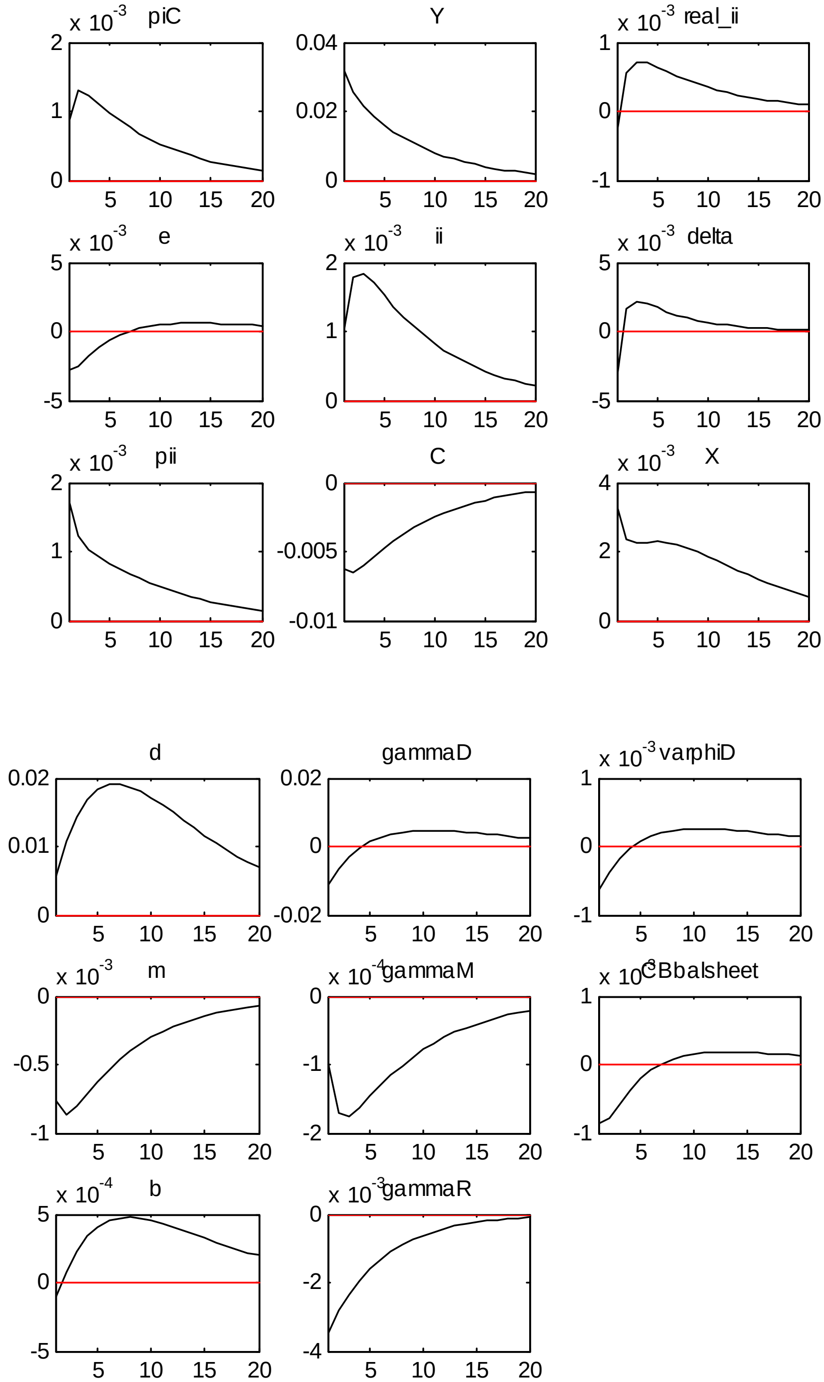
$$\begin{aligned} \widehat{i}_t &= 0.2\widehat{i}_{t-1} + 1.2\widehat{\pi}_t^C \\ \widehat{\delta}_t &= 0.2\widehat{\delta}_{t-1} - 0.5\widehat{Y}_t - 0.02\left(\widehat{r}_t + \widehat{e}_t - \widehat{Y}_t\right). \end{aligned}$$

Consider the case of a positive shock to $G$. Under the FER regime, the increase in government expenditure is expansionary and inflationary and generates real currency appreciation. Consumption is crowded out and falls, but the increase in government expenditures and in exports more than compensates. Households obtain funds abroad to avoid a further fall in consumption, also responding to the fall in the UIP risk premium (due to the fall in their debt ratio $\gamma^D = ed/Y$, since the fall in $e$ and the increase in $Y$ more than compensate for the increase in $d$). Under the MER regime, the shock is still expansionary and inflationary for domestic goods. However, it is less inflationary ($\pi$) and slightly less expansionary. The negative coefficient on GDP in the second rule makes the rate of nominal depreciation fall substantially (from 1.015 to around 1.005). This helps to generate a stronger initial real appreciation and makes the consumption inflation ($\pi^C$) fall on impact (and later increase less). This effect on $\pi^C$ makes the CB target a lower nominal interest rate, and hence the latter falls initially, making the expected real interest rate also fall initially and consumption fall less initially. The stronger initial real appreciation also makes exports fall initially. Notice the marked change in the dynamics of $d$, which on impact increases more then with the FER regime, allowing households to ameliorate their reduction in consumption taking advantage of the large reduction in the real interest rate. But already in the second quarter the household rapidly reduces its foreign debt, as the CB is by then selling reserves in order to induce the greater real currency appreciation. The role of the second policy rule is clearly stabilizing, at least for the most usual CB preferences (that target inflation or GDP).

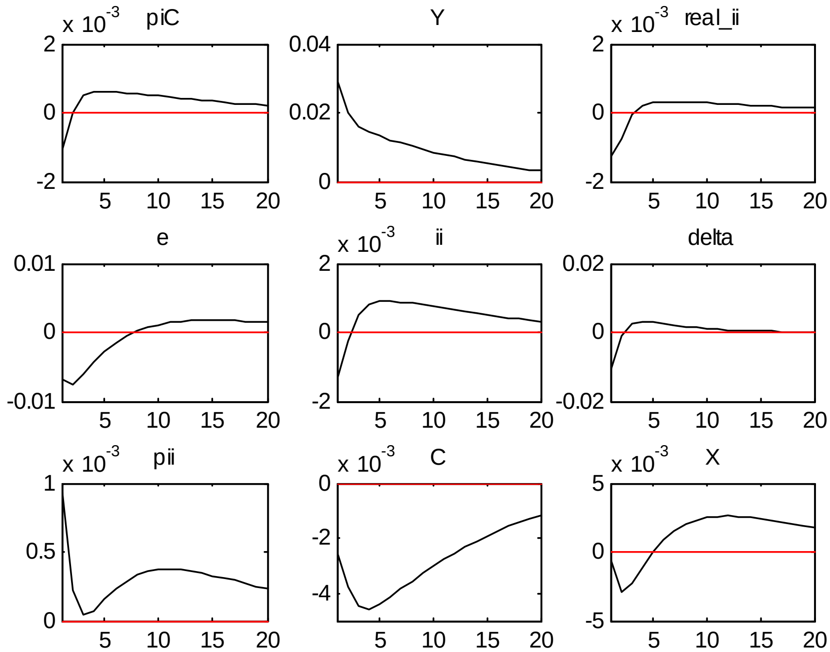
Under the FER regime, the negative shock to $\phi^*$ generates an exogenous availability of foreign funds that households take advantage of by increasing $d$. The capital inflow is deflationary and hence the action of the interest rate rule facilitates the reduction in the nominal interest rate on impact. The real interest rate falls even more because after the initial reduction in $\pi$ it is expected to increase. The inflow of funds also generates a real currency appreciation which reduces exports and GDP even though consumption increases.[1] In the MER regime the action of the nominal depreciation rule makes the CB initially purchase foreign reserves, which ameliorates the real appreciation, as well as the fall in exports and GDP. Households obtain a much greater quantity of funds abroad initially, when the CB is purchasing reserves. However, they quickly start to reduce their debt when the CB starts to sell reserves, overshooting the original (NSS) level. The action of the second rule hence reduces the impact and volatility of inflation, GDP and the RER.

