Online Appendix to "Shocks and Exchange Rates in Small Open Economies"

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Contents

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A Data Appendix

Nominal Exchange Rates (s_t, Monthly)

National Currency per U.S. Dollar, period average: Monthly [ENDA_XDC_USD_RATE], retrieved from International Financial Statistics, International Monetary Fund; https://legacydata.imf.org/regular.aspx?key=63140098

Short-term Interest Rates, small open economies (r_k, Monthly) Interest rate data are obtained from Hnatkovska et al. (2016):

Hnatkovska, Viktoria, Amartya Lahiri, and Carlos A. Vegh. 2016. "The Exchange Rate Response to Monetary Policy Innovations: Dataset." American Economic Journal: Macroeconomics. http://dx.doi.org/10.1257/mac.20140362

The interest rates are measured in the data as the period average T-bill rates. If these are not available, discount rates, or money market rates are used. The main data source is the International Financial Statistics (IFS) compiled by the International Monetary Fund (IMF).

Financial, Interest Rates, Government Securities, Treasury Bills, Percent per annum: Monthly [FITB_PA], retrieved from International Financial Statistics, International Monetary Fund; https://legacydata.imf.org/regular.aspx?key=63087881

Financial, Interest Rates, Discount, Percent per annum: Monthly [FID_PA], retrieved from International Financial Statistics, International Monetary Fund; https://legacydata.imf.org/regular.aspx?key=63087881

Financial, Interest Rates, Money Market, Percent per annum: Monthly [FIMM_PA], retrieved from International Financial Statistics, International Monetary Fund; https://legacydata.imf.org/regular.aspx?key=63087881

Short-term Interest Rate, U.S. ($r^{\star}$, Monthly)

Board of Governors of the Federal Reserve System (US), Federal Funds Effective Rate [FEDFUNDS], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/FEDFUNDS

Exchange Rate Regimes Exchange rate regimes are determined according to the historical exchange rate classification in Reinhart and Rogoff (2004), recently updated by Ilzetzki et al.

(2019). A country is deemed to have a flexible exchange rate regime if, in a given year, its exchange rate was either (i) within a moving band that is narrower than or equal to +/-2 percent; or (ii) was classified as managed floating; or (iii) was classified as freely floating; or (iv) was classified as freely falling in Reinhart and Rogoff (2004). We follow Hnatkovska et al. (2016) in including high-income OECD countries irrespective of their exchange rate classification. Source: `https://www.ilzetzki.com/irr-data`. Table A.1 reports the countries and time periods included in the dataset.

Industrial Production, U.S. (Monthly)

Board of Governors of the Federal Reserve System (US), Industrial Production: Total Index [INDPRO], retrieved from FRED, Federal Reserve Bank of St. Louis; `https://fred.stlouisfed.org/series/INDPRO`

Consumer Price Index, U.S. (Monthly)

U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers: All Items in U.S. City Average [CPIAUCSL], retrieved from FRED, Federal Reserve Bank of St. Louis; `https://fred.stlouisfed.org/series/CPIAUCSL`

VIX (Monthly)

Chicago Board Options Exchange, CBOE Volatility Index: VIX [VIXCLS], retrieved from FRED, Federal Reserve Bank of St. Louis; `https://fred.stlouisfed.org/series/VIXCLS`

Net Foreign Asset Positions to GDP (Annual) This paper uses the updated and extended version of the dataset on external assets and liabilities by Lane and Milesi-Ferretti (2007).

Lane, Philip R. and Gian Maria Milesi-Ferretti, 2018, "The External Wealth of Nations Revisited: International Financial Integration in the Aftermath of the Global Financial Crisis," IMF Economic Review 66, 189-222. The data are available at `https://www.brookings.edu/articles/the-external-wealth-of-nations-database/`.

List of Countries and Time Periods Table A.1 lists the countries and time periods included in the empirical analysis of the paper.

Table A.1: Sample of Small Open Economies and their NFA/GDP Positions

Country	Time Period	Avg. NFA/GDP
Australia	1974:1-2010:11	−41.70%
Austria	1974:1-1998:12	−10.20%
Belgium	1974:1-1998:12	−4.5%
Brazil	1999:2-2007:12	−39.20%
Canada	1974:1-2010:11	−28.20%
France	1974:1-1998:12	12.90%
Germany	1975:7-1998:12	9.60%
Indonesia	1997:8-2007:12	−67.60%
Italy	1977:3-1998:12	−7.10%
Japan	1974:1-2010:11	18.90%
Korea, Rep. of	1997:12-2007:12	−14.70%
Mexico	1995:1-2007:12	−35.40%
New Zealand	1978:1-2010:11	−69.20%
Norway	1974:1-2009:5	1.6%
Philippines	1997:7-1999:11	−52.10%
South Africa	1995:3-2007:12	−13.70%
Switzerland	1980:1-2010:11	99.90%
United Kingdom	1974:1-2010:10	−2.5%

B Appendix of Empirical Analysis

B.1 Block Exogeneity Test

This section presents the results from the Block Exogeneity tests on individual countries VARs. The details of the test can be found in Lütkepohl (2005). In the benchmark three-variable VAR, the tests assess whether domestic variables at time t, namely the natural logarithm of the bilateral nominal exchange rate and the domestic interest rate, Granger cause the Federal Funds rate at time $t+1$. Under the null hypothesis, the explanatory power on the Federal Funds rate of unrestricted VAR model is the same as the one from the VAR model in which we impose zero restrictions on the coefficients of past domestic variables in the Federal Funds rate regression. Table B.1 reports the p-values of the following F-statistic for each SOE:

$$F = \frac{(SSR_{rest} - SSR_{unrest})/q}{SSR_{unrest}/(T-k)}$$

where q is the number of parameters restricted to zero, and $T-k$ is the number of degrees of freedom in the unrestricted reduced form equation for the Federal Funds rate. For both the restricted and the unrestricted model we selected the same number of lags that we use in the individual country VARs.

