How important is global r-star for open economies?

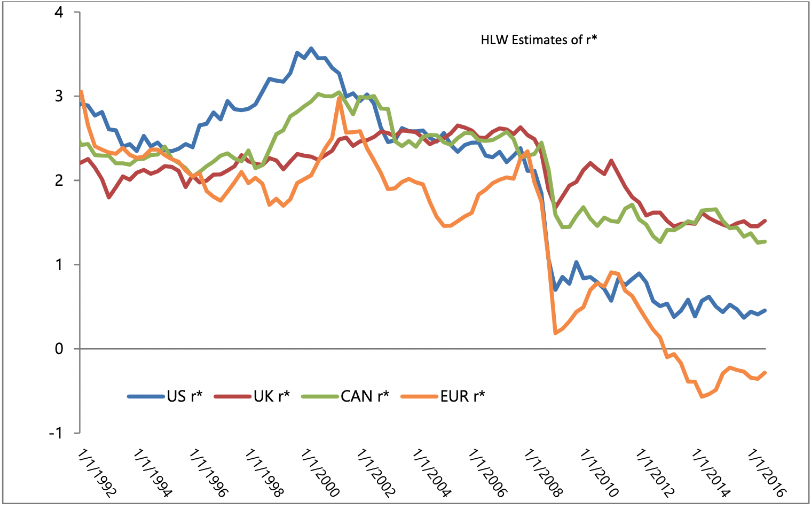
James Morley* Benjamin Wong†

*The University of Sydney

†Monash University

Melbourne Macro Policy Meeting
30 - 31 October 2025

Figure 1: HLW Estimates of r*



Source: Clarida (2019)

NY Fed estimates for US, Canada, and Euro Area

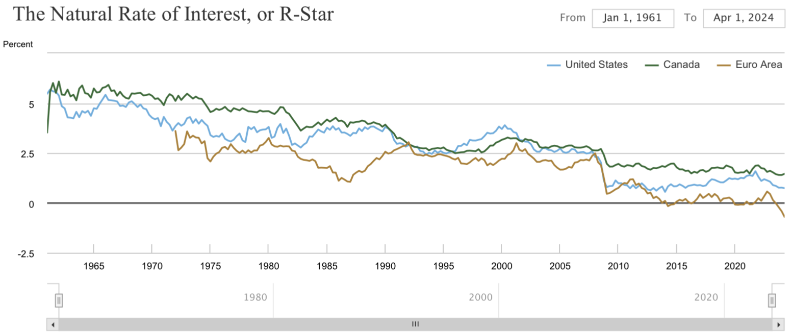
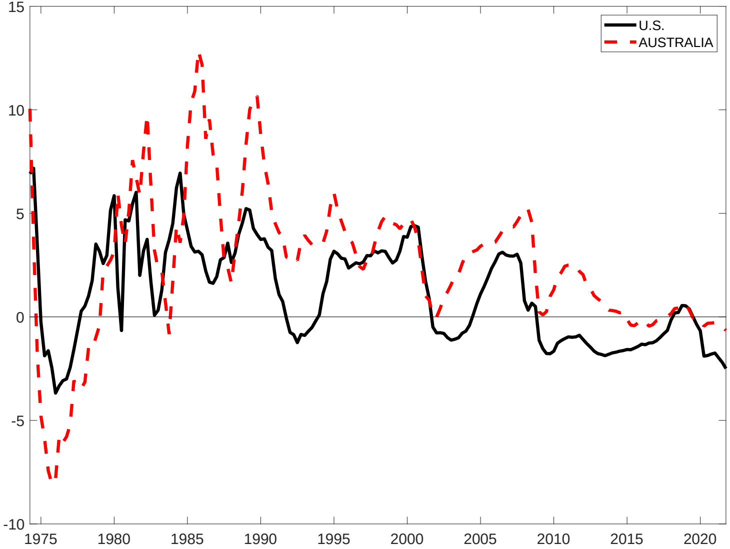


Figure: 3 month real interest rate



Contribution

- We quantify the role of domestic and foreign shocks in driving r^*.

Model

- Extends Morley, Tran and Wong (2024) into an open economy context by jointly estimate U.S. and small open economy r^*.
- Relatively standard open economy model with foreign and domestic block and block exogeneity.
  - r^* is a driftless random walk. Beveridge-Nelson decomposition and Morley, Tran and Wong (2024) correction identifies the trend (i.e. r^*).
  - Block exogeneity identifies the foreign and domestic shocks (see Zha 2008, Justiniano and Preston, 2010, Kamber and Wong 2020).
  - Use Morley and Wong (2020) decomposition to decompose r^* into domestic and foreign shocks.

Estimated on Australia, Canada, Euro Area, New Zealand, Norway, Sweden and U.K.

- U.S. r^* is a good approximation of global r^* for the domestic small open economy.
- Foreign shocks explain a lot of (or most of) domestic r^*, but domestic shocks matter too (non-trivially).

Plan for rest of talk

- Framework
- The BN decomposition and the Morley, Tran and Wong (2024) correction
- Empirical model
- Results

Simple structure adapted from Del Negro et al. (2019)

$$\mathbb{E}_t \left[M_{t+1}^{U.S.} (1 + \chi_t^{US\$})(1 + i_t^{US\$}) \frac{P_t^{US}}{P_{t+1}^{US}} \right] = 1$$

M_t : marginal rate of substitution (stochastic discount factor)
i_t^j: Country j's risk-free interest rate
χ_t^j: premium associated with country j's asset
S_t: Nominal exchange rate
P_t^j: Price level of country j

Simple structure adapted from Del Negro et al. (2019)

$$\mathbb{E}_t \left[M_{t+1}^{U.S.} (1 + \chi_t^{US\$})(1 + i_t^{US\$}) \frac{P_t^{US}}{P_{t+1}^{US}} \right] = 1$$

$$\mathbb{E}_t \left[M_{t+1}^{US} (1 + \chi_t^{C\$})(1 + i_t^{C\$}) \frac{S_{t+1}}{S_t} \frac{P_t^{US}}{P_{t+1}^{US}} \right] = 1$$

M_t : marginal rate of substitution (stochastic discount factor)
i_t^j: Country j's risk-free interest rate
χ_t^j: premium associated with country j's asset
S_t: Nominal exchange rate
P_t^j: Price level of country j