[1] In the paper I have noted the lack realism in not having a lagged response of exports to the RER.

Positive shock to $G$
FER



MER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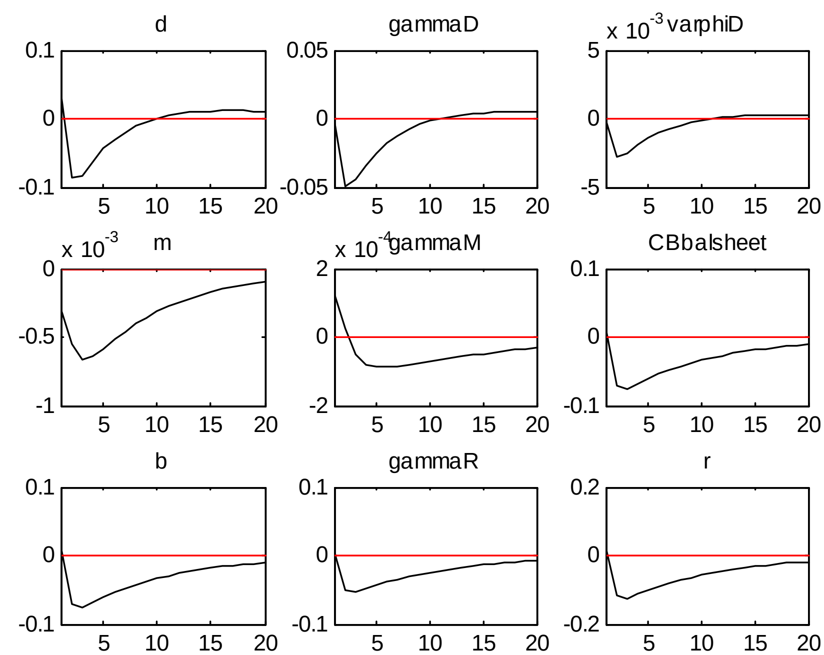
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Negative shock to $\phi^*$
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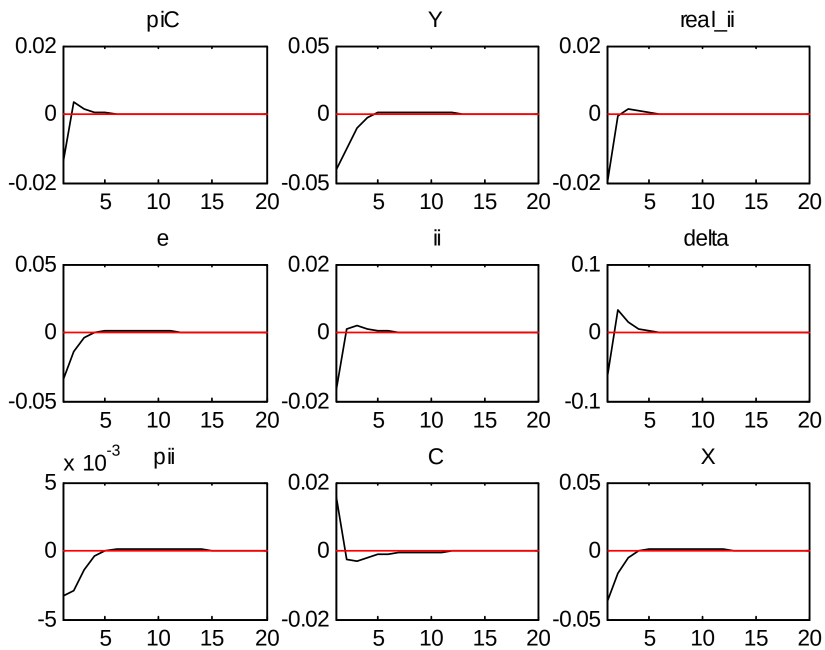
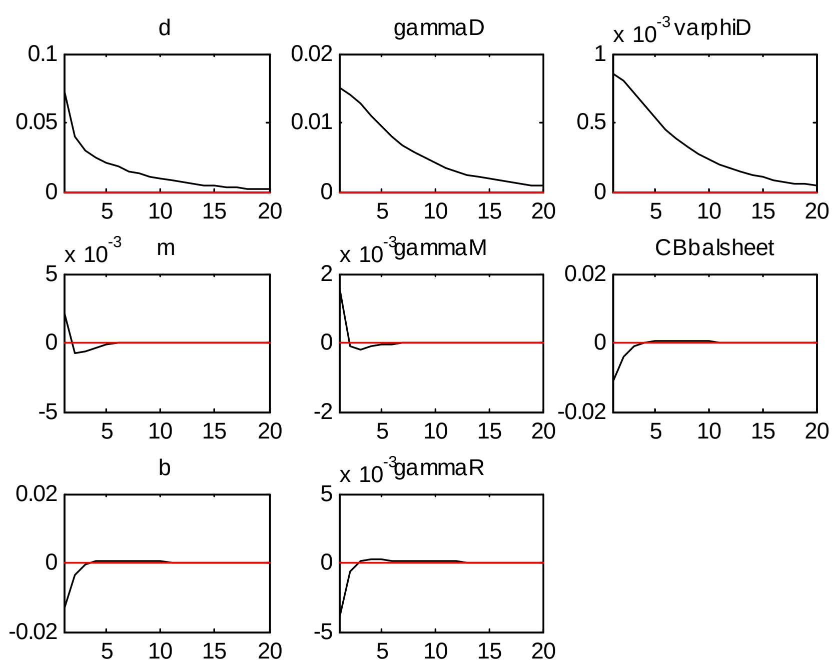
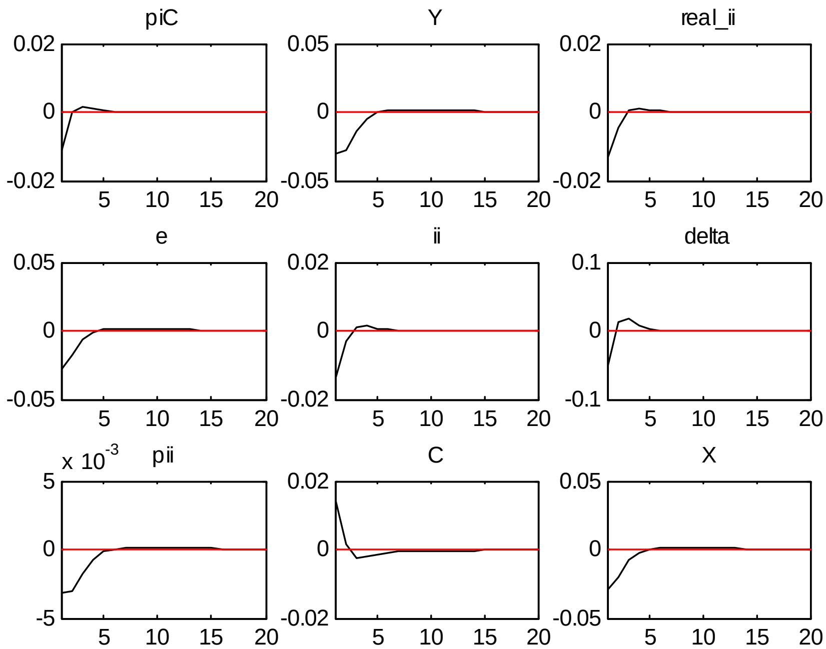