Table B.1: P-values of Block Exogeneity Test

Country	P-value	Country	P-value
Australia	0.17	Austria	0.00
Belgium	0.54	Brazil	0.03
Canada	0.93	France	0.75
Germany	0.02	Indonesia	0.72
Italy	0.00	Japan	0.00
Korea	0.01	Mexico	0.06
New Zealand	0.04	Norway	0.31
Philippines	0.69	South Africa	0.06
Switzerland	0.13	UK	0.00

B.2 Overidentification Test

We ask whether the identified domestic shocks lead to significant movements in the Fed Funds rate ($r_t^\star$). To do so, we estimate the F-statistic of the following regressions for each country:

$$r_t^\star = \alpha + \sum_{k=0}^{K} \delta_k \hat{\epsilon}_{t-k}^d + \eta_t \tag{B.1}$$

where $\hat{\epsilon}_t^d$ is our point estimate of the domestic shock, and K is equal to 24 months.[1] Table B.2 reports the p-values from the F-test. None of the p-values of the test of joint insignificance is smaller than 0.10. This evidence indicates that the identified domestic shocks are indeed not associated to significant movements in the Fed Funds rate ($r_t^\star$).

Table B.2: P-values of F-test with H_0: $\delta_0 = \delta_1 = \cdots = \delta_K = 0$ in Equation (B.1)

Country	P-value	Country	P-value
Australia	0.99	Austria	1.00
Belgium	1.00	Brazil	1.00
Canada	1.00	France	1.00
Germany	1.00	Indonesia	0.79
Italy	1.00	Japan	0.99
Korea	0.32	Mexico	1.00
New Zealand	1.00	Norway	1.00
Philippines	0.17	South Africa	1.00
Switzerland	1.00	UK	1.00

B.3 VAR Informational Sufficiency Test

We follow Forni and Gambetti (2014) and test the null of informational sufficiency of the main external shock. We identify the main external shock using the 3-variable VAR specification including the Federal Funds rate, the short-term interest rate of SOE, and the logarithm of the bilateral nominal exchange rate between the SOE and the U.S. dollar. Table B.3 reports the p-values of the F-test of a regression of the main external shock on four lags of up to five principal components extracted from a large monthly dataset of U.S. variables.

[1] For Phillippines, we set $K = 12$ months to avoid running out of degrees of freedom.

Table B.3: Information sufficiency test (Forni and Gambetti, 2014)

	P-value of F-statistic						
	P.C.=1	P.C.=3	P.C.=5		P.C.=1	P.C.=3	P.C.=5
Australia	0.18	0.07	0.19	Austria	0.23	0.07	0.28
Belgium	0.33	0.26	0.15	Brazil	0.77	0.77	0.87
Canada	0.29	0.84	0.94	France	0.40	0.31	0.57
Germany	0.60	0.20	0.40	Indonesia	0.99	1.00	1.00
Italy	0.57	0.80	0.84	Japan	0.67	0.09	0.23
Korea	0.00	0.01	0.06	Mexico	0.35	0.50	0.46
New Zealand	0.70	0.86	0.96	Norway	0.71	0.83	0.53
Philippines	0.54	0.67	0.41	South Africa	0.68	0.84	0.22
Switzerland	0.65	0.23	0.27	UK	0.67	0.41	0.12

Notes: The table reports the p-values of the F-test of a regression of the main external shock on four lags of up to five principal components extracted from a large monthly dataset of U.S. variables.

B.4 Main External Shock: Additional Evidence

Figure B.1 shows the fraction of the k-month-ahead forecast variance of exchange rate as a fraction of the total external variance, as k goes from 0 to 24.

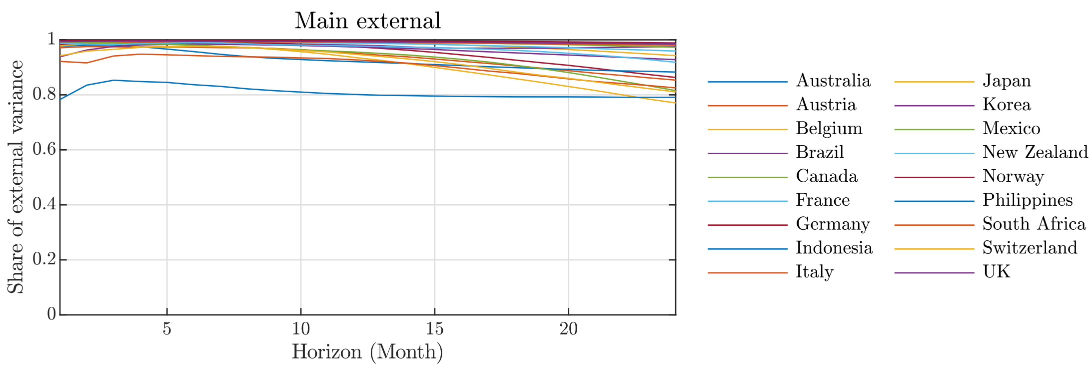


Figure B.1: Share of Total External Variance of Exchange Rate Due to Main External Shock

Notes: The plot reports the fraction of the forecast error variance of exchange rates explained by the main external shock, as a share of the total external variance.