Simple structure adapted from Del Negro et al. (2019)

$$\mathbb{E}_t\left[M_{t+1}^{U.S.}(1+\chi_t^{US\$})(1+i_t^{US\$})\frac{P_t^{US}}{P_{t+1}^{US}}\right]=1$$

$$\mathbb{E}_t\left[M_{t+1}^{US}(1+\chi_t^{C\$})(1+i_t^{C\$})\frac{S_{t+1}}{S_t}\frac{P_t^{US}}{P_{t+1}^{US}}\right]=1$$

$$\underbrace{i_t^{US\$}-\mathbb{E}_t\left[\pi_{t+1}^{U.S.}\right]}_{r_{U.S.,t}} = m_t^{U.S.}-\chi_t^{US\$}$$

$$\underbrace{i_t^{C\$}-\mathbb{E}_t\left[\pi_{t+1}^{C}\right]}_{r_{Can,t}} = m_t^{U.S.}-\chi_t^{C\$}-\mathbb{E}_t\left[\Delta q_{t+1}\right]$$

M_t : marginal rate of substitution (stochastic discount factor)
i_t^j: Country j's risk-free interest rate
χ_t^j: premium associated with country j's asset
S_t: Nominal exchange rate
P_t^j: Price level of country j
π_t^j: Inflation in country j
q_t: real exchange rate

Simple structure adapted from Del Negro et al. (2019)

$$\mathbb{E}_t\left[M^{U.S.}_{t+1}(1+\chi^{US\$}_t)(1+i^{US\$}_t)\frac{P^{US}_t}{P^{US}_{t+1}}\right]=1$$

$$\mathbb{E}_t\left[M^{US}_{t+1}(1+\chi^{C\$}_t)(1+i^{C\$}_t)\frac{S_{t+1}}{S_t}\frac{P^{US}_t}{P^{US}_{t+1}}\right]=1$$

$$\underbrace{i^{US\$}_t-\mathbb{E}_t\left[\pi^{U.S.}_{t+1}\right]}_{r_{U.S.,t}} = m^{U.S.}_t-\chi^{US\$}_t$$

$$\underbrace{i^{C\$}_t-\mathbb{E}_t\left[\pi^{C}_{t+1}\right]}_{r_{Can,t}} = m^{U.S.}_t-\chi^{C\$}_t-\mathbb{E}_t\left[\Delta q_{t+1}\right]$$

Taking the long-run (Beveridge-Nelson) components:

$$r^*_{U.S.,t} = = \bar{m}^{US}_t-\bar{\chi}^{US\$}_t$$

$$r^*_{Can,t} = = \bar{m}^{US}_t-\bar{\chi}^{C\$}_t-\bar{\Delta q}_t$$

M_t : marginal rate of substitution (stochastic discount factor)
i^j_t: Country j's risk-free interest rate
χ^j_t: premium associated with country j's asset
S_t: Nominal exchange rate
P^j_t: Price level of country j
π^j_t: Inflation in country j
q_t: real exchange rate

$$
\begin{aligned}
r^*_{U.S.,t} &= = \bar{m}^{US}_t - \bar{\chi}^{US\$}_t \\
r^*_{Can,t} &= = \bar{m}^{US}_t - \bar{\chi}^{C\$}_t - \bar{\Delta} q_t
\end{aligned}
$$

Four useful points:

1. Beveridge-Nelson trend
   - Unobserved components models, VARs, VARMAs, etc.
2. Two-country block structure
   - U.S. and domestic block with *permanent* shocks.
   - Looks like two country block models such as Zha (1999), Justiniano and Preston (2010), Kamber and Wong (2020).
3. Embeds traditional drivers of r^*
4. Implications if U.S. r^* is global r^*
   - U.S. r^* will have no idiosyncratic component (i.e. $\bar{\chi}^{US\$}_t = 0$).
   - Real interest rates will cointegrate $[1, -1]$ with the U.S.*conditional* on shocks to U.S. r^*.

Estimating r^* using the BN decomposition

- r_t^* is the permanent component of the real interest rate and is a random walk without drift (consistent with UC models, Laubach-Williams model etc.).
- Through the BN decomposition, with an information set Ω_t, r^* can be constructed as
$$r_t^* = \lim_{j\to\infty} \mathbb{E}_t \left[r_{t+j} \mid \Omega_t \right].$$
- Let $\Delta r_t \in \boldsymbol{X}_t$ and $\boldsymbol{X}_t = \boldsymbol{B}\boldsymbol{X}_{t-1} + \boldsymbol{H}\boldsymbol{e}_t$,

$$\hat{r}_t^* = \lim_{j\to\infty} \mathbb{E}_t \left[r_{t+j} \mid \hat{\Omega}_t \right] = r_t + \iota_k \boldsymbol{B}(\mathbf{I} - \mathbf{B})^{-\mathbf{1}}\mathbf{X_t}.$$

where $\hat{\Omega}_t \equiv \{\boldsymbol{B}, \boldsymbol{X}_t, \boldsymbol{X}_{t-1}, \boldsymbol{X}_{t-2}, \ldots\}$.

Correction

- If estimated r^* is consistent with random walk without drift assumption, $\mathbb{E}\left[\Delta \hat{r}_t^* \mid \hat{\Omega}_{t-1}\right] = 0$.
- Morley, Tran, and Wong (2024) show that under, even mild, misspecification $\Delta \tilde{r}_t^*$ will exhibit serial correlation and (possibly complicated) ARMA dynamics.
- Suppose $\Delta \hat{r}_t^*$ can be characterized as an ARMA

$$\phi(L)\Delta \hat{r}_t^* = \theta(L)\epsilon_t,$$

so the change in trend (or permanent component) is

$$\Delta \hat{r}_t^* \equiv \frac{\theta(1)}{\phi(1)}\epsilon_t,$$

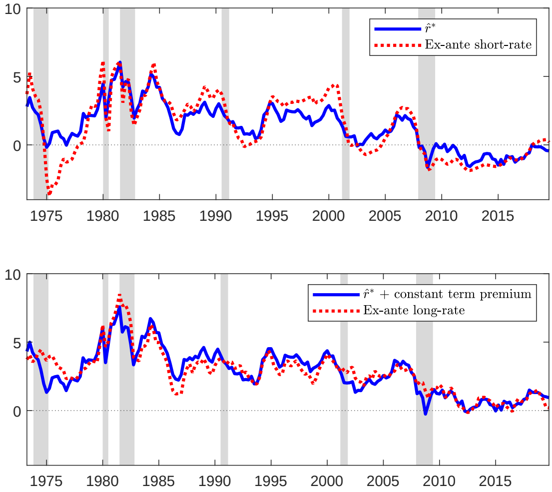
$\mathbb{E}\left[\Delta \tilde{r}_t^* \mid \hat{\Omega}_{t-1}, \phi(L), \theta(L)\right] = 0$ will be satisfied

Result, not assumption...