MER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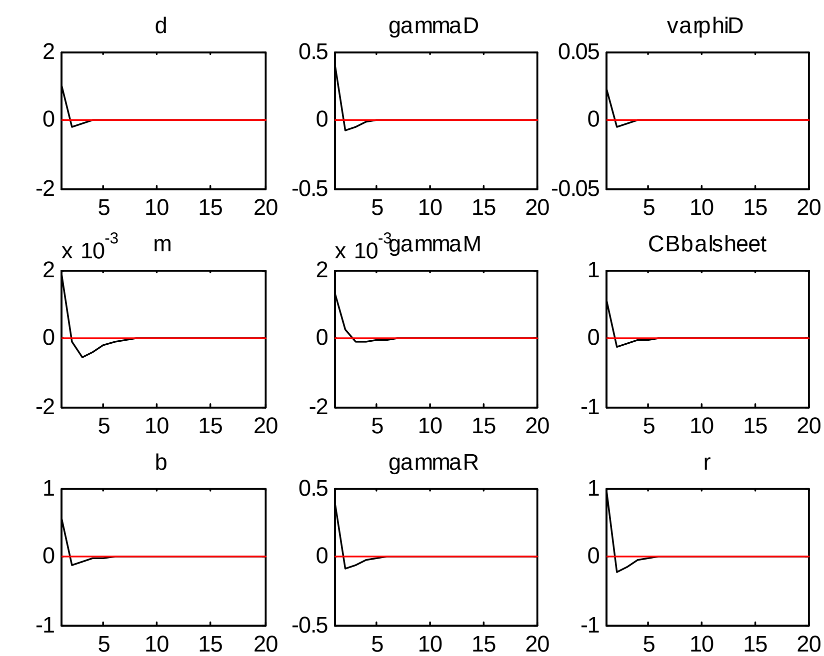
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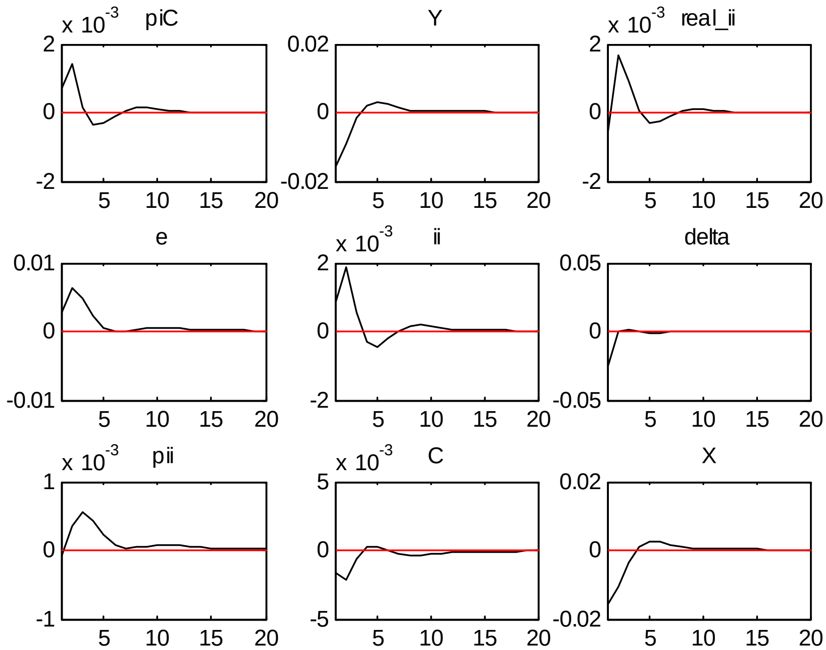
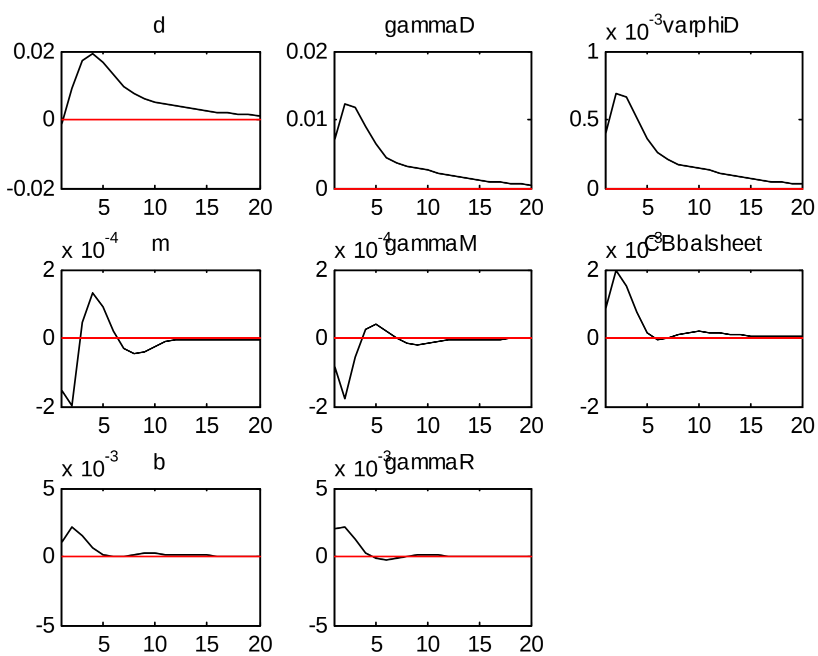
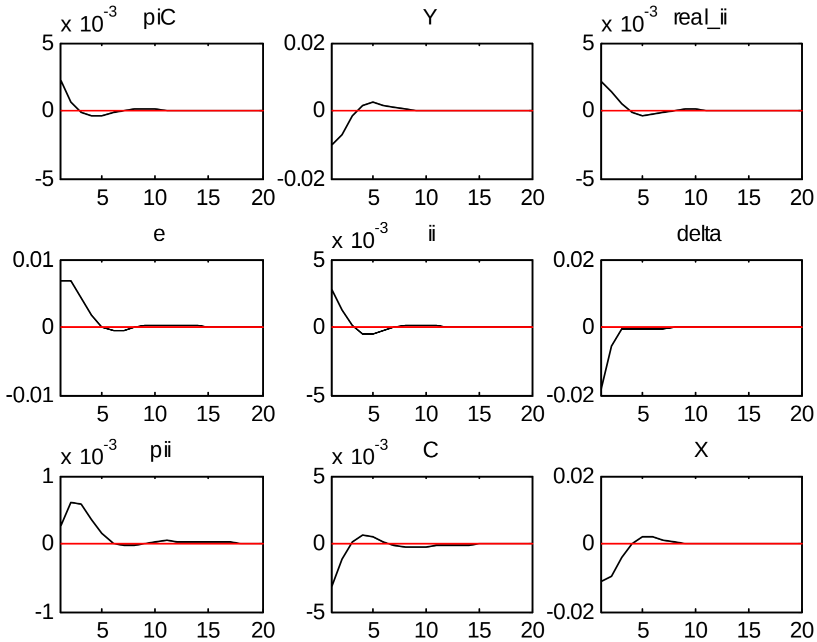
Positive shock to $\pi^*$