B.5 NFA and Exchange Rate Dynamics in Advanced SOEs

Figure B.2 illustrates the median responses to the main external shock of the advanced economies with a positive average NFA/GDP position and those with a negative average NFA/GDP position.

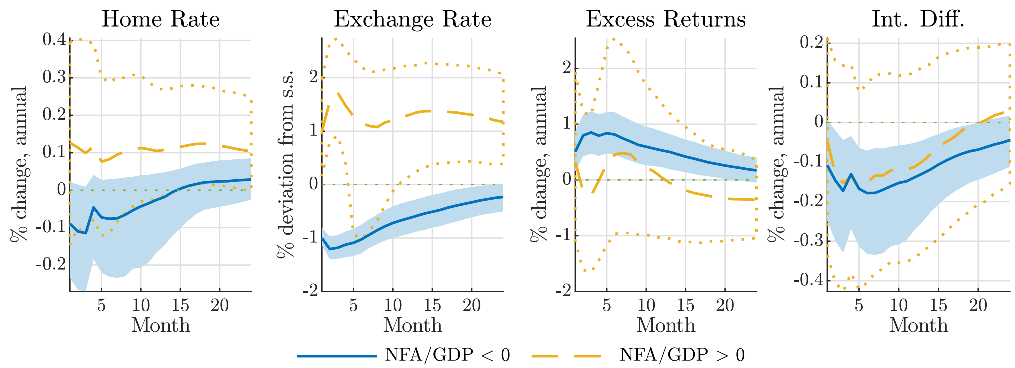


Figure B.2: Empirical Impulse Responses to Main External Shock, by NFA/GDP (Subsample of Advanced SOEs)

Notes: The lines denote median IRFs by group of advanced economies (Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, New Zealand, Norway, Switzerland, and United Kingdom) with corresponding 68% confidence intervals from 4000 bias-corrected bootstrap replications of the reduced-form VAR. Countries are grouped according to their period average NFA/GDP position. The external shock is normalized to have the same six-month-ahead response on the Federal Funds rate across all countries within each group. Excess returns are one-year ahead expected excess returns on the foreign currency. Each period is a month.

C Model Appendix

C.1 Solution to Traders' Problem

At the beginning of each period, all members of a household are identical. During the period, the members are separated from each other, and each member receives a shock that determines her role in the period. A random share m of foreign households operates as traders in the international financial market.

These traders adopt a zero-capital carry trade strategy by taking a long position in the home-currency bond and a short position of equal value in the foreign-currency bond or vice versa. The return on the carry trade is given by:

$$R_t - R_t^{\star}\frac{S_{t+1}}{S_t}$$

per unit of home-currency invested in the home-currency bond and $\frac{1}{S_t}$ foreign currency sold of the foreign-currency bond at time t. We denote the size of individual position by d_{t+1}, which may take positive or negative values.

We assume that traders choose their individual position d_{t+1} to maximize a constant relative risk aversion (CRRA) utility over home-currency returns. That is,

$$\max_{d_{t+1}} \mathrm{E}_t\left[\frac{\left(\iota + \left(R_t - R_t^{\star}\frac{S_{t+1}}{S_t}\right)\frac{d_{t+1}}{R_t}\right)^{1-\omega_t}}{1-\omega_t}\right] \tag{C.1}$$

where ι denotes a constant intra-household transfer (in home currency) that ensures that the argument of the trader's utility is always non-negative.

Below we follow Campbell and Viceira (2002, Chapter 2) to show that the CRRA utility has a mean-variance representation (see also Branson and Henderson (1985)). First, rewrite equation (C.1) as:

$$\max_{d_{t+1}} \mathrm{E}_t\left[\frac{\exp\left\{(1-\omega_t)\log(\iota + \widetilde{R}_{t+1}d_{t+1})\right\}}{1-\omega_t}\right] \tag{C.2}$$

where $\widetilde{R}_{t+1} = 1 - \frac{R_t^{\star}}{R_t}\frac{S_{t+1}}{S_t}$.

Second, take second-order Taylor expansion of $\log(\iota + \widetilde{R}_{t+1}d_{t+1})$ around $\widetilde{R} = 0$, and set

$\iota = 1$. That is:

$$\log(\iota + \widetilde{R}_{t+1}d_{t+1}) \approx d_{t+1}\widetilde{R}_{t+1} - \frac{d_{t+1}^2}{2}\widetilde{R}_{t+1}^2 \approx d_{t+1}\widetilde{R}_{t+1} - \frac{d_{t+1}^2}{2}\,\mathrm{Var}_t(\widetilde{R}_{t+1}) \tag{C.3}$$

where we replaced $\widetilde{R}_{t+1}^2$ with the conditional variance of $\widetilde{R}_{t+1}$ since $\mathrm{E}_t[\widetilde{R}_{t+1}]^2 \approx 0$ in our point of approximation. Note also that as the time interval shrinks, the higher order terms that are dropped from eq. (C.2) become negligible relative to those that are included, and the deviation of $\widetilde{R}_{t+1}^2$ from $\mathrm{Var}_t(\widetilde{R}_{t+1})$ also become negligible. In particular in the limit of continuous time the approximation is exact and can be derived using Ito's Lemma. Then, using eq. (C.3), eq. (C.2) can be approximated as:

$$\max_{d_{t+1}} \mathrm{E}_t \left[\frac{\exp\left\{(1-\omega_t)\left(d_{t+1}\widetilde{R}_{t+1} - \frac{d_{t+1}^2}{2}\,\mathrm{Var}_t(\widetilde{R}_{t+1})\right)\right\}}{1-\omega_t} \right]. \tag{C.4}$$

