Federal Reserve Bank of New York
Staff Reports

News Shocks, Monetary Policy, and Foreign Currency Positions

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Staff Report No. 750
December 2015

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JEL classification: F31, F41

Abstract

Over the past two decades, before the global financial crisis, there was a rapid rise in the size of gross external portfolio positions as well as a decrease in the net negative foreign currency exposure in external balance sheets. In this paper, we present a theoretical model in which these portfolio facts can be explained by changes in monetary policy rules and the composition of shocks that underlie economic fluctuations. We find that policies with a strong emphasis on price stability would imply shorter positions in foreign currency when the dominant sources of fluctuations are supply shocks. The model suggests that longer and larger foreign currency positions, as observed in the data, would be consistent with a world in which central banks are more committed to price stability, and that changes in economic conditions come mainly from demand shocks. Moreover, in this case, a move toward flexible exchange rate regimes would also imply larger equilibrium portfolios and these would be tilted toward foreign assets.

Key words: portfolio choice, international transmission of shocks, monetary policy

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1 Introduction

Over the past decades, international financial markets have become increasingly integrated. This process of financial globalization is reflected in the rapid expansion of the external balance sheets of countries which records cross-border ownership of assets and liabilities (see Lane and Milesi-Ferretti, 2006). The foreign currency exposure data compiled by Lane and Shambaugh (2010a) shows that holdings of assets denominated in foreign currency have increased over the past couple of decades both in emerging and advanced countries. In this paper we show how an increased focus in price stability in a news-driven business cycle model can explain a shift towards positive foreign currency exposure in international portfolios.

We lay out a simple two-country model in which countries can choose their holding of domestic currency denominated bonds and foreign currency denominated bonds.[1] International portfolios are chosen depending on how currencies co-move with income – a hedging motive shown to be empirically important by Lane and Shambaugh (2010b). In a typical macroeconomic model, this co-movement will depend critically on the way central banks set policy. So, in our analysis, we inspect the implication of a move towards monetary policy rules with stronger emphasis on price stability – a feature ratified by the empirical evidence over the past decades (Clarida, Gali, and Gertler (2000) and Bianchi (2012)) – and evaluate the role of different levels of exchange rate flexibility.

One clear-cut conclusion coming from our analysis is that, in a world where macroeconomic fluctuations are driven by unanticipated changes in productivity, a larger commitment towards price stability by central banks would imply shorter - rather than longer - positions in foreign exchange. When central banks respond aggressively to movements in inflation generated by supply shocks, interest rates tend to be strongly counter-cyclical and so are the movements in the value of domestic currency. But if drops in income are accompanied by weak foreign currency relative to the domestic one, a long position in foreign exchange cannot be explained. Our findings are consistent with the ones shown in Devereux and Sutherland (2008) and Devereux, Senay, and Sutherland (2014). In a model where monetary policy is specified as a Taylor rule and economic fluctuations are mainly driven by unanticipated productivity shocks, Devereux and Sutherland (2008) find a negative position in foreign bonds. In addition, Devereux, Senay, and Sutherland (2014) show that monetary policy which reduces the variability of domestic inflation leads to an increase in the diversification of international portfolios, generating higher gross external assets and liabilities. But the equilibrium bond portfolio still generally point to counterfactual short positions in foreign currency.

The result highlighted above suggests that a productivity-driven business cycles model is at odds the empirical evidence on international portfolio positions. But many other empirical macroeconomic facts have challenged such models[2] and, as a result, the literature has been searching for sources of demand disturbances. In particular, a growing literature is now devoting its attention to shocks to future, rather than current, productivity (e.g. Danthine et

[1]Nominal bond portfolios have been analysed before by, among others, Devereux and Sutherland (2008), Engel and Matsumoto (2009), Devereux and Sutherland (2011), Benigno and Nisticò (2012), Coeurdacier and Gourinchas (2011) and Benigno and Küçük (2012).

[2]See Lorenzoni (2011) for a general discussion and a number of relevant references.

al. (1998), Beaudry and Portier (2004, 2006), Rebelo and Jaimovich (2009)). Bayesian analyses of business cycles appear to support the importance of demand driven macroeconomic fluctuations generated by these so-called news shocks (Schmitt-Grohe and Uribe (2012) and Fujiwara, Hirose, and Shintani (2011)). Findings in Devereux and Engel (2006) and Nam and Wang (2010) show how these shocks affect normative and positive (respectively) implications for movements in international relative prices. Opazo (2006), Fratzscher and Straub (2010), and Lambrias (2013) show how these shocks can help reconcile the empirical evidence of cross-country consumption differentials and the real exchange rate (i.e. the Backus-Smith Puzzle). The asset pricing literature have also highlighted the importance of such demand side shocks. An important result can be shown in Pavlova and Rigobon (2007), who find that demand shocks are twice as important as supply shocks in explaining exchange rate. Finally, Song (2014) finds empirical evidence that demand shocks have become increasingly important in explaining the US nominal term structure.

Our analysis suggests yet another area in which news shock contribute to a better understanding of economic facts. In our model, the introduction of news shocks critically improves the ability of the theoretical framework in explaining portfolio positions. As stressed above, shocks to agents' expectations about the future move demand. Price stability prescribes offsetting such moves with pro-cyclical, rather than counter-cyclical interest rates. The change in the cyclicality of rates in the face of demand shocks imply a corresponding change in the cyclicality of exchange rates and, hence, in the sign of foreign currency positions. Consequently, countries following inflation targeting regimes should have long positions in foreign currency and these should become longer as the focus on inflation stabilization increases. Also, as monetary policy moves towards a more flexible exchange rate regime, larger portfolio positions are necessary to hedge the larger fluctuations in international relative prices. Our theoretical results are shown both analytically and numerically.

2 The model

We develop a two-country open economy DSGE model with capital accumulation similar to Devereux, Senay and Sutherland (2014). Households maximize utility over infinite horizon and they can trade in home and foreign nominal bonds; one-period risk-free bonds that pay one unit of the currency they are issued in. All goods are tradable. The baseline model assumes sticky prices with export prices set in the currency of the destination market.

2.1 Households

The representative household in the home economy gets utility from consumption and real money holdings and disutility from work. The expected present discounted value of utility is given by:

$$U_t = E_t \sum_{s=t}^{\infty} \delta_s u\left(C_s, \frac{M_s}{P_s}, L_s\right) \tag{1}$$

with

$$u\left(C_s, \frac{M_s}{P_s}, L_s\right) = \frac{C_s^{1-\rho}}{1-\rho} + \chi \log\left(\frac{M_s}{P_s}\right) - K\frac{L_s^{1+\varpi}}{1+\varpi} \tag{2}$$

where $\rho > 0$, $\varpi > 0$ and $K > 0$. L denotes hours worked, C denotes consumption, $\frac{M}{P}$ denotes real money holdings[3]. The discount factor δ_s is determined as follows:

$$\delta_{s+1} = \delta_s \beta(C_{As}),\ \delta_0 = 1, \tag{3}$$

where C_A is aggregate home consumption and $0 < \beta(C_A) < 1$. To achieve stationarity under incomplete market specification, we assume $\beta_C(C_A) \leq 0$, which implies that agents discount the future more as aggregate consumption increases, i.e. agents bring consumption forward when aggregate consumption is high. We assume that the individual takes C_A as given when optimising and we follow Devereux and Sutherland (2011) in assuming:

$$\beta(C_A) = \omega C_A^{-\eta}, \tag{4}$$

with $0 \leq \eta < \rho$ and $0 < \omega \bar{C}_A^{-\eta} < 1$ (as in the constant discount factor).

C represents a consumption index defined over C_H and C_F, home and foreign produced goods, respectively.

$$C_t = \left[\nu^{\frac{1}{\theta}} C_{H,t}^{\frac{\theta-1}{\theta}} + (1-\nu)^{\frac{1}{\theta}} C_{F,t}^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}, \tag{5}$$

where θ is the elasticity of intratemporal substitution between C_H and C_F and ν is the weight that the household assigns to home consumption. The consumption price index, defined as the minimum expenditure required to purchase one unit of aggregate consumption for the home agent is given by:

$$P_t = \left[\nu P_{H,t}^{1-\theta} + (1-\nu) P_{F,t}^{1-\theta}\right]^{\frac{1}{1-\theta}}. \tag{6}$$

We adopt a similar preference specification for the foreign country except that variables are denoted with an asterisk.