FER



MER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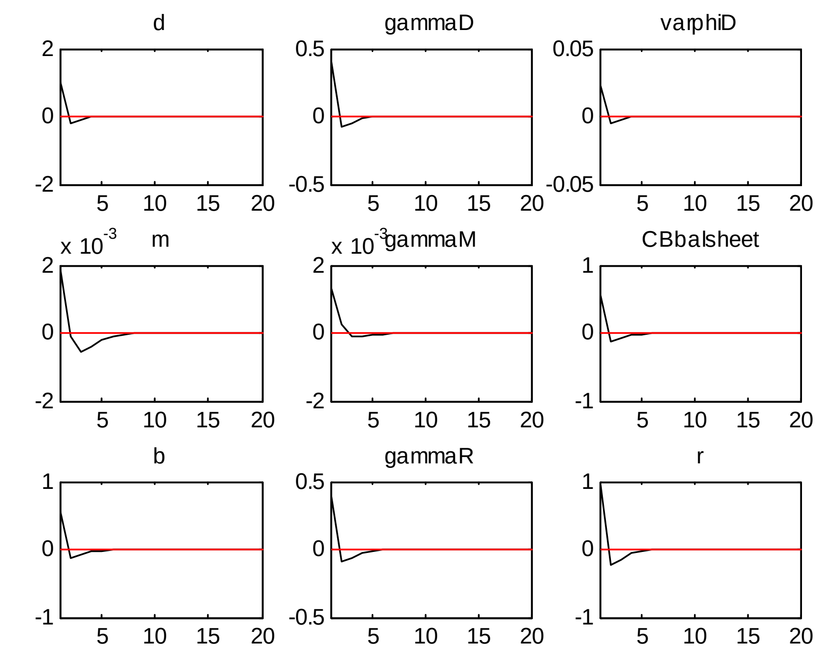
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Positive shock to $\pi^{*X}$
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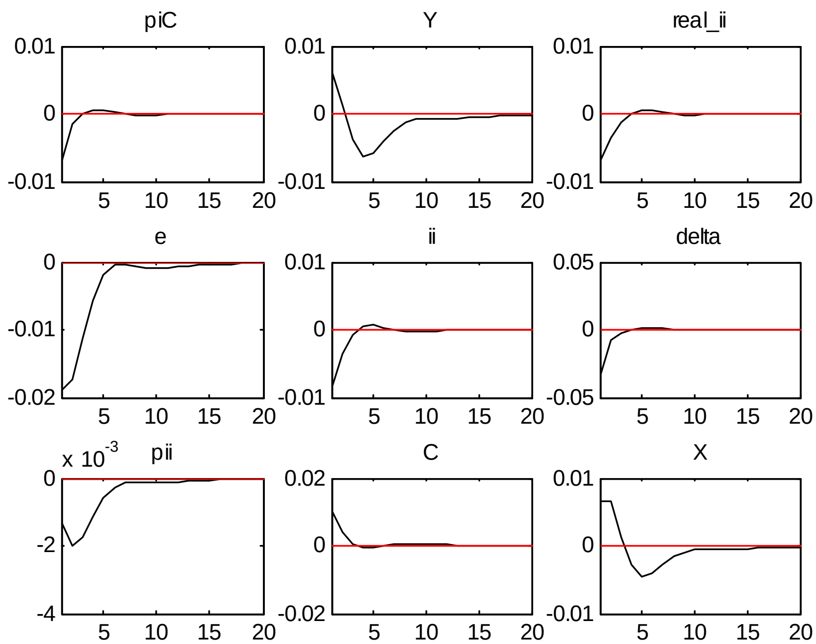
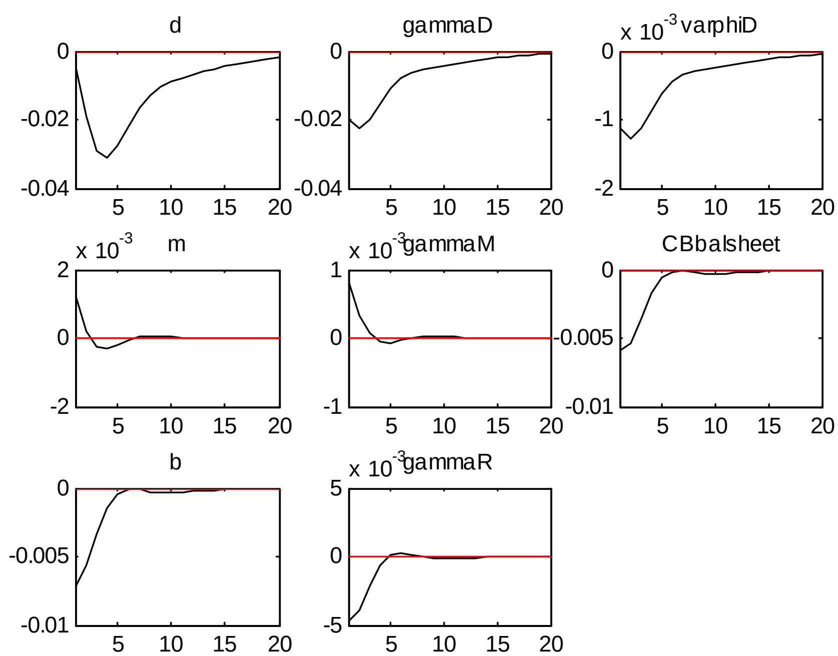
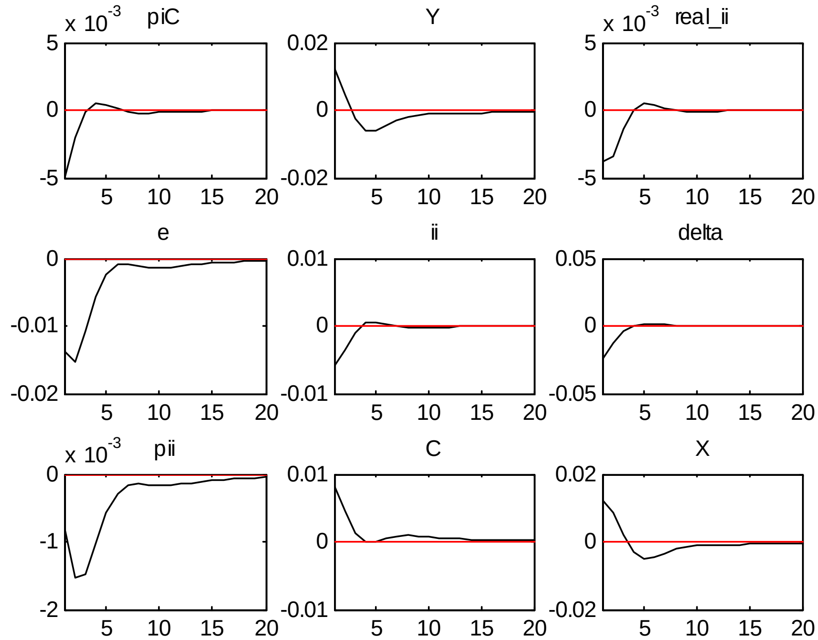