- If $\frac{\theta(1)}{\phi(1)} > 1$, the correction would actually produce a trend estimate that is *noisier* than the uncorrected estimate.
- If $\frac{\theta(1)}{\phi(1)} < 1$, the correction would produce a smoother trend estimate than the uncorrected estimate.

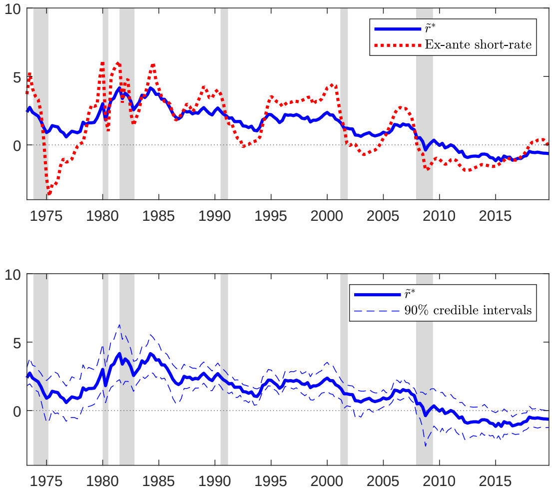
Empirical example is a bivariate VECM of short and long term interest rates with a cointegration vector of $[1, -1]$ or equivalently bivariate VAR with the change the short rate and the spread.

Preliminary estimate (Morley, Tran and Wong, 2024)



Note: The shaded areas denote NBER recession dates.

Estimate of r^* (Morley, Tran and Wong, 2024)



Note: The shaded areas denote NBER recession dates.

A two-block small open economy model for r^*

$$\begin{bmatrix} \boldsymbol{Y}_t^F \\ \boldsymbol{Y}_t^D \end{bmatrix} = \begin{bmatrix} \boldsymbol{\Phi}_{11}^1 & \boldsymbol{0} \\ \boldsymbol{\Phi}_{21}^1 & \boldsymbol{\Phi}_{22}^1 \end{bmatrix} \begin{bmatrix} \boldsymbol{Y}_{t-1}^F \\ \boldsymbol{Y}_{t-1}^D \end{bmatrix} + \ldots + \begin{bmatrix} \boldsymbol{\Phi}_{11}^p & \boldsymbol{0} \\ \boldsymbol{\Phi}_{21}^p & \boldsymbol{\Phi}_{22}^p \end{bmatrix} \begin{bmatrix} \boldsymbol{Y}_{t-1}^F \\ \boldsymbol{Y}_{t-1}^D \end{bmatrix} + \begin{bmatrix} \boldsymbol{A}_{11} & \boldsymbol{0} \\ \boldsymbol{A}_{21} & \boldsymbol{A}_{22} \end{bmatrix} \begin{bmatrix} \boldsymbol{\epsilon}_t^F \\ \boldsymbol{\epsilon}_t^D . \end{bmatrix}$$

$$\text{where } \boldsymbol{A} = \begin{bmatrix} \boldsymbol{A}_{11} & \boldsymbol{0} \\ \boldsymbol{A}_{21} & \boldsymbol{A}_{22} \end{bmatrix}, \boldsymbol{A}\boldsymbol{A}' = \mathbb{E}\boldsymbol{e}_t\boldsymbol{e}_t' = \boldsymbol{\Sigma}, \quad \begin{bmatrix} \boldsymbol{\epsilon}_t^F \\ \boldsymbol{\epsilon}_t^D \end{bmatrix} \sim (\boldsymbol{0}, \boldsymbol{I})$$

$$\boldsymbol{Y}_t^F = \begin{bmatrix} \Delta r_{U.S.,t}^L \\ r_{U.S.,t}^L - r_{U.S.,t}^S - \mu_{U.S} \end{bmatrix}, \boldsymbol{Y}_t^D = \begin{bmatrix} \Delta r_{Dom,t}^L \\ r_{Dom,t}^L - r_{Dom,t}^S - \mu_{Dom} \end{bmatrix}$$

- BN decomposition and MTW correction pins down r^* for both U.S. and the small open economy
- Block exogeneity pins down the role of foreign and domestic shocks.

Let $\boldsymbol{C}(1) = \boldsymbol{\Phi}(1)^{-1}\boldsymbol{A}$, and $\boldsymbol{\epsilon}_t^F = \begin{bmatrix} \epsilon_{P,t}^F \\ \epsilon_{T,t}^F \end{bmatrix}, \boldsymbol{\epsilon}_t^D = \begin{bmatrix} \epsilon_{P,t}^D \\ \epsilon_{T,t}^D \end{bmatrix}$

We can show

$$\hat{r}_t^* = \hat{r}_{t-1}^* + \boldsymbol{\iota}_k \boldsymbol{C}(1) \begin{bmatrix} \boldsymbol{\epsilon}_t^F \\ \boldsymbol{\epsilon}_t^D \end{bmatrix}$$

where $\boldsymbol{C}(1) = \begin{bmatrix} c(1)_{1,1} & 0 & 0 & 0 \\ c(1)_{2,1} & c(1)_{2,2} & 0 & 0 \\ c(1)_{3,1} & c(1)_{3,2} & c(1)_{3,3} & 0 \\ c(1)_{4,1} & c(1)_{4,2} & c(1)_{4,3} & c(1)_{4,4} \end{bmatrix}$

implies

$$\begin{aligned} \hat{r}_{U.S.,t}^* &= \hat{r}_{U.S.,t-1}^* + c(1)_{1,1}\epsilon_{P,t}^F \\ \hat{r}_{Dom,t}^* &= \hat{r}_{Dom,t-1}^* + c(1)_{3,1}\epsilon_{P,t}^F + c(1)_{3,2}\epsilon_{T,t}^F + c(1)_{3,3}\epsilon_{P,t}^D \end{aligned}$$