Under the assumption that $\widetilde{R}_{t+1}$ is normally distributed, we can rewrite (C.4) as:

$$\max_{d_{t+1}} \mathrm{E}_t[\widetilde{R}_{t+1}]d_{t+1} - \frac{\omega_t}{2}\,\mathrm{Var}_t(\widetilde{R}_{t+1})d_{t+1}^2,$$

with the solution to the individual trader's asset decision:

$$d_{t+1} = \frac{\mathrm{E}_t\,\widetilde{R}_{t+1}}{\omega_t\,\mathrm{Var}_t(\widetilde{R}_{t+1})}. \tag{C.5}$$

To obtain the aggregate trader's equilibrium demand, aggregate eq. (C.5) over the measure m of traders. The aggregate demand for home-currency bonds is thus:

$$\widetilde{D}_{t+1} = \frac{m}{\omega_t}\frac{\mathrm{E}_t\,\widetilde{R}_{t+1}}{\mathrm{Var}_t(\widetilde{R}_{t+1})} \tag{C.6}$$

where $\widetilde{D}_{t+1}$ is the financial sector's home-currency bond position.

Financial market clearing requires that interest rates R_t and $R_t^\star$ adjust so that, in both bond markets, the traders' position equates the respective households' demand for bonds. Home bond market clearing and foreign bond market clearing require $nB_{t+1} = -\widetilde{D}_{t+1}$ and $(1-n)B_{t+1}^\star = -\widetilde{D}_{t+1}^\star$, respectively. In the home country, B_{t+1} (nB_{t+1}) denotes the per-capita (aggregate) household bond demand, while $\widetilde{D}_{t+1}$ denotes the financial sector collective position's in the home bond. In addition, in the aggregate, the equilibrium net foreign asset position of the home economy equals the net foreign liabilities of foreign economy, that is $nB_{t+1} = -(1-n)B^{\star}_{t+1}S_t$.

Therefore, equation (C.6) becomes:

$$\frac{B_{t+1}}{Y} = -\frac{\mu}{\omega_t}\frac{\mathrm{E}_t\,\widetilde{R}_{t+1}}{\mathrm{Var}_t(\widetilde{R}_{t+1})}. \tag{C.7}$$

where we used the fact that the size of traders is proportional to the size of the small open economy, nY. That is, $m = \mu nY$, implying that the bonds issued by larger economies are intermediated by a larger financial sector.

We solve the model using a first-order approximation around a risky steady state that allows for a non-zero NFA. The linearized version of the traders' bond demand (eq. (C.7)) reads:

$$(r_t - r^{\star}_t) - \mathrm{E}_t\,\Delta s_{t+1} = -\chi\left(\frac{B}{Y}\xi_t + b_{t+1}\right) \tag{C.8}$$

or, equivalently:

$$\mathrm{E}_t\,\Delta s_{t+1} - (r_t - r^{\star}_t) = \chi\left(\frac{B}{Y}\xi_t + b_{t+1}\right) \tag{C.9}$$

where $\chi \equiv \sigma_s^2/(\mu/\omega)$ governs traders' steady-state risk bearing capacity, and B/Y is the steady-state NFA/GDP of the home economy (that is, the small open economy). Note that σ^2/μ is the quantity of risk per intermediary and ω is their aversion to risk; alternatively, ω/μ can be viewed as the effective risk aversion of the whole sector of intermediaries who jointly hold all exchange rate risk. This is equation (13) in the paper.

C.2 Model Solution

The model can be represented as the following system of equations:

$$\mathrm{E}_t\left[f(X_{t+1})\right] = 0$$

where X_{t+1} contains all the variables in the model (including variables dated at time t and $t-1$) and f has as many rows as endogenous variables in the model. The risky steady state (Coeurdacier et al., 2011) is obtained by taking a second-order approximation of f around

$\mathrm{E}_t\, X_{t+1}$:

$$\Phi\left(\mathrm{E}_t\, X_{t+1}\right) = f\left(\mathrm{E}_t\, X_{t+1}\right) + \mathrm{E}_t\left[f''\left[X_{t+1} - \mathrm{E}_t\, X_{t+1}\right]^2\right]$$

where f'' is also evaluated at $\mathrm{E}_t\, X_{t+1}$. The risky steady state, $\mathtt{X}$, is then characterized by $\Phi\left(\mathtt{X}\right) = 0$, and the second moments $\mathrm{E}_t\left[f''\left[X_{t+1} - \mathrm{E}_t\, X_{t+1}\right]^2\right]$ are generated by the linear dynamics around $\mathtt{X}$.

The model's solution thus consists in a log-linear approximation around a risky steady state that is consistent with the second moments generated by the log-linear dynamics around it. This is achieved through an iterative algorithm, along the lines of Coeurdacier et al. (2011).

C.3 Derivations of Model with Shocks to Dollar Demand

To accommodate shocks to the demand for dollar bonds (dollar-specific shocks) we make minimal changes to the micro-foundations of the baseline setting. As in the baseline, we consider a two-country SOE dynamic general equilibrium model that consists of two countries: the SOE and a large economy which is interpreted as the U.S.; asset markets are both incomplete and segmented, and the only assets available in the economy are two nominal riskless bonds denominated in home and foreign currency. Unlike in the baseline economy, we assume that the SOE households can only trade their local bond, U.S. households can trade U.S. bonds, and a subset of U.S. households can trade SOE bonds. Besides, U.S. households display time-varying preferences for U.S. bonds.