MER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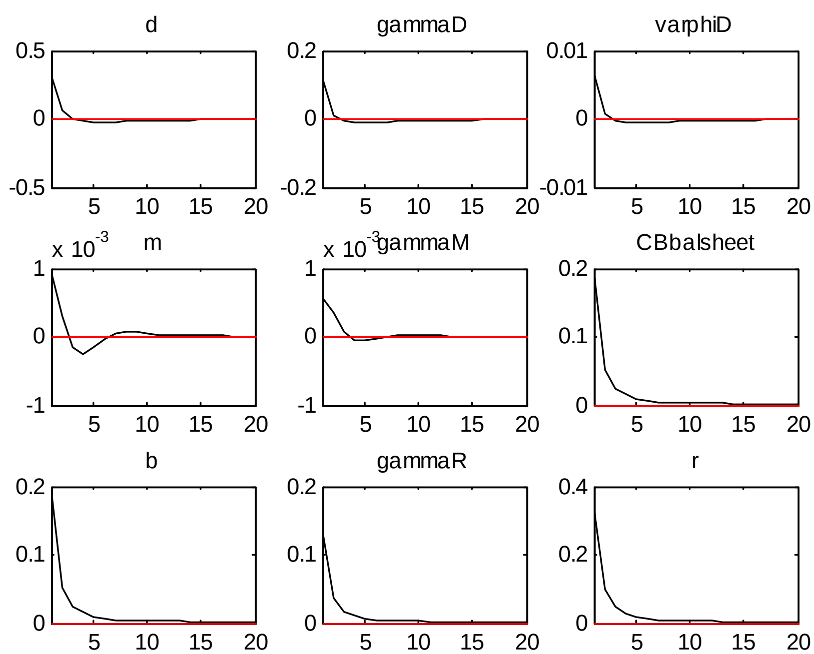
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The shock to imported goods inflation $\pi^*$ under a FER regime increases consumption inflation on impact, and generates nominal and real currency depreciation. Hence, consumption falls, dragging GDP with it. This makes exports fall, even though there is real depreciation. The CB, following its interest rate rule, increases the nominal interest rate. The fall in GDP makes the foreign debt ratio increase (even though the RER has increased) and hence the foreign currency interest rate households face when obtaining funds abroad also increases, which is consonant with the increased operational target for the domestic currency nominal interest rate. Households subsequently ameliorate their reduction in consumption by obtaining funds abroad. Under the MER regime, the second policy rule makes the CB purchase reserves on impact, generating a larger real depreciation. This makes exports and GDP fall less than in the FER regime and consumption fall more since there is greater inflation (for both domestic and imported goods) and the real interest rate rises on impact. Households now increase their foreign debt on impact (as the CB is purchasing reserves) but thereafter reduce it along with the CB's rapid reversal of its purchases. Hence, the use of the second rule makes the shock less recessionary, but it also makes it more inflationary and generate more real depreciation. Hence, in this case the MER regime should be favored over the FER regime whenever the CB cares more about stabilizing GDP than inflation or the RER.

Finally, a shock to exported goods inflation $\pi^{*X}$ boosts exports and generates nominal and real appreciation. Inflation falls on impact, boosting consumption and GDP, the increase in consumption being facilitated by the reduction in the target nominal interest rate (which makes the real interest rate fall). Under the MER regime, the action of the second policy rule makes the CB purchase reserves to obtain a lower reduction in the rate of nominal depreciation, which yields a lower real appreciation. Consequently, the shock is less deflationary, more expansionary and generates less real appreciation. Hence the MER regimes should be favored over the FER regime for CB preferences that care more for stabilizing inflation and the RER than stabilizing GDP.

*The strength of this separate channel depends on the debt elasticity of the risk premium, which the paper analyzes in section 4. These issues may be driving some of the results in different parts of the paper. For example, this dichotomy could help explain why reducing nominal rigidities makes the pegged regime closer to the managed float: each would be influencing the only distortion left (the international financial asset market structure). However, they would become clearer if the paper focused exclusively on a utility-based analysis.*

First, I see no need to think in terms of a 'dichotomy'. The two policy rules are complementary and strongly interact with other model equations. The CB can usually achieve better results when it uses both than in any of the two extremes (of the FER and PER regimes). Second, notice that it does not follow from Table 17 that '*reducing nominal rigidities makes the pegged regime closer to the managed float*'. The degree of nominal rigidity that makes the PER regime closest to the MER regime is very dependent on CB preferences. For style A the PER regime is closest to the MER regime when we have the highest alpha shown in the table (0.9), but for style B is comes with alpha=0.3 and for styles C and D with alpha=0.1. Third, as I stated in the reply to the first referee, a utility-based analysis would be a welcome complement, but makes a strong assumption on the preferences of policymakers (and on the strength of their belief on the model's adequacy with respect to distributive issues).