In each country agents can invest in two nominal bonds denominated in home and foreign currency. The budget constraint of the home agent in real terms is given by:

$$\alpha_{H,t} + \alpha_{F,t} + \frac{M_t}{P_t} = \alpha_{H,t-1} r_{H,t} + \alpha_{F,t-1} r_{F,t} + \frac{M_{t-1}}{P_{t-1}}\frac{P_{t-1}}{P_t} + \frac{P_{H,t}Y_t}{P_t} - C_t - T_t, \tag{7}$$

Domestic income $P_{H,t}Y_t$ is the sum of profits and wage income, ie $P_{H,t}Y_t = P_t\Pi_t + W_tL_t$, where Π denotes real profits of home firms and W_t is nominal wage. Net taxes T_t allows for variations in the nominal supply of money, i.e. $T_t = -\frac{M_t}{P_t} + \frac{M_{t-1}}{P_{t-1}}\frac{P_{t-1}}{P_t}$. Portfolios $\alpha_{H,t-1}$ and $\alpha_{F,t-1}$ denote the real holdings of home and foreign bonds expressed in units of home consumption good, purchased at the end of period $t-1$ for holding into period t.[4] Gross

[3] While agents' preferences towards different bonds are determined through an endogenous portfolio choice problem, preferences toward currency (or cash) are exogenously imposed in the utility function. Our specification is equivalent to the one in which agents can only do transactions with (domestic) currency – that is, they face cash-in advance constraint. And these constraints directly determine the demand for money. Although this is out of the scope of this paper, one could think of an alternative specification in which the choice of money holdings is also an outcome of a portfolio decision.

[4] A similar budget constraint holds for the foreign agent, where foreign variables are denoted with an asterisk, *. $\alpha^*_{H,t-1}$ and $\alpha^*_{F,t-1}$ denote the foreign country's real holdings of home and foreign bonds, expressed

real returns in home units, $r_{H,t}$ and $r_{F,t}$, are given by:

$$\begin{aligned} r_{H,t+1} &= \frac{1/P_{t+1}}{Z_{H,t}}, \\ r_{F,t+1} &= r^*_{F,t+1}\frac{Q_{t+1}}{Q_t} = \frac{1/P^*_{t+1}}{Z^*_{F,t}}\frac{Q_{t+1}}{Q_t}, \end{aligned} \tag{8}$$

where Z_H and Z^*_F are bond prices in terms of home and foreign consumption baskets, respectively. Q_t is the real exchange rate defined as $\frac{P^*_t S_t}{P_t}$. Nominal returns (in home currency) for each of these assets will be given by $R_{i,t} = r_{i,t}\frac{P_t}{P_{t-1}}$ for $i = H, F$.

Defining $NFA_t \equiv \alpha_{H,t} + \alpha_{F,t}$ as the total net claims of home agents on the foreign country at the end of period t (i.e. the net foreign assets of home agents) and $r_{x,t} = r_{F,t} - r_{H,t}$ as the excess return of foreign bond on home bond, we write the home budget constraint as follows:[5]

$$NFA_t = NFA_{t-1}r_{H,t} + \alpha_{F,t-1}r_{x,t} + \frac{P_{H,t}Y_t}{P_t} - C_t + \frac{M_{t-1}}{P_{t-1}}\frac{P_{t-1}}{P_t} - \frac{M_t}{P_t} - T_t \tag{9}$$

Note that once α_F is determined, α_H, α^*_H and α^*_F will also be determined as $\alpha_H \equiv NFA - \alpha_F$ by definition and $\alpha^*_H = -\alpha_H$, $\alpha^*_F = -\alpha_F$ from market clearing conditions. Thus, we let $\alpha_F \equiv \alpha$ and only focus on α in what follows.

2.1.1 Consumption, Labor Supply and Portfolio Choice

Given our assumption on preferences in (2), the Euler equations are given by:

$$C_t^{-\rho} = \beta(C_t)E_t C_{t+1}^{-\rho} r_{i,t+1}, \; i = H, F \tag{10}$$

where $\beta(C_t) = \omega C_t^{-\eta}$ from equation (4) since in equilibrium aggregate consumption, $C_{A,t}$, is equal to individual consumption, C_t. Money demand depends negatively on the opportunity cost of holding money, which is equal to $\frac{R_{i,t+1}-1}{R_{i,t+1}}$ in terms of gross returns.

$$\frac{M_t}{P_t} = \chi C_t^{\rho}\left(1 - R_{i,t+1}^{-1}\right)^{-1}. \tag{11}$$

Optimal labor supply is determined according to:

$$KL_t^{\varpi} = C_t^{-\rho}\frac{W_t}{P_t}. \tag{12}$$

2.1.2 Investment and Capital Accumulation

Households receive capital income by renting out the capital they own to firms that produce intermediate goods at a rate R^K. Households choose the capital stock and investment to

in units of home consumption good. Bonds are assumed to be in net zero supply in each country. Thus, equilibrium in asset market requires that total bond holdings of home and foreign agents should equal zero, i.e. $\alpha_{H,t} + \alpha^*_{H,t} = 0$ and $\alpha_{F,t} + \alpha^*_{F,t} = 0$.

[5] Net foreign assets of home agent is defined as net claims of home country on foreign country assets, i.e. $NFA_t \equiv \alpha_{F,t} - \alpha^*_{H,t}$. Since bonds are assumed to be in net zero supply, $\alpha_{H,t} = -\alpha^*_{H,t}$. It follows that $NFA_t \equiv \alpha_{H,t} + \alpha_{F,t}$.

maximize their intertemporal utility (1) subject to the budget constraint given by (7) and the capital accumulation equation:

$$K_{t+1} = (1 - \delta(u_t))K_t + S_I\left(\frac{I_t}{I_{t-1}}\right) I_t$$

where $\delta(u_t)$ denotes the variable cost of capital utilization and S_I denotes the investment adjustment costs respectively.

The functional form of $\delta(u_t)$ follows from Schmitt-Grohe and Uribe (2009):

$$\delta(u) = \delta_0 + \delta_1(u-1) + \delta_2(u-1)^2.$$

The functional form for investment adjustment cost is specified as:

$$S_I = \frac{S_1}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2.$$

We specify variable capacity utilization and investment adjustment costs as they are shown to be important in ensuring comovement between macro aggregates over the business cycle (See Rebelo and Jaimovich, 2009 among others).

2.2 Firms

Each country produces a single final good combining home and foreign intermediate goods according to the CES function given by 5. There is a continuum of intermediate good producers in each country, each producing a differentiated intermediate good using capital and labor. The final good sector is perfectly competitive while there is monopolistic competition in the intermediate good sector. Capital and labor are immobile across countries.

2.2.1 Intermediate Goods

Each intermediate good firm k uses a standard Cobb-Douglas technology to combine labor, L, and capital at the effective utilization rate, uK to produce output Y.

$$Y_t(k) = A_t(u_tK_t(k))^{\mu}(L_t(k))^{1-\mu}$$

where A_t is a common stochastic productivity shock that follows:

$$\log A_t = \zeta \log A_{t-1} + \log Z_{t-p} + \varepsilon_{u,t}, \quad 0 \le \zeta \le 1, \tag{13}$$

where $\varepsilon_{u,t}$ is i.i.d with $E_{t-1}[\varepsilon_{u,t}] = 0$ and $Var_{t-1}[\varepsilon_{u,t}] = \sigma_A^2$.