The expressions can be corrected up to a scale for $\tilde{r}_{U.S.,t}^*$ and $\tilde{r}_{Dom,t}^*$

Three questions:

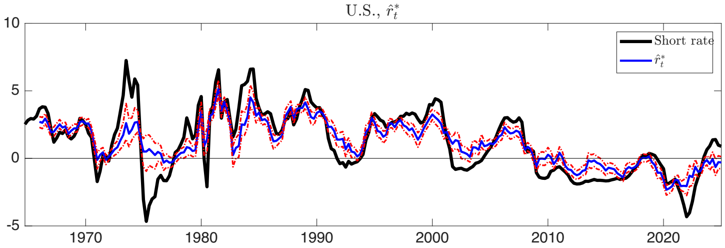
1. Is the U.S. r^* the global r^* from the domestic small open economy's perspective?
2. Do domestic factors matter in the determination of r^*?
3. Does the domestic r^* change one-for-one with the U.S.r^*?

Data

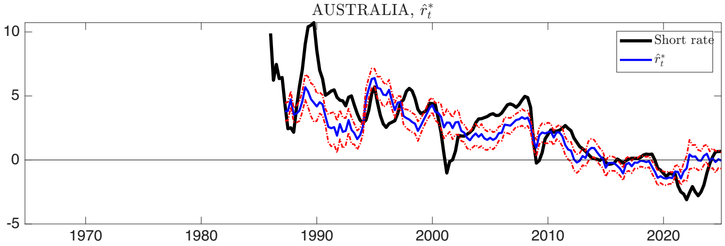
- U.S., Australia, Canada, Euro area, New Zealand, Norway, Sweden, and U.K.
- Ex-ante real interest rates
  - 3-month nominal yield
  - 10-year nominal yield
  - 4- and 20-quarter rolling averages of year-on-year core PCE deflator inflation ($\frac{1}{q}\sum \%\Delta_4$)
- 1966Q1 (or whatever is available) to 2025Q1.

Estimation

- Bayesian estimation of BVAR(4) with Minnesota prior with standard shrinkage.
- Correction applied using Metropolis-within-Gibbs step as per Morley, Tran and Wong (2024) with slight smoothing prior.
- In-fill missing domestic block observations. data structure
- Mean spread estimated using "steady-state" prior by Villani (2009).

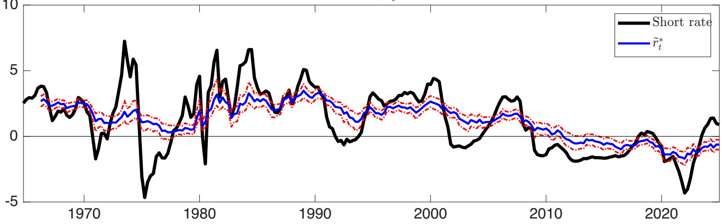


U.S., $\hat{r}_t^*$
Short rate
$\hat{r}_t^*$
10
5
0
-5
1970
1980
1990
2000
2010
2020

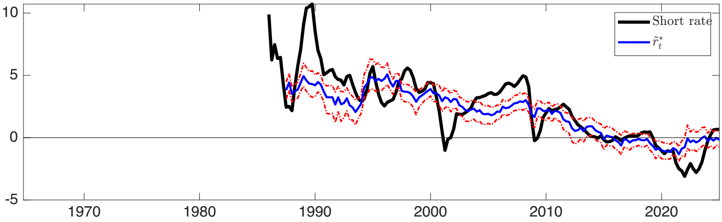


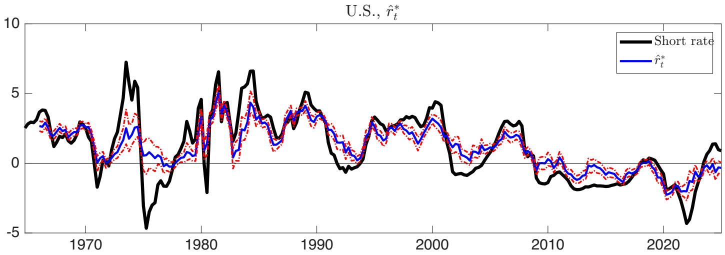
AUSTRALIA, $\hat{r}_t^*$
Short rate
$\hat{r}_t^*$
10
5
0
-5
1970
1980
1990
2000
2010
2020