**1.2. The mechanism through which sterilized interventions work.** *A limitation of the paper is that the channel through which sterilized interventions work, the existence of a private debt sensitive risk premium is not analyzed in greater detail. First, if the debt premium was modeled as depending on the country's overall net foreign assets (private plus public), which is perfectly feasible, then sterilized interventions would not work, and there would be no difference between a managed exchange rate regime and a flexible one.*

Introducing a second variable in the endogenous risk premium naturally affects the model. But notice that if I simply substitute $\tau_D\left(\gamma_t^D\right)$ for $\tau_D\left(\gamma_t^D - \gamma_t^R\right)$ then the risk premium in the UIP condition becomes

$$\varphi_D\left(\gamma_t^D, \gamma_t^R\right) = 1 + \frac{\alpha_1\left(1 + \alpha_2\gamma_t^R\right)}{\left[1 - \alpha_2\left(\gamma_t^D - \gamma_t^R\right)\right]^2},$$

which is not simply dependent on $\gamma_t^D - \gamma_t^R$. Hence, if any change in $\gamma_t^D$ where to be met by a corresponding change in $\gamma_t^R$ the UIP would still be affected. This is due to the fact that the CB's international reserves is not a decision variable for the household and it is the latter's utility maximization that achieves the transformation of $\tau_D$ to $\varphi_D$.

To address this more generally I have, first, made a more moderate (i.e., lower) calibration of the elasticity of the endogenous risk premium with respect to the foreign debt ratio. This is basically to show that my results hold even with moderate elasticities. Second, I modified the functional form so that the risk premium is negatively dependent on the CB's level of international reserves. Defining

$$\overline{\tau}_D\left(\gamma_t^D, \gamma_t^R\right) \equiv \frac{\alpha_1}{1 - \alpha_2\gamma_t^D + \alpha_3\gamma_t^R}, \qquad \alpha_1, \alpha_2, > 0, \alpha_3 \geq 0.$$

the special case we had so far is $\alpha_3 = 0$. Now we have two partial elasticities:[2]

$$\begin{aligned} \varepsilon_{\overline{\tau}_{D,1}} &= \frac{\alpha_2\gamma^D}{1 - \alpha_2\gamma^D + \alpha_3\gamma^R} \\ \varepsilon_{\overline{\tau}_{D,2}} &= \frac{-\alpha_3\gamma^R}{1 - \alpha_2\gamma_t^D + \alpha_3\gamma_t^R}. \end{aligned}$$

This yields:

$$\varphi_D\left(\gamma_t^D, \gamma_t^R\right) = 1 + \frac{\alpha_1\left(1 + \alpha_3\gamma_t^R\right)}{\left(1 - \alpha_2\gamma_t^D + \alpha_3\gamma_t^R\right)^2}.$$

[2]Notice that I am not using the Marshallian convention that makes the elasticies always positive.

We can calibrate the alphas by expressing them in terms of the (calibrated) elasticities and other NSS values of variables:[3]

$$\begin{aligned}
\alpha_1 &= \frac{\left(\frac{1}{\beta\phi^*(1+i^*)}-1\right)}{\left(1+\varepsilon_{\overline{\tau}_{D,1}}+\varepsilon_{\overline{\tau}_{D,2}}\right)\left(1+\varepsilon_{\overline{\tau}_{D,1}}\right)} \\
\alpha_2 &= \frac{1}{\gamma^D}\frac{\varepsilon_{\overline{\tau}_{D,1}}}{1+\varepsilon_{\overline{\tau}_{D,1}}+\varepsilon_{\overline{\tau}_{D,2}}} \\
\alpha_3 &= \frac{1}{\gamma^R}\frac{-\varepsilon_{\overline{\tau}_{D,2}}}{1+\varepsilon_{\overline{\tau}_{D,1}}+\varepsilon_{\overline{\tau}_{D,2}}}.
\end{aligned}$$

In the Dynare code, $\varepsilon_{\overline{\tau}_{D,i}}$ is ELASTtauBarD_i ($i = 1, 2$). The following table is equivalent to Table 18 in the paper (which was in terms of the elasticity of $\varphi$, i.e., $\varepsilon_D^{\varphi}$) but shows a more moderate range of values for $\varepsilon_{\overline{\tau}_{D,1}}$. It assumes $\varepsilon_{\overline{\tau}_{D,2}} = 0$. Naturally, the more moderate elasticities used give lower relative costs from using the extreme regimes but still shows that higher elasticities yield greater advantage to using both rules.

| SENSITIVITY OF LOSS TO DEBT RATIO ELASTICITY OF UIP UNDER OPTIMAL POLICY UNDER COMMITMENT (ELASTtauBarD_2=0) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STYLE | LOSS | | | | | | | | | | | | | | |
| | ELASTtauBarD_1=1 | | | ELASTtauBarD_1=5 | | | ELASTtauBarD_1=10 | | | ELASTtauBarD_1=15 | | | ELASTtauBarD_1=20 | | |
| | MER | FER | PER | MER | FER | PER | MER | FER | PER | MER | FER | PER | MER | FER | PER |
| A | 114.7 | 114.7 | 114.8 | 117.8 | 118.1 | 118.1 | 119.9 | 121.0 | 120.9 | 121.2 | 123.5 | 123.2 | 121.8 | 125.8 | 125.4 |
| B | 124.0 | 124.1 | 125.1 | 117.6 | 118.4 | 120.4 | 112.0 | 114.5 | 117.3 | 107.0 | 111.7 | 115.1 | 102.2 | 109.4 | 113.3 |
| C | 395.8 | 395.9 | 396.1 | 389.4 | 392.3 | 392.7 | 378.1 | 388.1 | 388.8 | 364.4 | 384.4 | 385.4 | 349.4 | 380.9 | 382.2 |
| D | 410.0 | 410.2 | 410.3 | 404.8 | 408.0 | 408.3 | 394.5 | 405.2 | 405.7 | 381.8 | 402.6 | 403.2 | 367.8 | 400.1 | 400.9 |
| | RELATIVE LOSS | | | | | | | | | | | | | | |
| A | | *1.0001* | 1.0010 | | *1.002* | 1.003 | | 1.009 | *1.008* | | 1.019 | *1.017* | | 1.032 | *1.029* |
| B | | *1.0006* | 1.0088 | | *1.007* | 1.024 | | *1.023* | 1.047 | | *1.044* | 1.076 | | *1.070* | 1.109 |
| C | | *1.0004* | 1.0008 | | *1.007* | 1.009 | | *1.027* | 1.028 | | *1.055* | 1.058 | | *1.090* | 1.094 |
| D | | *1.0005* | 1.0008 | | *1.008* | 1.009 | | *1.027* | 1.028 | | *1.054* | 1.056 | | *1.088* | 1.090 |

We can easily obtain the conditions under which $\alpha_2$ and $\alpha_3$ are equal:

$$\alpha_2 = \alpha_3 <=> \frac{\varepsilon_{\overline{\tau}_{D,1}}}{\gamma^D} = \frac{-\varepsilon_{\overline{\tau}_{D,2}}}{\gamma^R} <=> -\varepsilon_{\overline{\tau}_{D,2}} = \frac{\gamma^R}{\gamma^D}\varepsilon_{\overline{\tau}_{D,1}} = \frac{0.13}{0.5}\varepsilon_{\overline{\tau}_{D,1}} = 0.26\varepsilon_{\overline{\tau}_{D,1}}.$$