In equation (13), $\varepsilon_{u,t}$ represents the unanticipated shock to productivity, while Z_{t-p} denotes news about A_t that becomes known p-period in advance (p>0). Z_t follows an AR(1) process:

$$\log Z_t = \zeta_Z \log Z_{t-1} + \varepsilon_{Z,t}, \quad 0 \le \zeta_Z \le 1, \tag{14}$$

where $\varepsilon_{Z,t}$ is i.i.d with $E_{t-1}[\varepsilon_{Z,t}] = 0$ and $Var_{t-1}[\varepsilon_{Z,t}] = \sigma_Z^2$.

We assume that unanticipated shocks and news shocks are orthogonal to each other. Variants of this specification are widely used in the literature concerned with the effects of news on productivity such as Beaudry and Portier (2004) and Fujiwara (2011) among others.

Cost minimization with respect to labor and capital implies that capital-labor ratio is identical across all intermediate good producers:

$$\frac{L_t(k)}{K_t(k)} = \frac{\mu}{1-\mu}\frac{R_t^K}{W_t}. \tag{15}$$

Prices change at random intervals à la Calvo. At each period a fraction $\kappa \in [0,1)$ of randomly selected firms cannot change their prices. The remaining $1-\kappa$ fraction of firms chooses prices optimally to maximize expected discounted value of future profits given the demand for their goods.

Each firm in home country chooses the optimal home and foreign market price, $\tilde{P}_{H,t}$ and $\tilde{P}^*_{H,t}$, respectively to maximize expected value of discounted future profits from selling at home and abroad:

$$E_t \sum_{j=0}^{\infty} \kappa^j \Psi_{t+j} \left[\tilde{P}_{H,t}\tilde{Y}_{H,t+j} + S_{t+j}\tilde{P}^*_{H,t}\tilde{Y}^*_{H,t+j} - \frac{W_{t+j}}{A_{t+j}}(\tilde{Y}_{H,t+j} + \tilde{Y}^*_{H,t+j}) \right] \tag{16}$$

where Ψ is the stochastic discount factor and $\tilde{Y}_{H,t}$ and $\tilde{Y}^*_{H,t}$ are the demand for home good from the home market and the demand for home good from the foreign market, respectively and are given by the following expressions:

$$\tilde{Y}_{H,t+j} = \left(\frac{\tilde{P}_{H,t}}{P_{H,t+j}}\right)^{-\phi} \nu \left(\frac{P_{H,t+j}}{P_{t+j}}\right)^{-\theta} (C_{t+j} + I_{t+j}) \tag{17}$$

$$\tilde{Y}^*_{H,t+j} = \left(\frac{\tilde{P}^*_{H,t}}{P^*_{H,t+j}}\right)^{-\phi} (1-\nu) \left(\frac{P^*_{H,t+j}}{P^*_{t+j}}\right)^{-\theta} (C^*_{t+j} + I_{t+j}) \tag{18}$$

The optimal price for the home good sold in the home market is given by:

$$\tilde{P}_{H,t} = \frac{\phi}{\phi-1} \frac{E_t \sum_{j=0}^{\infty} \kappa^j \Psi_{t+j} \frac{W_{t+j}}{A_{t+j}} \tilde{Y}_{H,t+j}}{E_t \sum_{j=0}^{\infty} \kappa^j \Psi_{t+j} \tilde{Y}_{H,t+j}} \tag{19}$$

We assume that export prices are set is in the local currency as in Engel and Matsumoto (2009). Under local currency pricing (LCP), export prices are set in the currency of the buyer. Maximizing equation (16) with respect to $\tilde{P}^*_{H,t}$ gives the following equation for optimal export price under LCP:

$$\tilde{P}^*_{H,t}\Big|_{lcp} = \frac{\phi}{\phi-1} \frac{E_t \sum_{j=0}^{\infty} \kappa^j \Psi_{t+j} \frac{W_{t+j}}{A_{t+j}} \tilde{Y}^*_{H,t+j}}{E_t \sum_{j=0}^{\infty} \kappa^j \Psi_{t+j} S_{t+j} \tilde{Y}^*_{H,t+j}} \tag{20}$$

When prices are set according to LCP, the law of one price no longer holds. In this case, real exchange rate fluctuations reflect both the presence of home bias in consumption and deviations from the law of one price.

Under Calvo price-setting, the price indices $P_{H,t}$ and $P^*_{H,t}$ can be written as follows:

$$
\begin{aligned}
P_{H,t} &= \left[(1-\kappa)\tilde{P}_{H,t}^{1-\phi} + \kappa P_{H,t-1}^{1-\phi}\right]^{\frac{1}{1-\phi}} \\
P^*_{H,t} &= \left[(1-\kappa)\tilde{P}_{H,t}^{*1-\phi} + \kappa P_{H,t-1}^{*1-\phi}\right]^{\frac{1}{1-\phi}}
\end{aligned}
$$

Optimal prices for the foreign goods sold in the domestic market and abroad, $\tilde{P}^*_{F,t}$ and $\tilde{P}_{F,t}$ as well as $P^*_{F,t}$ and $P_{F,t}$ are derived in a similar way.

2.3 Policy rules

Monetary policy in both countries are given by interest rate rules. We first consider a Taylor rule, where the central bank in each country sets the nominal interest rate on domestic bonds in response to CPI inflation (inflation target assumed to be zero) and output growth as a proxy for deviations of output from its potential. Home country Taylor rule is given by:

$$
R_{H,t+1} = \beta^{\frac{1}{1-\zeta_R}} R_{H,t}{}^{\zeta_R} \left[\left(\frac{P_t}{P_{t-1}}\right)^{\phi_\pi} \left(\frac{Y_t}{Y_{t-1}}\right)^{\phi_Y}\right]^{\zeta_R} \exp(\varepsilon_{R,t}) \tag{21}
$$

where $E_{t-1}[\varepsilon_{R,t}] = 0$ and $Var[\varepsilon_{R,t}] = \sigma_R^2$. The foreign country follows a symmetric Taylor rule in setting the interest rate, $R^*_{F,t+1}$.

Alternatively, we allow the home country central bank to also react to changes in the nominal exchange rate, which represents a managed exchange rate regime as described in Benigno and Benigno (2008). In this case, equation (22) is modified in the following way:

$$
R_{H,t+1} = \beta^{\frac{1}{1-\zeta_R}} R_{H,t}{}^{\zeta_R} \left[\left(\frac{P_t}{P_{t-1}}\right)^{\phi_\pi} \left(\frac{Y_t}{Y_{t-1}}\right)^{\phi_Y} \left(\frac{S_t}{S_{t-1}}\right)^{\phi_\S}\right]^{\zeta_R} \exp(\varepsilon_{R,t}) \tag{22}
$$

where $E_{t-1}[\varepsilon_{R,t}] = 0$ and $Var[\varepsilon_{R,t}] = \sigma_R^2$.

2.4 Market Clearing

Asset market clearing conditions are the following:

$$
\begin{aligned}
\alpha_{H,t} + \alpha_{F,t} &= 0, \\
\alpha^*_{H,t} + \alpha^*_{F,t} &= 0.
\end{aligned}
$$

Goods market clearing implies:

$$
\begin{aligned}
Y_t &= \nu \left(\frac{P_{H,t}}{P_t}\right)^{-\theta} (C_t + I_t) + (1-\nu)\left(\frac{P^*_{H,t}}{P^*_t}\right)^{-\theta} (C^*_t + I^*_t, \\
Y^*_t &= \nu \left(\frac{P^*_{F,t}}{P^*_t}\right)^{-\theta} (C^*_t + I^*_t) + (1-\nu)\left(\frac{P_{F,t}}{P_t}\right)^{-\theta} (C_t + I_t).
\end{aligned}
$$

2.5 Approximated solution

To solve the model we use the approximation techniques proposed in Devereux and Sutherland (2011) and Tille and van Wincoop (2010). We approximate our model around the symmetric steady state in which steady-state inflation rates are assumed to be zero.