U.S., $\tilde{r}_t^*$

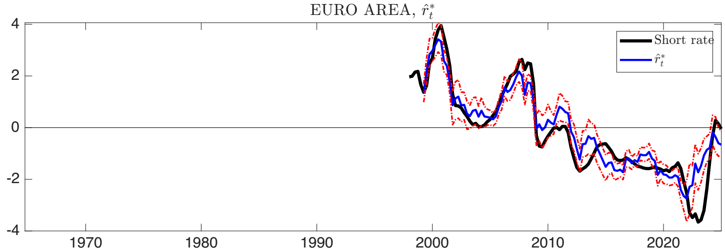


AUSTRALIA, $\tilde{r}_t^*$

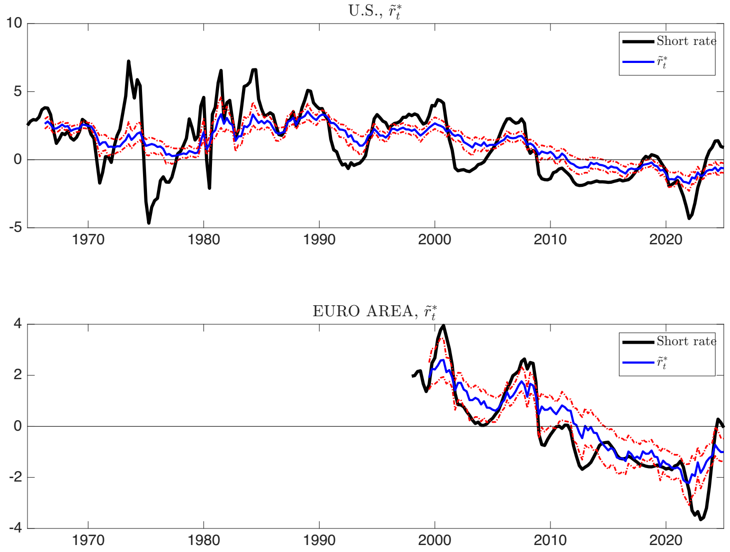


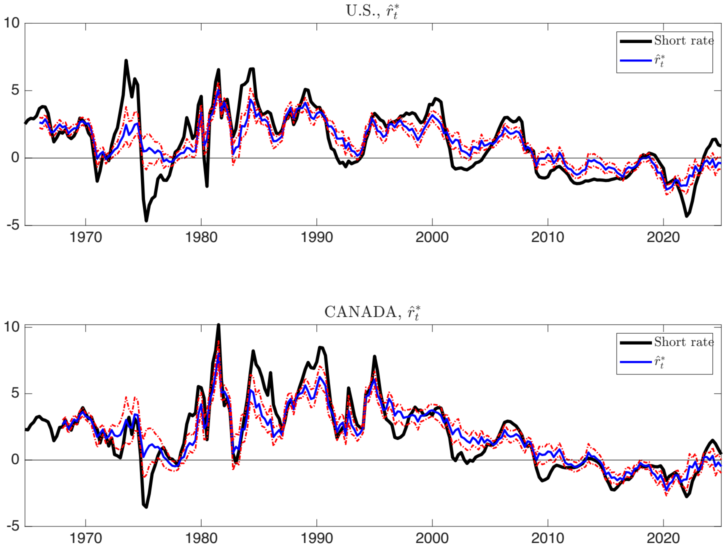


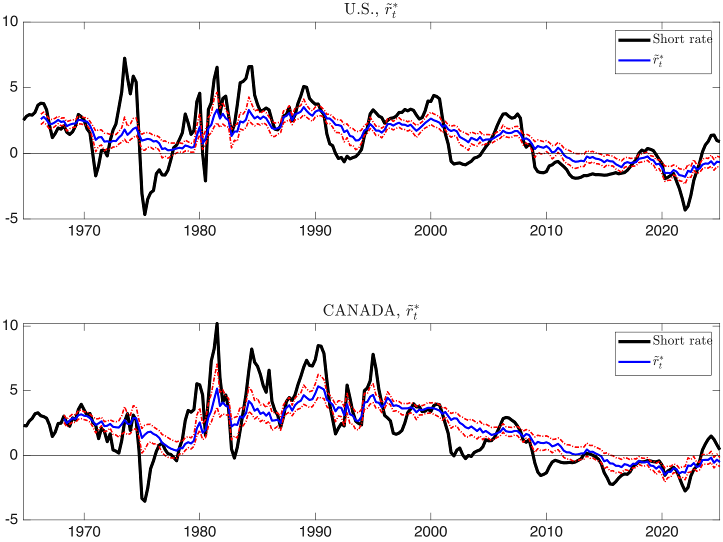
U.S., $\hat{r}_t^*$
Short rate
$\hat{r}_t^*$
10
5
0
-5
1970
1980
1990
2000
2010
2020



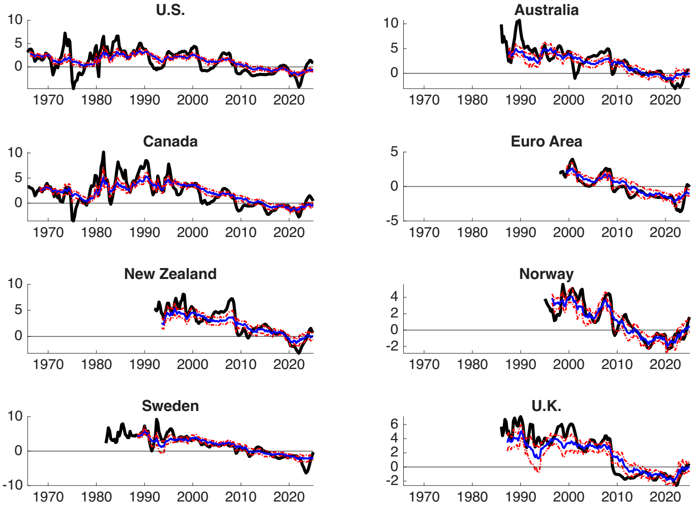
EURO AREA, $\hat{r}_t^*$
Short rate
$\hat{r}_t^*$
4
2
0
-2
-4
1970
1980
1990
2000
2010
2020


U.S., $\tilde{r}_t^*$
10
5
0
-5
1970
1980
1990
2000
2010
2020
Short rate
$\tilde{r}_t^*$
EURO AREA, $\tilde{r}_t^*$
4
2
0
-2
-4
1970
1980
1990
2000
2010
2020
Short rate
$\tilde{r}_t^*$


U.S., $\hat{r}_t^*$
Short rate
$\hat{r}_t^*$
10
5
0
-5
1970
1980
1990
2000
2010
2020
CANADA, $\hat{r}_t^*$
Short rate
$\hat{r}_t^*$
10
5
0
-5
1970
1980
1990
2000
2010
2020

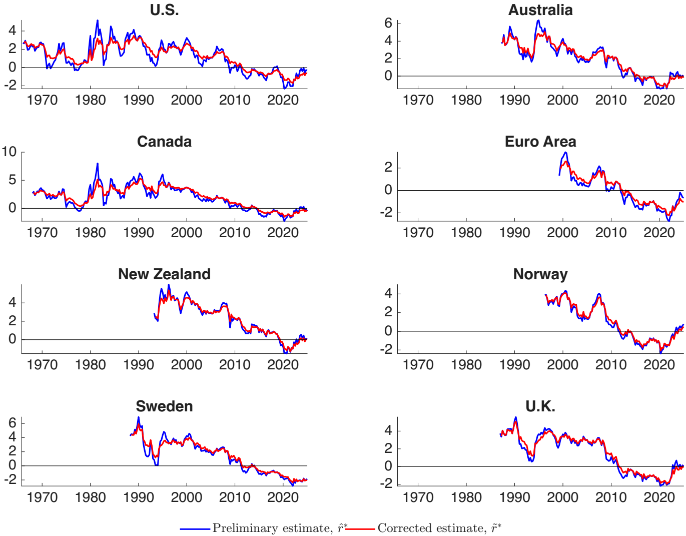

U.S., $\tilde{r}_t^*$
Short rate
$\tilde{r}_t^*$
10
5
0
-5
1970
1980
1990
2000
2010
2020
CANADA, $\tilde{r}_t^*$
Short rate
$\tilde{r}_t^*$
10
5
0
-5
1970
1980
1990
2000
2010
2020

Estimates of $\tilde{r}^*$



Notes: Posterior median estimates with 90% credible interval. Also presented is the ex-ante short term real interest rate.