The problem of the SOE household is identical to the one in the baseline model. Instead, the lifetime utility of the U.S. household reads:

$$\mathrm{E}_t \sum_{j=0}^{\infty} \beta^{\star j}\left[\frac{C_t^{\star 1-\omega}}{1-\omega} - \frac{N_t^{\star 1+\eta}}{1+\eta} + \log(\xi_t^{\$}) V\left(\frac{B_{t+1}^{\star}}{P_t^{\star}}\right)\right] \tag{C.10}$$

As in Eichenbaum et al. (2020), the function V governs the utility flow from dollar-denominated U.S. bond holdings, $B_{t+1}^{\star}/P_t^{\star}$. The variable $\xi_t^{\$}$ is a shock to the utility that the U.S. household derives from holding those bonds. For convenience, we assume that $\log(\xi_t^{\$})$ is zero in steady state, so the steady-state utility flow from the bonds is zero. Outside of steady state, there may be shocks, reflecting flights to safety or liquidity concerns, that put a premium on dollar-denominated bonds (see also Kekre and Lenel, 2024).

The foreign household's flow budget constraint is:

$$B_{t+1}^{\star} + \frac{B_{F,t+1}}{S_t} + P_t^{\star} C_t^{\star} + \frac{\delta}{m}\frac{1}{2}\left(\frac{B_{F,t+1} - B_F}{S_t}\right)^2 = W_t^{\star} N_t^{\star} + B_t^{\star} R_{t-1}^{\star} + \frac{B_{F,t}}{S_t} R_{t-1} \tag{C.11}$$

where, following Turnovsky (1985) and Benigno (2009), we assume that the subset of households incur a quadratic cost in changing its real asset position with respect to a constant value (B_F) when trading bonds from abroad, $B_{F,t+1}$. This cost is proportional to m, which is the share of U.S. households that trade bond internationally. The assumption of portfolio adjustment costs guarantees the stationarity of net foreign asset positions.[2]

The first-oder conditions with respect to $B_{t+1}^{\star}$ and $B_{F,t+1}$ are, respectively:

$$\beta^{\star} \, \mathrm{E}_t \left[\left(\frac{\lambda_{t+1}^{\star}}{\lambda_t^{\star}} \right) \frac{R_t^{\star}}{\Pi_{t+1}^{\star}} \right] = 1 - \frac{\log(\xi_t^{\$})}{\lambda_t^{\star}} V' \left(\frac{B_{t+1}^{\star}}{P_t^{\star}} \right)$$

$$\beta^{\star} \, \mathrm{E}_t \left[\left(\frac{\lambda_{t+1}^{\star}}{\lambda_t^{\star}} \right) \frac{S_t}{S_{t+1}} \frac{R_t}{\Pi_{t+1}^{\star}} \right] = 1 + \frac{\delta}{m} \left(\frac{B_{F,t+1} - B_F}{P_t S_t} \right)$$

We then combine and log-linearize the last two equations to obtain:[3]

$$\mathrm{E}_t \, \Delta s_{t+1} - (r_t - r_t^{\star}) = \tilde{\chi} b_{t+1} - \xi_t^{\$} \tag{C.12}$$

where $\tilde{\chi} = \frac{\delta}{\mu}$. To maximize comparability with the baseline model, in our simulations we parametrize δ such that $\tilde{\chi}$ in equation (C.12) is equal to χ from equation (13) in the paper.

The shock that shifts the demand of dollar bonds evolves according to the following autoregressive process:

$$\xi_t^{\$} = \rho_{\xi^{\$}} \xi_{t-1}^{\$} + \varepsilon_{\xi^{\$},t} \tag{C.13}$$

where $\varepsilon_{\xi^{\$},t}$ are i.i.d. disturbances drawn from a Normal distribution with mean zero and standard deviation $\sigma_{\xi^{\$}}$.

The rest of the model is identical to the baseline model presented in Section IV of the paper.

[2] Because only U.S. households can trade the bond of the SOE, $B_{t+1} + B_{F,t+1} = 0$.

[3] We follow Eichenbaum et al. (2020) and assume that the function V is increasing and strictly concave, and that $V'(0) = \lambda^{\star}$. This assumption is equivalent to a normalization that implies that $\xi_t^{\$}$ enters the intertemporal Euler equation with a coefficient of unity. Without loss of generality, we derive equation (C.12) under $\beta \approx 1$.

C.4 Variance Decomposition

Table C.1 reports the median 12-months ahead forecast error variance explained by the model structural shocks, with interquartile ranges reported in parentheses, under the calibration described in Section IV of the paper.

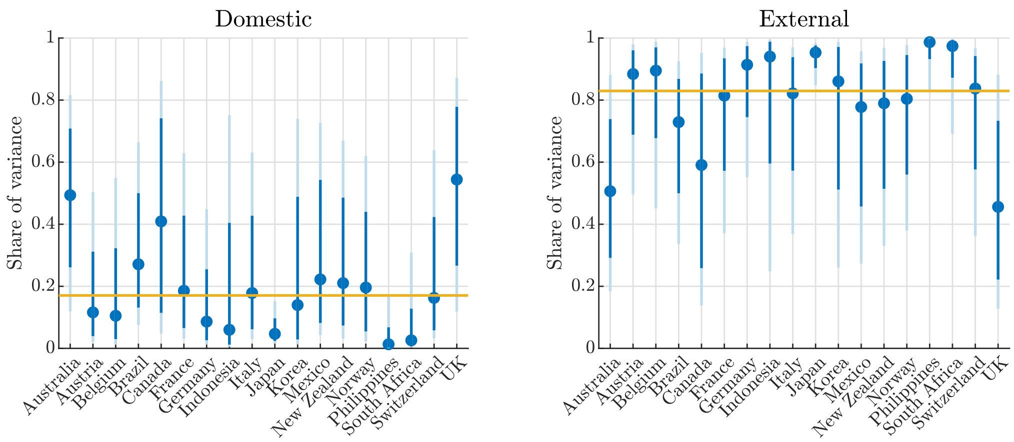
Table C.1: Theoretical Forecast-error Variance Decomposition