To determine the portfolio allocation, it is useful to rewrite the home portfolio choice equation given in equation (10) and its foreign counterpart as follows:

$$E_t\left[\psi_{t+1} r_{x,t+1}\right] = 0,$$
$$E_t\left[\psi^*_{t+1} r_{x,t+1} \frac{Q_t}{Q_{t+1}}\right] = 0,$$

where home and foreign stochastic discount factors are given by $\psi_{t+1} = \beta \frac{C_{t+1}^{-\rho}}{C_t^{-\rho}}$ and $\psi^*_{t+1} = \beta \frac{C_{t+1}^{*-\rho}}{C_t^{*-\rho}}$, respectively, and $r_{x,t+1}$ is the excess return on foreign nominal bond, taking home bond as a reference.

Given the definiton of stochastic discount factors, these two sets of conditions imply the following equation that characterizes optimal portfolio choice up to a second order:

$$E_t\left[\left(\Delta\hat{C}_{t+1} - \Delta\hat{C}^*_{t+1} - \frac{\Delta\hat{Q}_{t+1}}{\rho}\right)\hat{r}_{x,t+1}\right] = 0 + O(\varepsilon^2).$$

This is an orthogonality condition between excess return on the foreign bond and relative consumption adjusted by the real exchange rate. Since expected excess returns are zero up to a first-order approximation, i.e. $E_t\left[\hat{r}_{x,t+1}\right] = 0 + O(\varepsilon^2)$, this condition can be expressed as:

$$Cov_t(\hat{C}_{t+1} - \hat{C}^*_{t+1} - \frac{\hat{Q}_{t+1}}{\rho}, \hat{r}_{x,t+1}) = 0 + O(\varepsilon^2). \tag{23}$$

As shown by Devereux and Sutherland (2011), to evaluate equation (23) and determine the portfolio shares, it is sufficient to take a first-order approximation of the remaining equilibrium conditions for which the only aspect of portfolio behavior that matters is the steady-state foreign bond portfolio, $\tilde{\alpha}$.

The excess return on foreign bonds relative to home bonds is given by surprises in home currency depreciation in a first-order approximation to the model:

$$\hat{r}_{x,t+1} = \hat{S}_{t+1} - E_t\hat{S}_{t+1}. \tag{24}$$

Thus, according to equations (23) and (24), it is optimal to take a long position in foreign currency (i.e. $\tilde{\alpha} > 0$) if home currency depreciates in periods when home consumption (adjusted by the real exchange rate) is lower than foreign consumption. Whether the nominal exchange rate comoves with relative consumption or relative income depends crucially on the monetary policy regime as we illustrate in the general equilibrium solution below.[6].

[6]The appendix shows that real adjusted relative consumption fluctuates due to two sources: changes in relative non-financial income and changes in the real exchange rate

3 Analytical Representation of the Portfolio Problem

In this section we report some analytical results to illustrate the interaction between monetary policy and the composition of shocks in determining the sign and the size of the foreign currency portfolio. We use a simple version of the model described above to characterize a full general equilibrium solution for foreign currency positions.

3.1 General equilibrium solution for optimal foreign currency position

It is possible to characterize closed-form solutions for optimal foreign bond portfolios for a simplified version of the model laid out in section2. We consider a flexible price version of the model with inelastic labor supply and , i.e. endowment economy. Thus shocks to technology described by equations (13) and (14) are replaced by shocks to endowment.[7] Monetary policies in each country are described by a Taylor rule that focus on inflation stabilization (i.e. we assume $\zeta_R = 0$ and ϕ_Y=0 in equation (22)). Although quite simplified, this model has the necessary ingredients to illustrate the role of monetary policy and the composition of shocks in determining the optimal foreign currency position of a country. Since optimal portfolios are pinned down by the portfolio orthogonality condition given in equation (23), it is useful to analyze the components of this covariance, $\hat{C}^R_{t+1} - \frac{\hat{Q}_{t+1}}{\rho}$ and $\hat{r}_{x,t+1}$ (or $\hat{S}_{t+1}$).

First, we consider the analytical solution for the real exchange rate adjusted consumption differential as a function of the structural shocks and the excess return on foreign bond holdings in the following way:[8]

$$\begin{aligned}\hat{C}^R_{t+1} - \frac{\hat{Q}_{t+1}}{\rho} &= \frac{\Lambda_1}{\rho(1+2\nu(\theta-1))}\left[(\varepsilon_{u,t+1} - \varepsilon_{u^*,t+1}) + \frac{\beta}{1-\beta}(\varepsilon_{z,t+1} - \varepsilon_{z^*,t+1})\right] \\ &\quad + \frac{(1-\beta)\Lambda_2}{(1-\nu)\rho(1+2\nu(\theta-1))}\tilde{\alpha}\hat{r}_{x,t+1}. \end{aligned} \tag{25}$$

where

$$\begin{aligned}\Lambda_1 &\equiv 2\nu(\theta\rho - 1) + 1 - \rho \\ \Lambda_2 &\equiv 1 + 4\nu(1-\nu)(\theta\rho - 1)\end{aligned}$$

Assumption 1: $\theta > \frac{1}{\rho} + \frac{1}{2\nu}\frac{\rho-1}{\rho} \equiv \theta_1$ and $\rho \geq 1$. $\Lambda_1 > 0$ and $\Lambda_2 > 0$ under Assumption 1.[9]

Equation (25) shows that if agents did not have any foreign currency position, that is $\tilde{\alpha} = 0$, the real exchange rate adjusted relative consumption would depend on the relative supply shock and news about the relative supply shock, but not on relative monetary policy shock. This is because, without valuation effects coming from movements in the exchange

[7] Even in this simple endowment economy the expressions are quite complicated. Thus, for ease of exposition, we set the persistence of endowment shocks to 1 in this section, i.e. $\zeta = 1$ and $p = 1$ in equation (13) and $\zeta_Z = 1$ in equation (14).

[8] Note that we ignore other state variables in the solution as they do not matter when evaluating the conditional covariance given in equation (23).

[9] *Proof:* $\Lambda_1 > 0 \leftrightarrow \theta > \frac{1}{\rho} + \frac{1}{2\nu}\frac{\rho-1}{\rho} \equiv \theta_1$. $\theta > \frac{1}{\rho} \equiv \theta_2$ is a sufficient condition for $\Lambda_2 > 0$. $\theta_1 > \theta_2$ if $\rho \geq 1$.

rate, monetary policy has no effect on real variables under flexible prices. So, if agents were only faced with monetary policy shocks, the optimal portfolio would imply having no foreign currency position, as this ensures perfect smoothing in the adjusted relative consumption. But equation (25) also shows that the zero-portfolio position, i.e. $\tilde{\alpha} = 0$, would not ensure full risk sharing against anticipated or unanticipated relative supply shocks. Thus, the relative importance of different type of shocks will pin down how far from the zero portfolio agents will choose to be.

Assuming that monetary policy is characterized by a Taylor rule that only responds to movements in inflation, we can derive the relative stance of monetary policies in the two countries by taking the difference of the linearized Taylor rules:

$$\hat{R}_{H,t+1} - \hat{R}^*_{F,t+1} = \phi_\pi(\hat{P}_t - \hat{P}_{t-1}) - \phi_\pi(\hat{P}^*_t - \hat{P}^*_{t-1}) + \varepsilon_{R,t} - \varepsilon_{R^*,t}.$$

Substituting the condition for excess returns (24) we get:

$$-(\hat{S}_t - E_t\hat{S}_{t+1}) = \phi_\pi(\hat{\pi}_t - \hat{\pi}^*_t) + \varepsilon_{R,t} - \varepsilon_{R^*,t}. \tag{26}$$

Equation (26) shows that the domestic currency appreciates when domestic inflation increases relative to foreign. The intuition is that higher inflation at home requires the domestic central bank to raise interest rates which would trigger a domestic nominal appreciation. In the words of Clarida and Waldman (2007), any bad news about inflation is 'good news for the exchange rate'. As we demonstrate below, for reasonable parameter values, an unanticipated relative decline or an anticipated relative rise in domestic supply is associated with an increase in domestic inflation, and a domestic nominal appreciation.