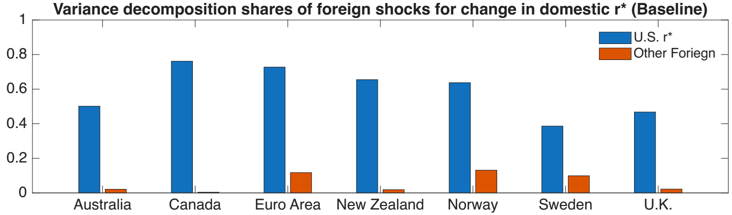
Comparison of preliminary and corrected estimates of r^*

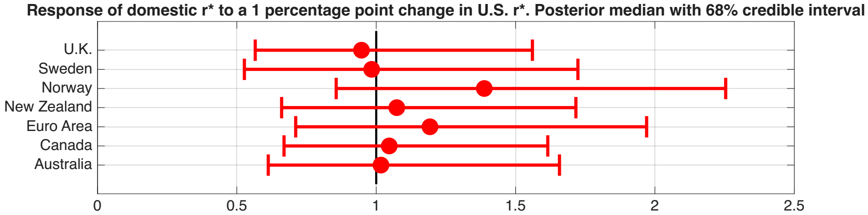


Notes: The posterior median estimates of the corrected measure is presented alongside the posterior median preliminary estimate (i.e. $\tilde{r}^*$).

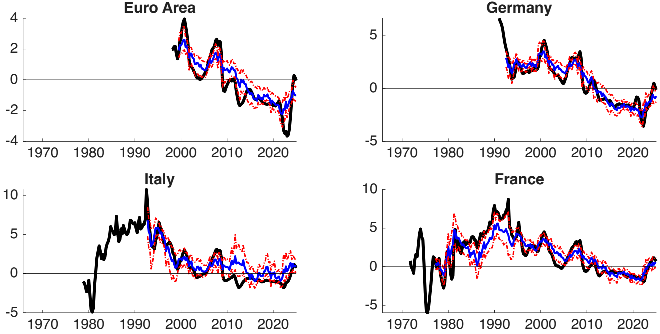
The importance of global r^*

Is U.S. r^* global r^*?





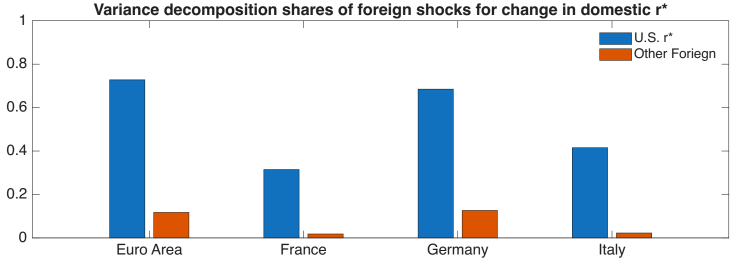
Estimates of $\tilde{r}^*$

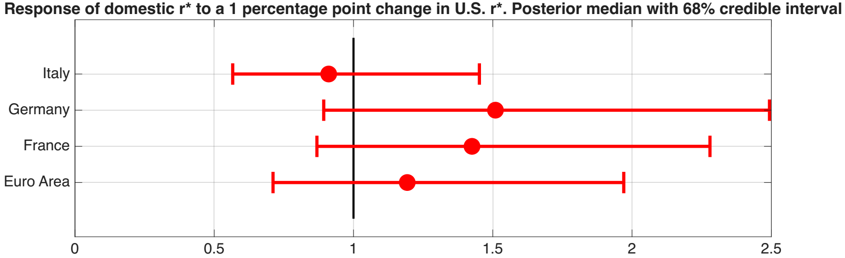


Notes: Posterior median estimates with 90% credible interval. Also presented is the ex-ante short term real interest rate.

The importance of global r^*

Is U.S. r^* global r^*?





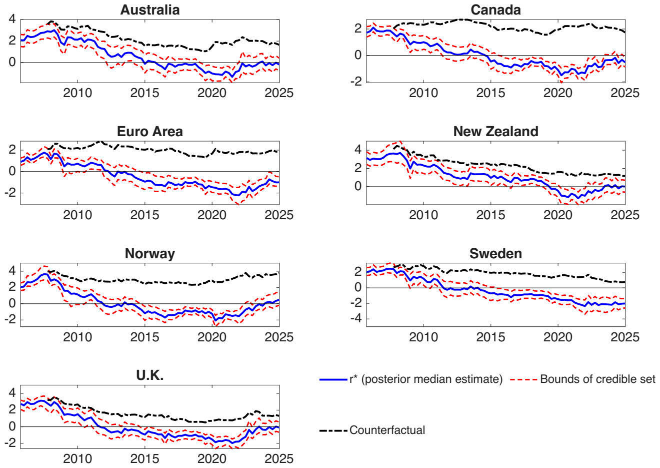
Counterfactual exercise

We can write

$$\tilde{r}^*_{Dom,t} = \tilde{r}^*_{Dom,t-\tau} + \sum_{j=0}^{\tau-1} \theta(1)_{dom} \boldsymbol{\iota}_3 \boldsymbol{C}(1) \begin{bmatrix} \boldsymbol{\epsilon}^F_{t-j} \\ \boldsymbol{\epsilon}^D_{t-j} \end{bmatrix}$$

- Given identified foreign shocks, what would be the level of r^* if we turned off the sequence of foreign shocks from 2007Q4?
- Difference between counterfactual level and estimated level of r^* is the role of foreign shocks.