Hence, if, say, $\varepsilon_{\overline{\tau}_{D,1}} = 10$, then $-\varepsilon_{\overline{\tau}_{D,2}} = 2.6$. In the following table I take the central set of columns from the table above and make different assumptions with respect to $\varepsilon_{\overline{\tau}_{D,2}}$.

| SENSITIVITY OF LOSS TO RESERVES ELASTICITY OF RISK PREMIUM UNDER OPTIMAL POLICY UNDER COMMITMENT (ELASTtauBarD_1=10) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STYLE | LOSS | | | | | | | | | | | | | | |
| | ELASTtauBarD_2=0; | | | ELASTtauBarD_2=-2.6; | | | ELASTtauBarD_2=-3.33; | | | ELASTtauBarD_2=-6.66; | | | ELASTtauBarD_2=-10; | | |
| | MER | FER | PER | MER | FER | PER | MER | FER | PER | MER | FER | PER | MER | FER | PER |
| A | 119.9 | 121.0 | 120.9 | 120.207 | 120.210 | 120.31 | 119.95 | 120.00 | 120.15 | 117.2 | 119.1 | 119.4 | 112.6 | 118.2 | 118.7 |
| B | 112.0 | 114.5 | 117.3 | 114.3 | 114.3 | 115.2 | 114.1 | 114.3 | 114.6 | 109.2 | 114.0 | 112.0 | 99.6 | 113.7 | 109.4 |
| C | 378.1 | 388.1 | 388.8 | 387.1 | 387.1 | 387.3 | 386.3 | 386.8 | 386.9 | 366.7 | 385.6 | 384.9 | 331.8 | 384.3 | 382.9 |
| D | 394.5 | 405.2 | 405.7 | 404.0 | 404.1 | 404.2 | 403.2 | 403.7 | 403.8 | 382.4 | 402.3 | 402.0 | 348.5 | 400.8 | 400.1 |
| | RELATIVE LOSS | | | | | | | | | | | | | | |
| A | | 1.0086 | *1.0079* | | *1.00002* | 1.00088 | | *1.0004* | 1.0017 | | *1.016* | 1.019 | | *1.049* | 1.054 |
| B | | *1.0226* | 1.0472 | | *1.0001* | 1.0079 | | 1.0010 | *1.0044* | | 1.044 | *1.026* | | 1.141 | *1.099* |
| C | | *1.0266* | 1.0284 | | *1.0001* | 1.0005 | | 1.0013 | *1.0013* | | 1.052 | *1.050* | | 1.158 | *1.154* |
| D | | *1.0272* | 1.0283 | | *1.0001* | 1.0005 | | 1.0013 | *1.0015* | | 1.052 | *1.051* | | 1.150 | *1.148* |

The second set of columns shows that $-\varepsilon_{\overline{\tau}_{D,2}} = 2.6$ gives the lowest relative advantage of the MER regime (among those shown), but it is still positive. Both lower and higher values of $-\varepsilon_{\overline{\tau}_{D,2}}$ give higher advantages for using the two policy rules. The actual values of these elasticities (and the actual functional form of the endogenous risk premium) is of course an empirical question in any concrete case.

[3] As in the paper, the first expression makes use of the NSS UIP equation.

The point is that the presence of the CB's international reserves in the risk premium does not invalidate my results. But thanks to the referee having raised this issue I now have a richer model. The IRFs shown above were obtained using the present more general functional form with calibrations $\varepsilon_{\overline{\tau}_{D,1}} = 10$ and $\varepsilon_{\overline{\tau}_{D,2}} = 0$.

*The introduction of debt sensitive risk premium in the macro literature was a technical solution to the problem of lack of a unique steady state in open economy models (and the presence of a unit root in consumption and net foreign assets). The fact that this premium matters for sterilized interventions is a fortunate coincidence but that was not its original purpose.*

The use of a debt sensitive risk premium in open economy models goes back to at least the early 80s (See Bhandari, Turnovsly and Ul Haq (1990) and the papers there cited). And its use was based in its realism, since it has long been noted and accepted as a well established empirical fact, although various other variables also affect the interest rate spreads. Theoretically, but not within the open economy context, it goes back at least to Kalecki (1937), who says that 'the entrepreneur who has invested in equipment his reserves (cash, deposits, securities) and taken "too much credit" is obliged to borrow at a rate of interest which is higher than the market one' and attributes this to 'the danger of "illiquidity."' The fact that the debt-elastic risk premium also avoids the "unit root problem" is of value for DSGE model practitioners but not necessarily the principal reason for its widespread use. As Schmitt-Grohe and Uribe (2003) note, other closures of the SOE model are available to eliminate the unit root (such as portfolio adjustment costs or Uzawa preferences).

*The paper would benefit from discussing in greater detail what this endogenous premium is meant to represent. In Berg et al (2013), for example, sterilized interventions affect the economy through balance sheet effects in the financial sector, even though the debt sensitive risk premium affecting consumer optimization depends on the country's overall net foreign asset position (and therefore does not provide a channel for sterilized interventions).*

What the endogenous risk premium represents should be perfectly clear, since it is a well established fact, theoretically reasonable, and one of the typical ways of closing SOE models in which the fiction of a complete set of financial markets is absent.

Berg et al (2013) use a model where there is no money and (since the CB net worth is also assumed to be zero) the value of domestic currency bonds is always equal to the value of CB international reserves. Introducing money, even if it is merely cash as in my paper, allows for a much richer analysis, including the very concept of 'sterilization' (of presumably unwanted monetary effects due to both domestic currency bond and foreign exchange market interventions). Berg et al (2013) define *sterilized* interventions as exchange rate interventions that keep market interest rates unchanged, hence allowing them to represent sterilized intervention in a model with no money. Notice that when the CB has the means to impose an operational target for the interest rate it does not in general keep the interest rate constant but changes it responding to certain endogenous variables. The same holds when it has two operational targets, one of which is related to the exchange rate. We can only model the sterilization that is needed to ensure money market equilibrium taking into account the use of the two instruments the CB uses. In my models these two instruments are linked through the CB balance sheet (where the quasi-fiscal surplus (deficit) has been given up to (financed by) the Treasury. Hence, as modelers there is no need to think in terms of sterilized intervention, which implicitly gives primacy to interest rate policy and gives exchange rate policy a subordinate role. Money market balance must be achieved in any case, as well as the various accounting identities the model may have. Sterilized intervention in the foreign exchange market is just a way of thinking about the issues to which economists have generally become used to in a world that has for decades vilified exchange rate policy and hailed inflation targeting with freely floating exchange rates, but really adds nothing to our model. I think this justifies applying Occam's razor and shelving the concept, at least in the modeling domain.

Finally, Berg et al (2013) introduce two exogenous premia, one for households' loan adjustment costs (that depends on the real volume of domestic loans) and another for bank arbitrage relationships (that depends on the real value of CB reserves). In Escudé (2007) I obtained analogous results in a complete DSGE model through the risk premium banks faced when obtaining funds abroad and their quadratic cost function (that depended on their deposit and loan activities). In the present paper I eliminate banks and obtain analogous results with only household foreign debt but, as in Escudé (2009), I proceed to welfare analysis.