Under the assumption of a simple inflation targeting Taylor rule, an unanticipated fall in the relative supply of the home good which leads to an increase in domestic inflation, triggers a rise in domestic nominal interest rate, which in turn leads to a nominal appreciation in the domestic currency, i.e. a decline in the excess return on foreign bonds ($\hat{r}_{x,t+1}$). This suggests that foreign currency denominated bonds are a poor hedge in the face of unanticipated supply shocks when monetary policy is represented by an inflation targeting Taylor rule. On the other hand, an anticipated relative increase in domestic supply raises domestic inflation as domestic demand rises in anticipation, which again triggers an interest rate hike under the Taylor rule, appreciating the domestic currency when relative consumption is high. Thus, foreign currency bonds are a better hedge in the face of anticipated supply shocks.

To demonstrate this point formally, let us consider the zero-portfolio general equilibrium solution for excess returns (i.e. $\tilde{\alpha} = 0$):[10]

$$\begin{aligned}
\hat{r}_{x,t+1} &= \hat{S}_{t+1} - E_t\hat{S}_{t+1} \\
&= \frac{2\nu - 1}{1 + 2\nu(\theta - 1)}\left[(\varepsilon_{u,t+1} - \varepsilon_{u^*,t+1}) + \frac{(2v-1)(2\nu\theta\rho - \beta\phi_\pi\Lambda_1 - \beta(2\nu-1))}{(1-\beta)(\phi_\pi - 1)\Lambda_2}(\varepsilon_{z,t+1} - \varepsilon_{z^*,t+1})\right] \\
&\quad - \frac{1}{\phi_\pi}(\varepsilon_{R,t+1} - \varepsilon_{R^*,t+1}),
\end{aligned} \tag{27}$$

[10] The general equilibrium solution for excess returns as a function of $\tilde{\alpha}$ is the exact same expression as in except that all the right hand side coefficients are multiplied by $\varkappa_{tr} = \left[1 + \frac{\tilde{\alpha}_{tr}(1-\beta)(2\nu-1)^2}{(1-\nu)(1+2\nu(\theta-1))}\right]^{-1}$.

Assumption 2: There is consumption home bias; i.e. $\nu > \frac{1}{2}$. $\frac{2\nu-1}{1+2\nu(\theta-1)} > 0$ under Assumptions 1 and 2.[11]

Under these assumptions an unexpected negative supply shock at home leads to a unexpected appreciation in the home currency and a decrease in relative consumption (See equation (25)). Thus, under a simple Taylor rule, it is optimal to have a short position in foreign bonds ($\tilde{\alpha} < 0$) to hedge against anticipated supply shocks.

Let us now analyze how excess return on foreign bonds responds to a negative news shock about future domestic supply under the zero-portfolio solution under the same assumptions. The coefficient on the relative news shock ($\varepsilon_{z,t+1} - \varepsilon_{z^*,t+1}$) shows that the domestic currency could depreciate in response to negative news if the inflation reaction coefficient ϕ_π is sufficiently large [12]. Under these assumptions, a negative news shock that leads to a decline in relative consumption as shown in (25) would lead to a rise in the excess return on foreign bonds. Hence, it would be optimal to have a long position in foreign bonds ($\tilde{\alpha} > 0$) to hedge against unanticipated supply shocks under an inflation targeting Taylor rule.

As is apparent from the analytical solutions for relative consumption and excess returns given in equations (25) and (10), the existence of unanticipated and anticipated supply shocks creates a tension in the choice of the optimal portfolio under a Taylor rule. While the former implies a short position in foreign bonds, the latter implies a long position provided that the interest rate response to inflation is sufficiently strong.

Evaluating equations (23), (25) and (10) we can obtain the analytical expression for steady-state foreign bond holdings:

$$\tilde{\alpha} = -\frac{(1-\nu)(2\nu-1)\Lambda_1\left[1 - \frac{\beta}{1-\beta}(\phi_\pi - 1)\Lambda_4\frac{\sigma_z^2}{\sigma_u^2}\right]}{(1-\beta)\left((1+2\nu(\theta-1))\Lambda_2\frac{\sigma_R^2/\phi_\pi^2}{\sigma_u^2} + \rho(2\nu-1)^2\left[1-\Lambda_4\frac{\sigma_z^2}{\sigma_u^2}\right]\right)} \tag{28}$$

where

$$\begin{aligned}
\Lambda_3 &\equiv (2\nu-1)\phi_\pi\Lambda_1 + \Lambda_2 - \frac{(1+2\nu(\theta-1))\rho}{\beta} \\
\Lambda_4 &\equiv \frac{\beta}{1-\beta}\frac{\Lambda_3}{\Lambda_2}\frac{1}{(\phi_\pi-1)^2} \\
\Lambda_5 &\equiv \frac{\beta}{1-\beta}(\phi_\pi - 1) - 1
\end{aligned}$$

We can now study some special cases. First, we can consider the case in which there are no anticipated shocks (i.e.$\sigma_z^2 = 0$). Equation 28) becomes:

$$\tilde{\alpha}|_{\sigma_{z=0}^2} = -\frac{(1-\nu)(2\nu-1)\Lambda_1}{(1-\beta)(1+2\nu(\theta-1))\left[\Lambda_2\frac{\sigma_R^2/\phi_\pi^2}{\sigma_u^2} + (2\nu-1)^2\rho\right]}. \tag{29}$$

This shows that under Assumptions 1 and 2, it is optimal to have a short position in foreign bonds under the Taylor rule. Also, the bigger the response to inflation in the Taylor rule, ϕ_π, the bigger the size of the bond portfolio. This is because with a stronger response

[11] $2\nu - 1 > 0$ *under Assumption 2.* $1 + 2\nu(\theta-1) > 0 \leftrightarrow \theta > 1 - \frac{1}{2\nu} \equiv \theta_3$. $\theta_1 > \theta_3 \leftrightarrow \rho > \frac{1-2\nu}{2(1-\nu)}$. $\nu > \frac{1}{2} \rightarrow 1 - 2\nu < 0 \rightarrow \rho > \frac{1-2\nu}{2(1-\nu)}$.

[12] We assume that the Taylor principle $\phi_\pi > 1$ holds

to inflation the monetary authority offsets the effect of monetary shocks on excess returns (as shown in equation (10) and pointed out by Devereux and Sutherland (2008)). Hence, in this case it is not possible to account for longer positions in foreign currency as monetary policy becomes more oriented towards price stability.

We now consider the case where only sources of risk are anticipated and unanticipated supply shocks, i.e. there are no monetary policy shocks for simplicity:

$$\tilde{\alpha}|_{\sigma^2_{M=0}} = \frac{(1-\nu)}{(1-\beta)\rho(2\nu-1)} \left\{ \Lambda_5 \left[\frac{\sigma_u^2}{\Lambda_4 \sigma_z^2} - 1 \right]^{-1} - 1 \right\} \tag{30}$$

where

$$\Lambda_5 \equiv \frac{\beta}{1-\beta}(\phi_\pi - 1) - 1$$

Assumption 3: $\phi_\pi > \max\left[\frac{1}{\beta}, \frac{(1+2\nu(\theta-1)\rho)-\beta\Lambda_2}{(2\nu-1)\Lambda_1}\right]$. Assumption 1,2 and 3 provide a sufficient condition for $\Lambda_3 > 0$, $\Lambda_4 > 0$ and $\Lambda_5 > 0$.[13]

According to 30, portfolio positions can be negative or positive in the presence of anticipated and unanticipated supply shocks. Under Assumptions 1,2 and 3, $\partial\tilde{\alpha}_{tr|\sigma^2_M=0}/\partial(\sigma_z^2/\sigma_u^2) > 0$. In other words, provided that there is consumption home bias, a sufficient degree of substitutability between home and foreign goods and a sufficiently large coefficient of inflation in the Taylor rule, the foreign currency portfolio increases with the relative size of anticipated versus unanticipated shocks. So while the model without news shocks can only produce short positions under a Taylor rule, the model with news shocks can produce long positions depending particularly on the relative size of the news shock, as well as the strength of the Taylor rule reaction to inflation.