Estimates of actual and counterfactual r^*



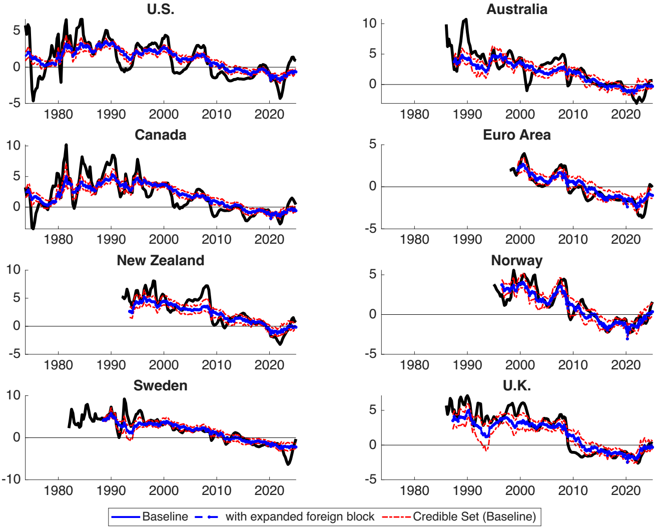
Notes: Posterior medians of the estimated r^* for various countries are presented alongside with the estimated posterior median counterfactual estimate where there are no foreign shocks from 2007Q1 to the end of the sample. Presented alongside are the associated 90% credible set of the r^* estimate.

Table: Decomposition of decline in r^* from 2007Q4 to 2025Q1

	Total Change	Change due to global shocks	Proportion accounted for by global shocks
Australia	-361	-184	51
Canada	-275	-226	82
Euro Area	-334	-285	85
New Zealand	-463	-115	25
Norway	-415	-330	80
Sweden	-521	-276	53
U.K.	-379	-140	37

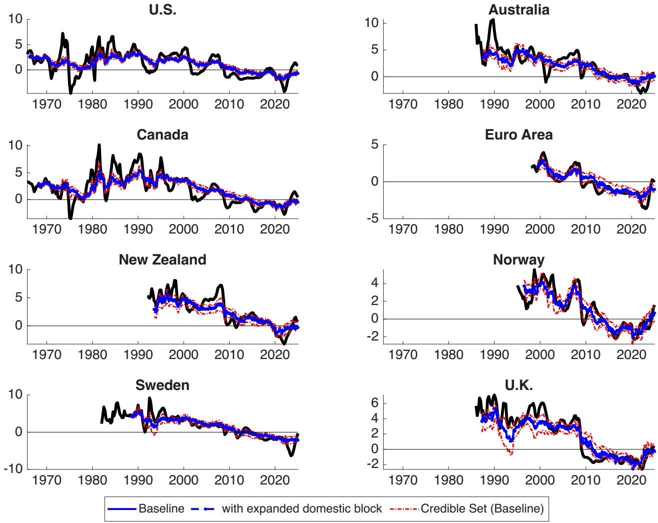
Notes: The first column presents the total change in the posterior median estimate of r^* from 2007Q4 to 2025Q1 (basis points). The second column shows the posterior median estimate of the decline attributed to foreign shocks in terms of basis points. The third presents the proportion (in percent) of the decline attributed to the global shocks.

Comparison of estimates with expanded foreign block



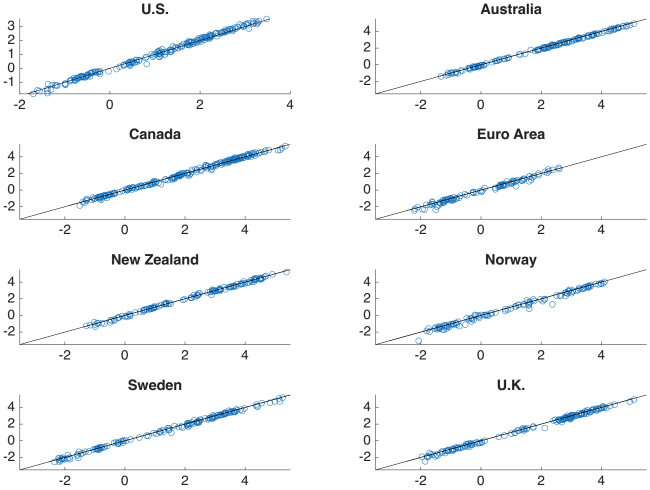
Notes: Foreign block includes GECON indicator (Baumeister, Korobilis Lee, 2022) and OEDC+6 industrial production (Baumeister and Hamilton, 2019).

Comparison of estimates with expanded domestic block



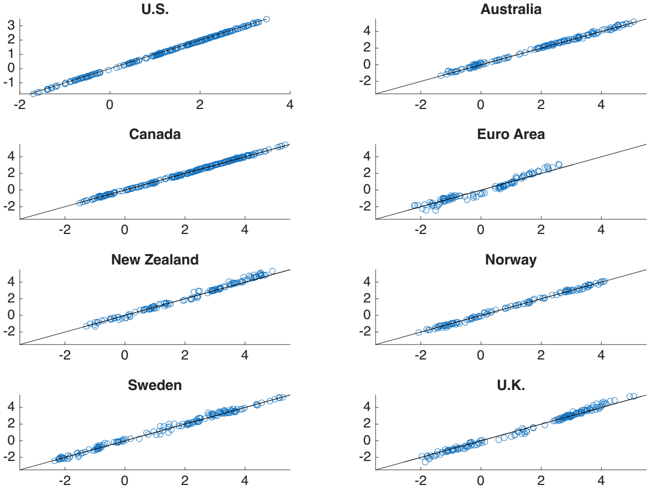
Notes: Domestic block includes real exchange rate, inflation and output gaps estimated using Kamber, Morley and Wong (2025).