	Domestic shocks		External shocks		
	Home MP	Home Tech.	Foreign MP	Foreign Tech.	Global risk aver.
Foreign Consumption	0%	0%	1%	14%	84%
Foreign Interest Rate	0%	0%	10%	54%	36%
Home Consumption	20%	6%	0%	2%	72%
	[7%, 33%]	[1%, 8%]	[0%, 0%]	[0%, 2%]	[56%, 91%]
Home Interest Rate	18%	3%	0%	1%	78%
	[4%, 61%]	[0%, 9%]	[0%, 0%]	[0%, 3%]	[26%, 96%]
Exchange Rate	18%	0%	1%	0%	81%
	[1%, 50%]	[0%, 1%]	[0%, 2%]	[0%, 1%]	[47%, 99%]
Expected Excess Returns	0%	0%	0%	0%	100%
	[0%, 0%]	[0%, 0%]	[0%, 0%]	[0%, 0%]	[100%, 100%]
Realized Excess Returns	17%	0%	1%	0%	82%
	[1%, 49%]	[0%, 1%]	[0%, 2%]	[0%, 1%]	[48%, 99%]

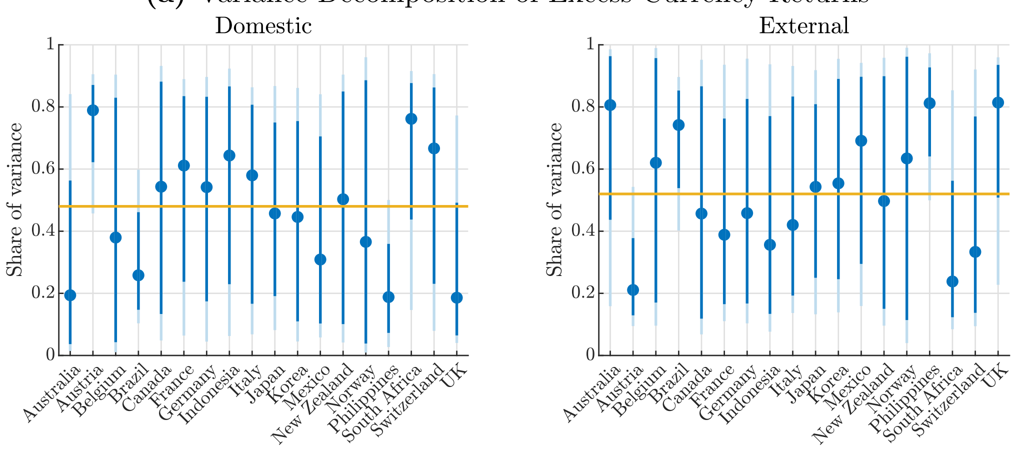
Notes: The table reports the median 12-months ahead forecast error variance explained by the model structural shocks. We report the first and fourth quintile of the country medians in parentheses. The calibration is reported in Section IV of the paper.

D Results using First Log-difference of Exchange Rates

The figures and tables in this Appendix section reproduce the paper's analysis using VARs in which we replace the log-level of the nominal exchange rate with its first difference. Specifically, we run individual country VARs including the vector of endogenous variables $Y_t \equiv [r_t^\star \;\; r_{k,t} \;\; \Delta s_t]'$. The identification procedure exactly follows the one described in Section I of the paper. The correlation between the common external shock extracted from the two VAR specifications is around 91% (see Figure D.7).



(a) Variance Decomposition of Excess Currency Returns



(b) Variance Decomposition of Exchange Rate Changes

Figure D.1: Variance Decomposition of Excess Currency Returns and Exchange Rates Changes

Notes: The plot reports the fraction of the one-year-ahead forecast error variance of excess currency returns (Figure D.1a) and exchange rates (Figure D.1b) explained by domestic and external shocks. For each country, we report the median value of the coefficient along with 68% (dark) and 90% (light) confidence intervals from 4000 bias-corrected bootstrap replications of the reduced-form VAR. The horizontal lines depict the median estimates across countries.

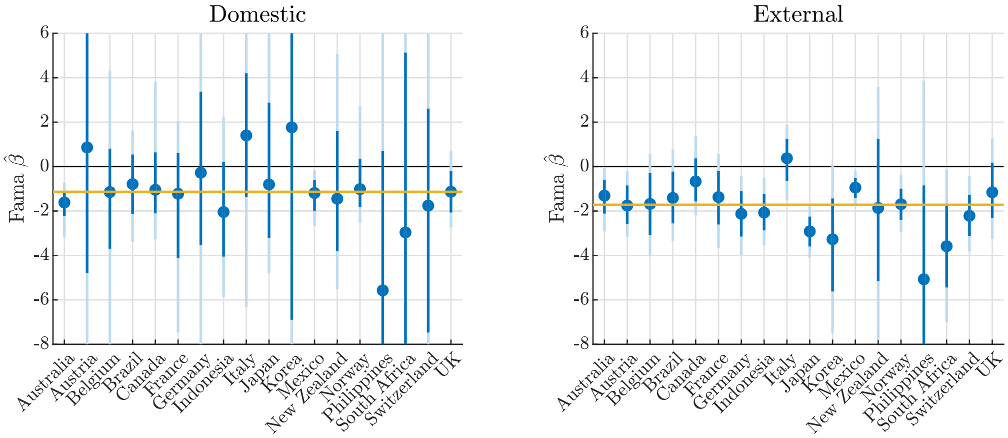


Figure D.2: Forward Premium Puzzle

Notes: The figure reports the UIP regression coefficients, $\hat{\beta}$, in conditional versions of the Fama's (1984) regression. For each country, we report the median value of the coefficient along with 68% (dark) and 90% (light) confidence intervals from 4000 bias-corrected bootstrap replications of the reduced-form VAR. The horizontal lines depict the median estimates across countries.