As emphasized by Benigno and Benigno (2008) and Clarida and Waldman (2007), cyclical properties of the exchange rate are determined by monetary policy regimes. Moreover, the relative importance of demand versus supply shocks is also important for the cyclical properties of the exchange rate (e.g. Opazo (2006), Lambrias (2013) and Fratzscher and Straub (2010)). So, clearly, the hedging characteristic of domestic over foreign bonds - that is, whether the domestic currency depreciates or appreciates in periods of low domestic income – is critically affected by the conduct of monetary policy and the source of economic shocks driving economic fluctuations.

4 Numerical results and robustness checks

The previous section provided some analytical results for the foreign currency portfolios using a flexible price endowment economy set-up. In this section, we present numerical results for the full model described in section (2). We analyze the sensitivity of foreign currency portfolios to the parameters of the interest rate rules and the relative variance of anticipated and unanticipated shocks.

[13] *Proof:* $\Lambda_3 > 0 \leftrightarrow \phi_\pi > \frac{(1+2\nu(\theta-1)\rho)-\beta\Lambda_2}{(2\nu-1)\Lambda_1} \equiv \phi^*_\pi$. $\Lambda_4 > 0 \leftrightarrow \frac{\Lambda_3}{\Lambda_2} > 0$. $\Lambda_2 > 0$ under Assumption 1. $\Lambda_3 > 0 \leftrightarrow \phi_\pi > \phi^*_\pi \rightarrow \Lambda_4 > 0$. $\Lambda_5 > 0 \leftrightarrow \phi_\pi > \frac{1}{\beta}$.

Optimal portfolios under sticky prices have been analyzed before in Devereux and Sutherland (2008), Engel and Matsumoto (2009) and Devereux, Senay and Sutherland (2014). In a model where monetary policy is specified as a Taylor rule that reacts to producer price inflation, Devereux and Sutherland (2008) find – consistent with the results above – a negative position in foreign bonds under incomplete markets. Engel and Matsumoto (2009), on the other hand, assume a money-growth rule for monetary policy and show that the optimal foreign currency position will be negative whether or not money supplies are allowed to respond to productivity shocks under a complete market setting.[14] Devereux, Senay and Sutherland (2014) find that monetary policy which reduces the variability of domestic inflation leads to an increase in the diversification of international portfolios, generating higher gross external assets and liabilities. But the equilibrium bond portfolio still generally point to short positions in foreign currency. In our model is the introduction of news shocks that allow for a reversal of this result.[15] This result will are illustrated in the numerical simulations below.

We use a fairly standard calibration (see Table 1). Discount factor is endogenous to ensure the stationarity of the model. The steady-state value of the discount factor, $\bar{\beta}$, equals 0.99. The coefficient of relative risk aversion (CRRA), ρ, equals 2 and the elasticity of substitution across domestic and foreign goods, θ, equals 2. This is slightly higher than the values chosen by Heathcote and Perri (2002) but below that typically chosen in the New Open Economy Macroeconomics literature (see for instance De Paoli (2009)). The home bias in consumption parameter, ν, is equal to 0.85 which implies an import share of 15%. We also assume Local Currency Pricing in our benchmark specification, to allow for deviations from the law of one price.

The elasticity of substitution across varieties in each country, ϕ, is set to 10, which is consistent with a price mark-up of 11%. The price stickiness parameter κ equals 0.75, so that prices are set for a year at a time. The inverse of the Frisch elasticity of labour supply, ϖ, is set to 2.5.

Unanticipated shocks to productivity are calibrated in line with the IRBC literature with $\sigma_u = 0.007$ and $\zeta = 0.95$. The standard deviation of unanticipated interest rate shock is about half the standard deviation of the unanticipated productivity shock, which is consistent with the estimates in Smets and Wouters (1997). The standard deviation of news shocks is set relative to that of the unanticipated productivity shocks such that half the volatility in output is accounted by anticipated shocks to productivity in line with the estimates in Schmitt-Grohe and Uribe (2012). In the benchmark calibration we assume that news about future productivity are known eight quarters in advance as in Nam and Wang (2010). Since there is no consensus on the calibration of news in the literature, we carry out sensitivity analysis with respect to different values of the relative variance and persistence of anticipated productivity shocks.

[14] The intuition in Engel and Matsumoto is as follows: due to price stickiness, home labour income and relative returns on home equity are negatively correlated for a given exchange rate. Thus, it is optimal to have home bias in equity. When exchange rate depreciates, home revenues increase in home currency terms. Given that equity portfolios are home biased, this leads to an increase in relative consumption which can be hedged by having a short position in foreign currency.

[15] An earlier version of this paper (available as a Bank of England working paper) shows that the negative position can also be reverted with a passive monetary policy rule. But given that such rules are not thought to represent monetary policy in the recent periods, we abstract for this analysis in the present paper.

Parameter	Description	Taylor Rule
β	Steady-state discount factor	0.99
ρ	CRRA	2
ϖ	Inverse of Frisch elas.	2.5
θ	Elas. of subs. across dom. and foreign goods	2
ν	Preference for domestic goods in consumption	0.85
ϕ	Elas. of subs. across domestic varieties	10
κ	Calvo parameter of price stickiness	0.75
δ	Depreciation rate of capital	0.025
Φ	Capital adjustment cost parameter	1.3
ζ	Persistence of unanticipated productivity shocks	0.95
p	Lag of the anticipated productivity shock	8
ϕ_π	Reaction to inflation	2.5
ϕ_Y	Reaction to output	0.1
ϕ_S	Reaction to nom. exchange rate	0
σ_u	Standard dev. of unanticipated TFP shocks	0.0045
σ_R	Standard dev. of interest rate shocks	0.0024
σ_z/σ_u	Relative size of news shocks wrt TFP shocks	1.8
$Cor(u_i, u_i^*)$	Cross-country corr. of u_i shocks $i = a, u$	0.25

Table 1: Baseline calibration

The business cycle statistics of the model under the benchmark calibration given in Table 1 are reported in Table 2. Moreover, the transmission mechanism of shocks under this calibration is shown in Figure 1.The cross-country and business-cycle correlations produced by the model are reasonably in line with the data. But, as in many international business cycle models (see, for example, Bodenstein (2008) for a discussion), the volatility of consumption and the real exchange rate volatility are small relative to output. As shown in the table, the model with only unanticipated productivity (TFP) shocks produces a large negative foreign currency position while the sign switches in the model with only unanticipated (or news) TFP shocks. The benchmark calibration produces a positive portfolio position consistent with the data. The model overestimates the size of the position, probably due to the lack of transaction costs – which are likely to be present when bonds are traded internationally.

The first column of Figure 2 shows the foreign bond position under Local Currency Pricing for different values of the Taylor rule inflation reaction coefficient ϕ_π. The rest of the columns of charts in Figure 2 illustrate the impact response of the portfolio determinants to different shocks. The first row of charts in Figure 2 corresponds to the case in which there are no news shocks and the second row corresponds to the case in which unanticipated and anticipated shocks contribute almost equally to the volatility of output. As it is clear from the figure, the covariance of real exchange rate adjusted relative consumption, $\hat{C}_t^R - \hat{Q}_t/\rho$, and excess returns, $\hat{r}_{x,t} = \hat{S}_t - E_{t-1}\hat{S}_t$ is negative when there are no news shocks while it is positive when news shocks are introduced and the Taylor rule coefficient ϕ_π is larger than 1.5. While negative unanticipated supply shocks appreciate the exchange rate, negative news shocks tend to depreciate the exchange rate given their negative impact on demand. The latter happens whenever monetary policy is sufficiently active in reducing interest rates in response to bad news regarding future productivity. This can be seen by inspection of Figure 1. So while with unanticipated productivity shocks, the value of foreign currency

	Data	Only TFP (1)	Only TFP News (2)	TFP and TFP News (3)
$\bar{\alpha}_{B^*}/\beta\bar{Y}$	0.53	-5.18	4.23	1.10
Std(Y)	1.58	0.79	0.81	1.66
Std(C)/Std(Y)	0.76	0.38	0.26	0.28
Std(I)/Std(Y)	4.55	3.40	3.76	3.70
Std(N)/Std(Y)	0.75	0.47	0.63	0.59
Std(Q)/Std(Y)	3.06	0.69	0.56	0.50
Corr(Y,C)	0.84	0.73	0.77	0.77
Corr(Y,I)	0.91	0.97	0.99	0.98
Corr(Y,N)	0.87	0.54	0.69	0.65
Corr(Y,Y*)	0.44	0.33	0.42	0.42
Corr(C,C*)	0.36	0.46	0.34	0.41
Corr(I,I*)	0.28	0.33	0.33	0.35
Corr(N,N*)	0.40	0.19	0.48	0.46

Notes: Data is from Mandelman et al.(2011) calculated for the U.S and an aggregate of 15 countries for the period between 1973:1 to 2006:4.