Comparison of estimates with expanded foreign block



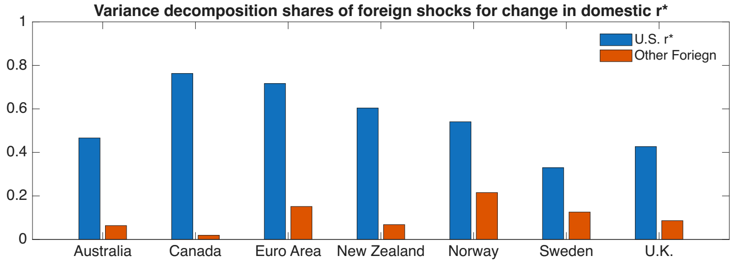
Notes: Foreign block includes GECON indicator (Baumeister, Korobilis Lee, 2022) and OEDC+6 industrial production (Baumeister and Hamilton, 2019).

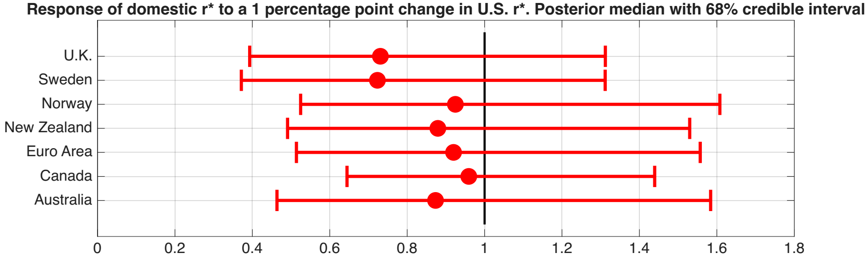
Comparison of estimates with expanded domestic block



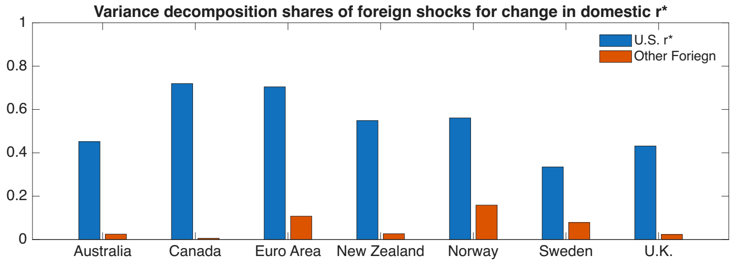
Notes: Domestic block includes real exchange rate, inflation and output gaps estimated using Kamber, Morley and Wong (2025).

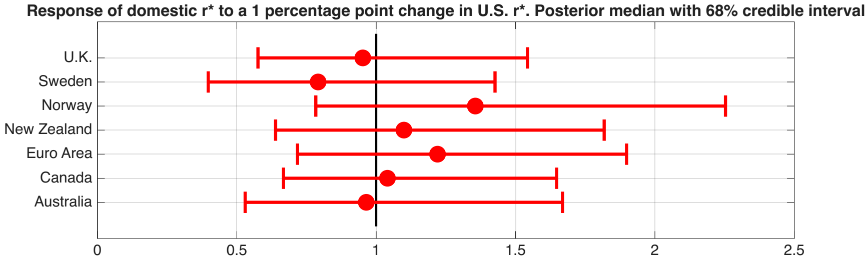
With expanded foreign block



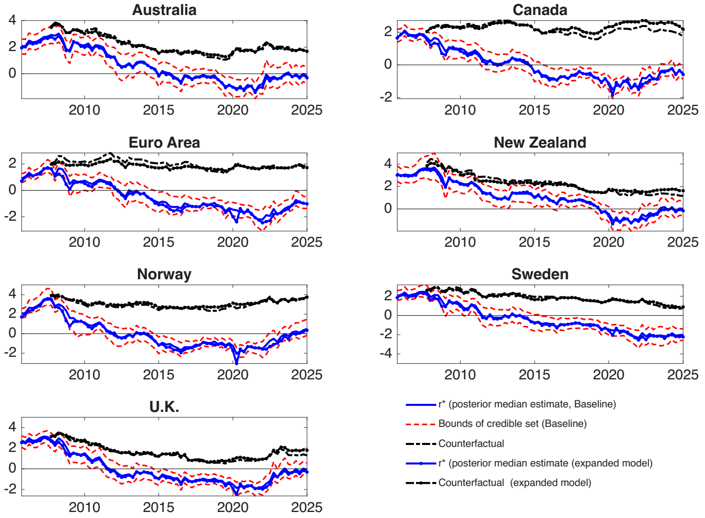


With expanded domestic block

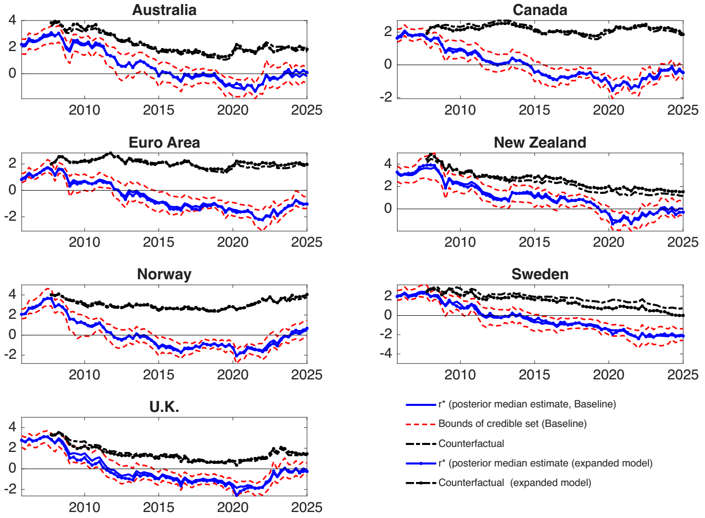




Estimates of actual and counterfactual r^* with expanded foreign block



Estimates of actual and counterfactual r^* with expanded domestic block



Wrapping up

- Developed a small open economy model to estimate r^* and also quantify role of foreign and domestic shocks.
- Estimated the model for Australia, Canada, Euro Area, New Zealand, Norway, Sweden and U.K.
- Results
  - U.S. r^* is mostly a good approximation for global r^*, but domestic shocks do matter.
  - Domestic r^* do move one-for-one to the U.S. (i.e. they conditionally cointegrate). Domestic shocks are why real interest rates do not cointegrate unconditionally.
  - Foreign shocks can account for much of the decline in r^* internationally since 2007.

Data structure

Back