**1.3. Robustness to individual shocks.** *The paper would also benefit from understanding how the ranking of policy regimes depends on the type of shock, especially in the context of the utility-based assessment. Is the superiority of the managed regime robust to any of the shocks taken separately?*

To address this issue, I completed the following table, which focuses on the base case I am now using and takes the shocks one by one, with the same standard deviations used in the paper (leaving out in the table the foreign interest rate shock, which is least significant in magnitude and in any variance decomposition has very low figures).

| LOSSES FOR INDIVIDUAL SHOCKS (ELASTtauBarD=10) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STYLE | LOSS | | | | | | | | | | | | | | |
| | epsilon | | | G | | | phiStar | | | piStar | | | piStarX | | |
| | MER | FER | PER | MER | FER | PER | MER | FER | PER | MER | FER | PER | MER | FER | PER |
| A | 103.4 | 104.0 | 104.1 | 103.7 | 104.3 | 104.5 | 116.5 | 117.5 | 117.5 | 104.6 | 105.2 | 105.3 | 104.9 | 105.5 | 105.6 |
| B | 88.5 | 90.4 | 93.2 | 90.7 | 92.5 | 95.5 | 104.1 | 106.4 | 109.1 | 89.1 | 91.0 | 93.8 | 93.3 | 95.2 | 98.0 |
| C | 333.7 | 342.0 | 343.2 | 344.5 | 353.0 | 354.3 | 355.8 | 365.3 | 366.1 | 334.8 | 343.2 | 344.4 | 341.0 | 349.6 | 350.7 |
| D | 337.5 | 345.2 | 346.3 | 349.3 | 357.3 | 358.4 | 363.3 | 372.6 | 373.2 | 340.2 | 347.9 | 348.9 | 351.2 | 359.8 | 360.6 |
| | RELATIVE LOSS | | | | | | | | | | | | | | |
| A | | *1.006* | 1.007 | | *1.006* | 1.007 | | 1.009 | *1.008* | | *1.006* | 1.007 | | *1.006* | 1.007 |
| B | | *1.021* | 1.053 | | *1.021* | 1.053 | | *1.023* | 1.049 | | *1.021* | 1.053 | | *1.021* | 1.051 |
| C | | *1.025* | 1.029 | | *1.025* | 1.028 | | *1.027* | 1.029 | | *1.025* | 1.029 | | *1.025* | 1.028 |
| D | | *1.023* | 1.026 | | *1.023* | 1.026 | | *1.026* | 1.027 | | *1.022* | 1.026 | | *1.024* | 1.027 |

The table shows that the superiority of the MER regime is robust to any of the shocks taken separately. It also shows that with only one exception, the (ramsey-optimal) pure float is superior to the (ramsey-optimal) pure peg for any of the individual shocks and CB preferences. The one exception is the case of the shock to the exogenous risk/liquidity premium $\phi^*$ under CB style A (in which only inflation matters). It is to be noted that when we have all the shocks together (as in the central set of columns in the first table above) the pattern of this one exception is repeated, which points to the importance of the risk/liquidity shock in the overall model.

**1.4. Policy implications.** The referee gives a number of reasons for which it may not be '*straightforward to run a managed float*': '*First, the paper does not* *analyze shocks with permanent effects on the terms of trade or the real exchange rate. Such shocks can easily lead to policy inconsistencies: by trying to target an overvalued or undervalued rate the central bank may end up either running out of reserves or endlessly accumulating reserves, to the point where the cost of carrying these may become an issue. Second, depending on how the central bank designs its intervention rule it may expose itself to speculative attacks. This is less likely to be the case if it simply leans against the wind than if it targets an exchange rate level (as in Berg et al (2013)). More generally, there are limits to how many reserves a central bank may be willing/able to sell (the stock out problem).*

As far as I know, the optimal policy under commitment can only be calculated using Dynare starting at the non-stochastic steady state (NSS). Hence, I cannot have a change in the steady state. In Escudé (2009), however, I laboriously calculated the optimal policy under commitment using a quite larger model and only MATLAB for the computations. With that setup, one can assume a starting point that is not the (final) NSS and make the assumption that the initial point is the initial NSS. Hence, one could in principle analyze the effects of permanent shocks when one starts from an initial NSS. Note that with the methodology I use, in which the NSS real exchange rate is given by the level that makes the NSS current account zero, there is no possibility of '*trying to target an overvalued or undervalued rate*'. All the gaps in the quadratic ad hoc loss function are with respect to the NSS. Hence, the policymaker tries to diminish the fluctuations of certain target endogenous variables around their NSS values, with weights given by the CB styles I defined. Also, as noted in Woodford (2003), Appendix A.3, in a first order approximation the endogenous variables vary within a small neighborhood of the NSS. So if we have a sufficiently positive level of CB international reserves there should be only a minute probability of encountering the zero lower bound. In any case, this is definitely not a model to be used for representing an exchange crisis and only pretends to reflect a normal working environment.

*A third point is that in practice, the central bank may not be able to keep a clear distinction between instruments and objectives, and so they may end up giving up on interest rate policy out of concern for their exchange rate implications. Unlike the analysis in the paper, a clear hierarchy between what comes first and what comes after is key.*

Notice that there is no targeting of the exchange rate *level* in my paper (as there is in Berg et al (2013)). In any of the possible policy setups in which there is an exchange rate policy (MER or PER), it is the rate of nominal depreciation that is taken as an intermediate target (or control, in the optimal control framework). The NSS rate of nominal depreciation is simply the inflation target divided by the NSS imported goods inflation. Hence, any long run inflation target defines a corresponding rate of nominal depreciation target (and viceversa). I show that it is always better to use both policies (nominal interest rate and nominal currency depreciation rate). Obviously, in any actual situation the additional cost of refraining from using an exchange rate policy may be low and hence may not justify the (ignored) costs of implementation. However, in many actual situations the additional cost due to allowing a free float may be considerable. And the opposite case is also feasible: in any actual situation the additional cost of refraining from using the interest rate policy may be low and it may be deemed desirable to not use it, relying on the nominal depreciation policy. One of the problems in many developing countries is that policymakers often try to maintain policies that are not sustainable, like trying to defend a level of the exchange rate that is not compatible with other policies (except maybe in the very short run). This is one of the reasons I would refrain from a model in which the level of the nominal exchange rate is targeted. But if it is the nominal rate of depreciation that is targeted there should be no difficulty in obtaining a consistent policy model.

**1.5. Smaller comments.** *There is an inconsistency between the description of the export sector on page 17 (where it is stated that its production uses land) and the production function in equation (22), where production depends on GDP instead.*

This is true and I will correct it. There was a previous version in which the export sector output only had domestic output as input, with $0 < b^A < 1$. Hence, a non-produced input such as 'land' could justify the decreasing returns. In the new version I found that the specification in which GDP also entered the production function simplified some of the algebra.

## 2. References

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