Table 2: Bond Portfolio and Business Cycle Moments

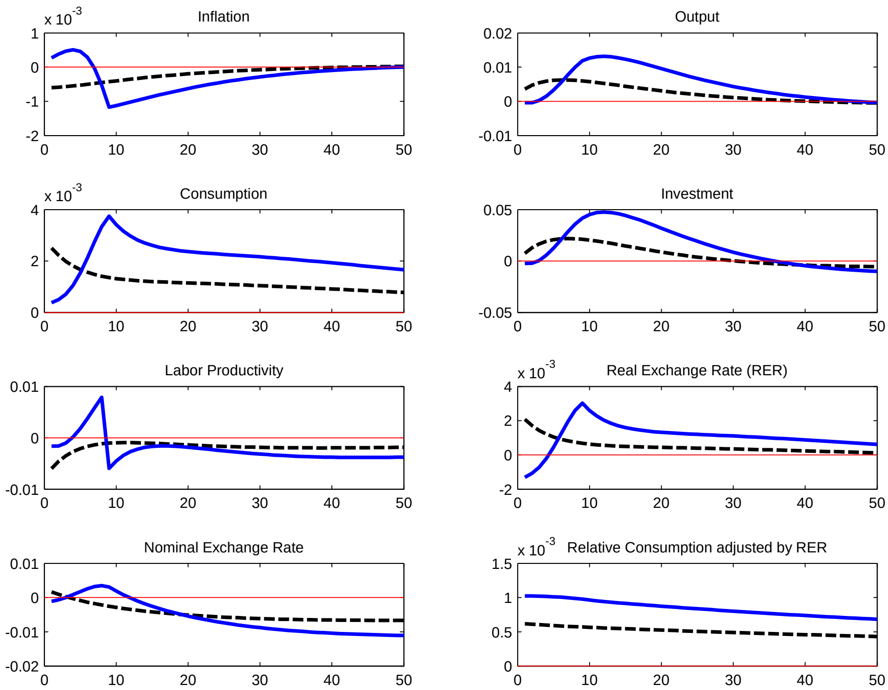

Figure 1: Impulse Responses to Anticipated (News) and Unanticipated Shocks

goes down in periods of relatively low income – implying that foreign currency bond is a bad hedge and should be shortened – the opposite happens when there are anticipated shocks that adversely affect demand. Moreover, the more monetary policy responds to depressed demand by lowering interest rates, the bigger the gains in the value of the foreign currency following adverse news shocks. Thus, as shown in the first column, second row of Figure 2, the equilibrium portfolios turn positive when news shocks are introduced and inflation reaction coefficient in the Taylor rule ϕ_π increases.[16] Figure 3 shows a similar result: the smaller is the response to output – i.e the smaller ϕ_π – and thus the larger the focus of policy on inflation stabilization, the larger (smaller) are the position in foreign bonds when news (productivity) shocks are predominant.

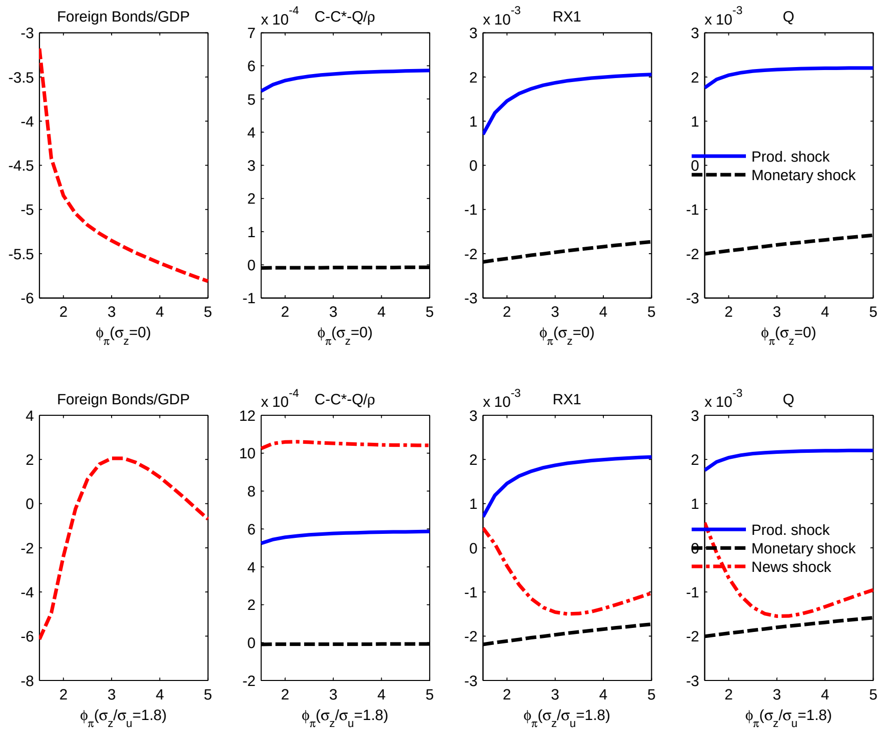

Figure 2: Increase in Inflation Reaction with and without News

Unsurprisingly, Figure 4 shows that the size of countries foreign currency exposure increases with the size of news shocks relative to unanticipated productivity shocks. Overall, since both the composition of shocks and the conduct of monetary policy change the hedging properties of foreign currency, these are crucial determinants of the portfolio position.

Figure 4 also shows that the result that a positive portfolio position can only be obtained when news shocks are relatively important is robust to different monetary policy specifications. In particular, the result is robust to the introduction of interest rate persistence as well as to the inclusion of a small the exchange rate response in the policy rule. Nonetheless, a policy rule with a very strong response to the exchange rate will imply a negative position even if the volatility of news shocks is high relative to unanticipated shocks (see Figure 5). This is because when the central bank is too active in responding to exchange rate movements; it is very effective in offsetting the effect of news shocks on the exchange rate. In this case, macroeconomic volatility is mainly driven by productivity shocks and thus portfolio positions are negative.

Finally, Figure 6 shows that the cyclical properties of the real and nominal exchange rate is highly dependent on the persistence of the news shocks. As shown in Opazo (2006) the magnitude of the demand effect of news shocks depend crucially on the persistence of the

[16] Note that these results are in line with the analytical results obtained for flexible price endowment model derived in section (3.1).