Table D.1: Conditional Properties of Fama β

(a) Fama β: Data vs. Model

VAR empirical data		VAR simulated data		Theoretical moments	
Domestic	External	Domestic	External	Domestic	External
-1.14 $[-1.74, -0.33]$	-1.72 $[-2.85, -1.17]$	3.67 $[-3.58, 8.48]$	-3.94 $[-4.81, -1.79]$	0.12 [0.08, 0.21]	-2.45 $[-2.77, -2.00]$

(b) Fama β: Theoretical Moments by Structural Shock

Domestic shocks		External shocks		
Home MP	Home TFP	Foreign MP	Foreign TFP	Global risk aver.
0.13 [0.09, 0.21]	0.05 [0.03, 0.13]	0.13 [0.09, 0.27]	0.06 [0.04, 0.15]	-2.78 $[-2.94, -2.52]$

Note: The table reports the median estimates across SOEs for the Fama β, conditional on domestic and external shocks. We report the first and fourth quintile of the country medians in parentheses. Table D.1a reports the moments obtained by applying the VAR decomposition to both the data (columns 1-2) and model-simulated data (columns 3-4), as well as the theoretical moments conditional on domestic and external shocks (columns 5-6). Table D.1b reports the theoretical moments conditional on each of the model's five structural shocks.

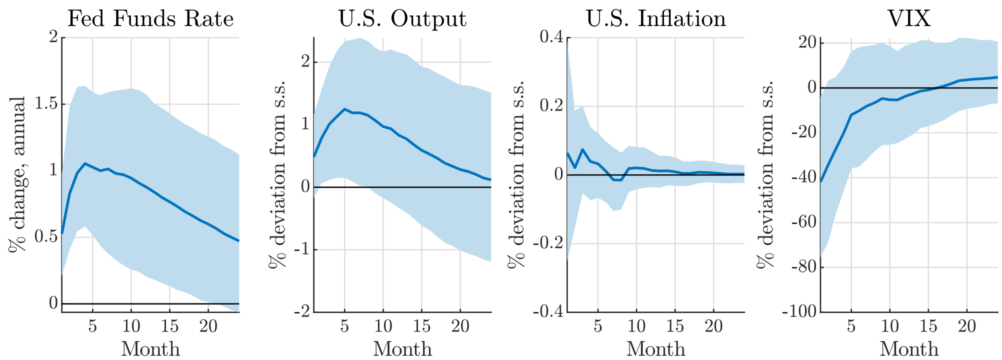


Figure D.3: Empirical Impulse Responses of External Variables to Main External Shock

Notes: This figure depicts the estimated IRFs to an external shock in VARs that include a set of external variables. We run 4-variable VARs including the three baseline variables and either U.S. industrial production, U.S. CPI inflation, or the VIX ordered fourth. The lines denote median IRFs across countries and VAR specification. The external shock is normalized to have the same six-month-ahead response on the Federal Funds rate across all countries. The shaded areas are the corresponding 90% confidence intervals from 2000 bias-corrected bootstrap replications of the reduced-form VAR.

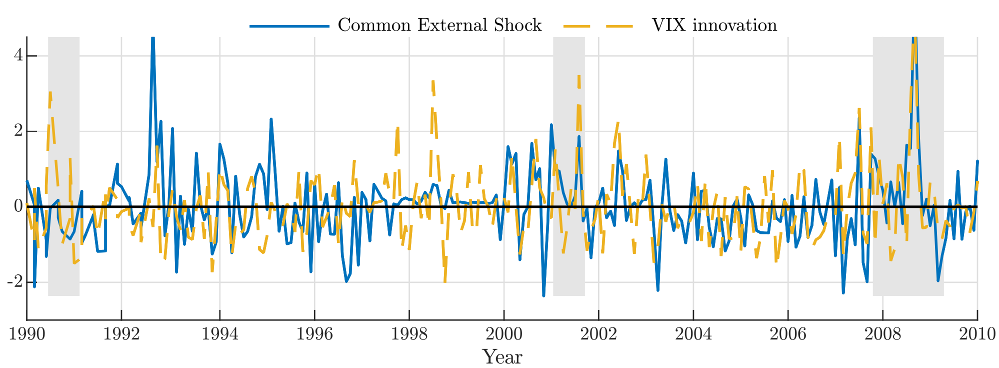


Figure D.4: Empirical Impulse Responses of External Variables to Main External Shock

Notes: The figure plots the first principal component of the main external shocks across countries and the innovation in the VIX. The latter is computed as the residual of an AR(1) process for the VIX.