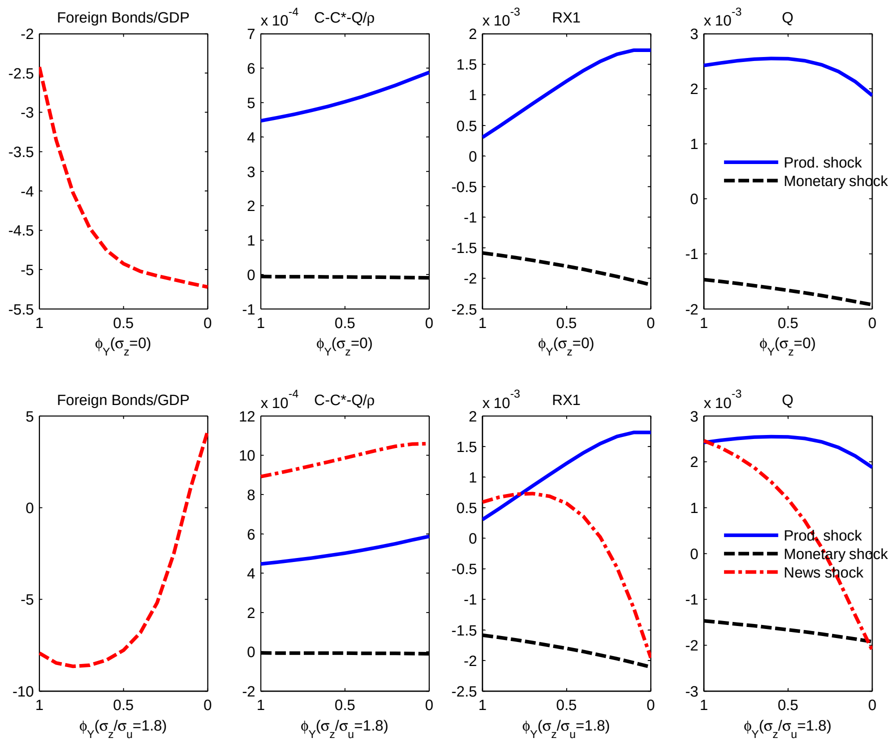

Figure 3: Decrease in Output Reaction with and without News

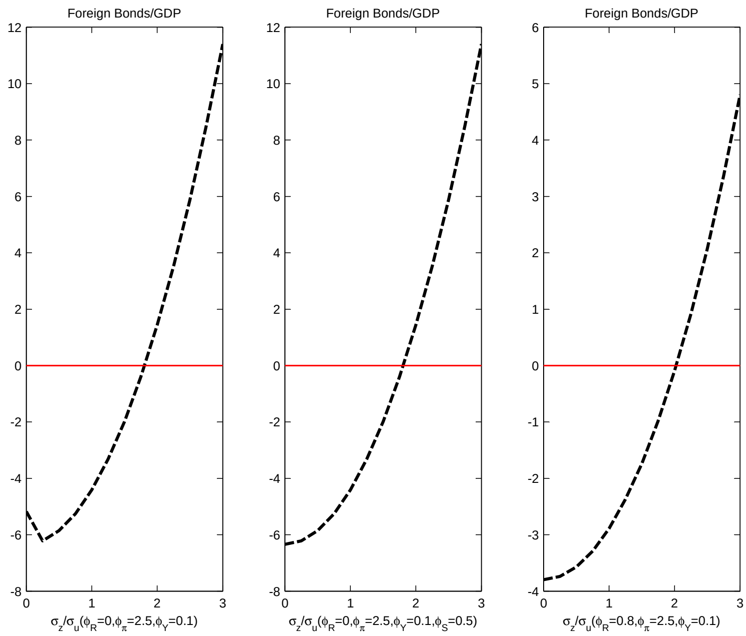

Figure 4: Increase in the Relative Size of News for Different Policy Rules

shocks and the elasticity of substitution between intermediate goods (the latter is consistent with our analytical results). So only persistent news shocks can generate long positions in foreign currency.

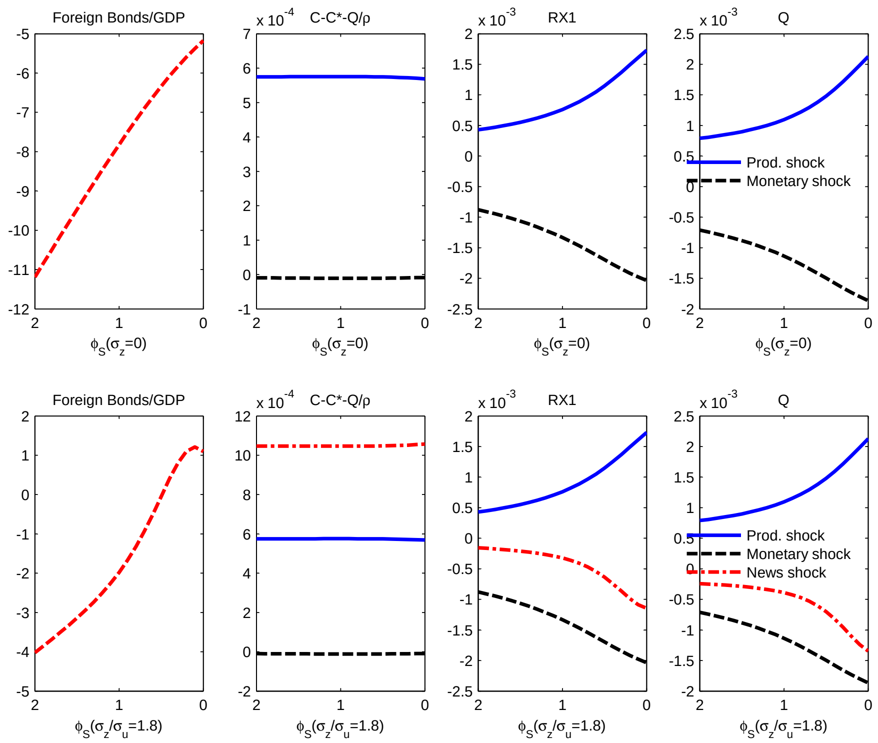

Figure 5: Decrease in Exchange Rate Reaction with and without News

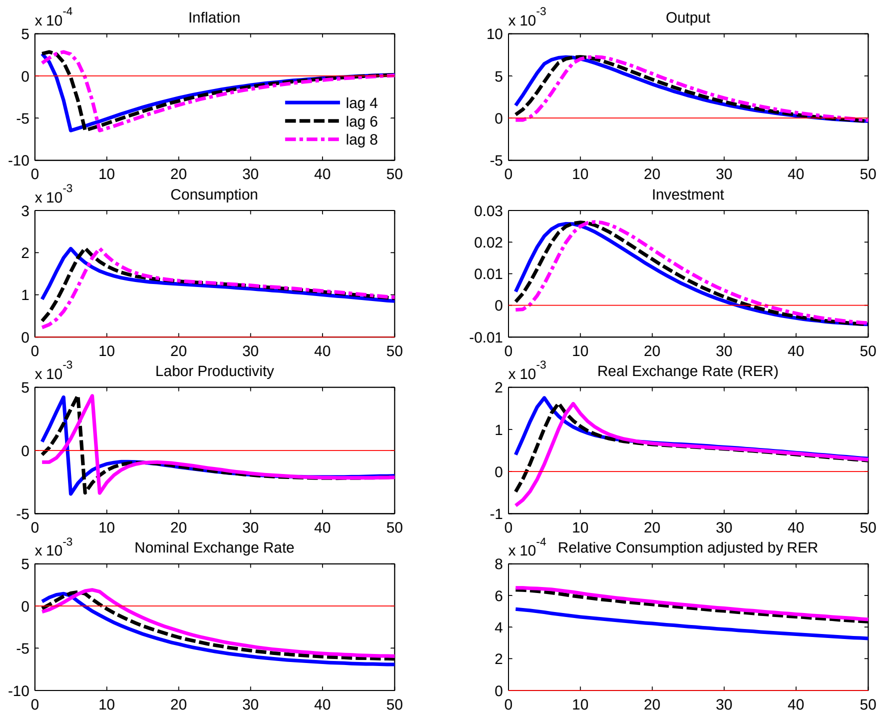

Figure 6: News Shock Transmission for Different Lag Structure of News

5 Conclusion

In this paper we show how an increased focus in price stability in a news-driven business cycle model can reconcile empirical facts on countries' foreign currency portfolio. Our findings are very much in line with the results of Song (2014). In particular, in an estimated model, the author shows how changes in policy regimes as well as changes in the composition of demand versus supply can explain the observed inflation risk premium in the US over the past decades. While Song's endowment economy model is concise enough to allow for an empirical analysis, such analysis would be difficult in our sticky-price production economy model. Nevertheless, an empirical evaluation of the importance of the channels highlighted in this paper – probably using a reduced form econometric method – may be a fruitful avenue for further research.

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