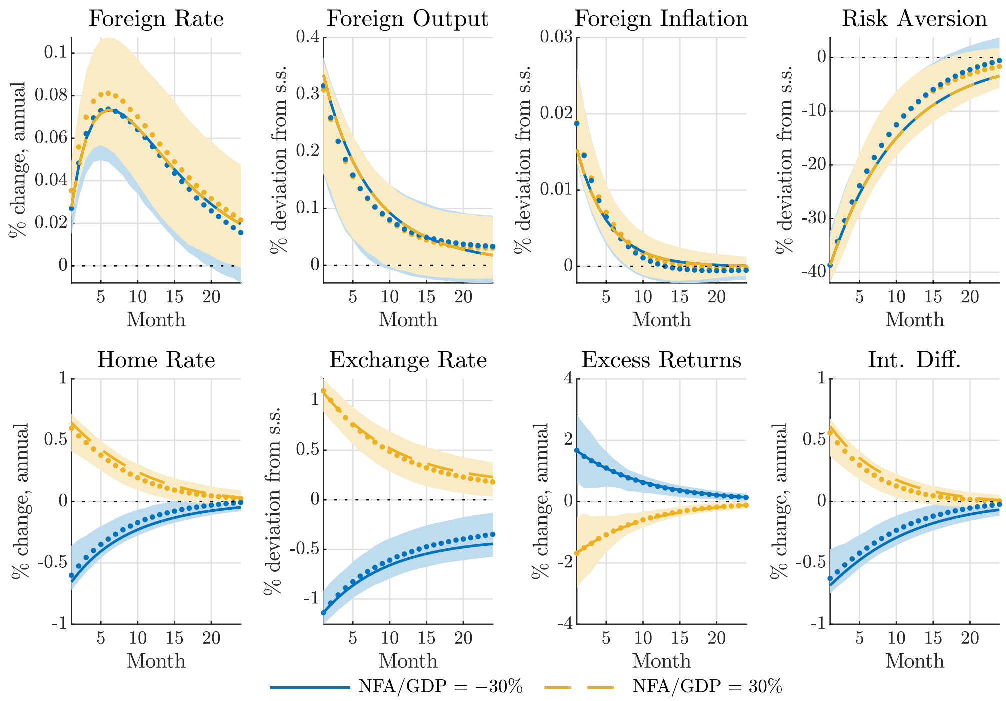


Figure D.5: IRFs to a Temporary Reduction in Global Risk Aversion

Notes: The figure depicts the theoretical impulse responses to an unanticipated reduction in the degree of global risk aversion. We report IRFs for calibrations to the average NFA/GDP among net debtor countries (−30%, solid line), and to the average NFA/GDP among net lender countries (+30%, dashed line). Excess returns are one-period ahead expected excess returns on the foreign currency. The figure also depicts the impulse responses to the main external shock identified by the VAR on model-simulated data. The dotted lines represent the point estimates; the shaded areas represent the corresponding 68% confidence intervals. Each period is a month.

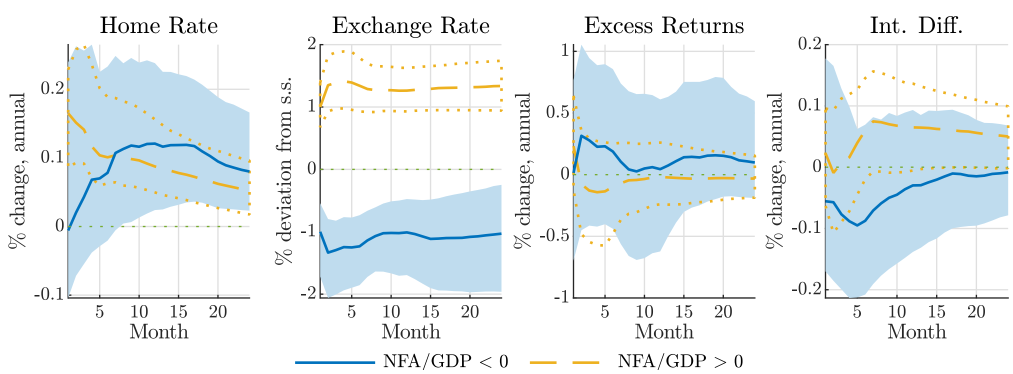


Figure D.6: Empirical Impulse Responses to an External Shock, by NFA/GDP

Notes: The lines denote median IRFs by group of countries with corresponding 68% confidence intervals from 4000 bias-corrected bootstrap replications of the reduced-form VAR. Countries are grouped according to their period average NFA/GDP position. The external shock is normalized to have the same six-month-ahead response on the Federal Funds rate across all countries within each group. Excess returns are one-year ahead expected excess returns on the foreign currency. Each period is a month.

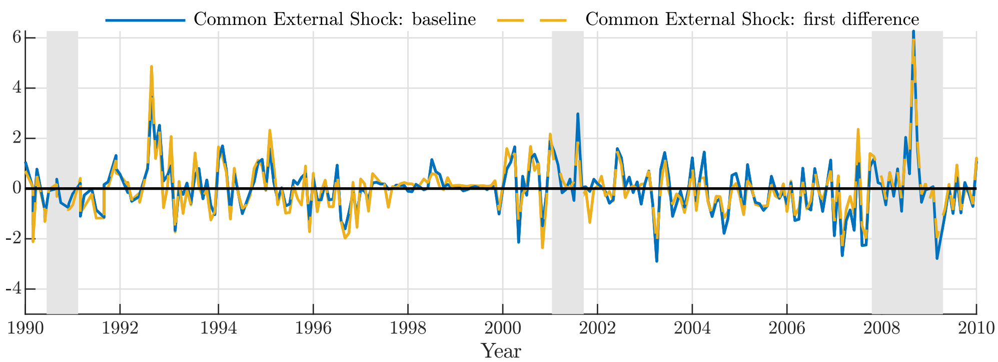


Figure D.7: Comparison of External Shock Series across VAR Specifications

Notes: The figure plots the first principal component of the main external shocks across countries under the level specification and first-difference specification.

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