**Quarterly Macro-Fiscal Model (QMFM)**

**Model development: Revision Real Interest Rate Trend**

**Foreign RIR in QMFM model**

The foreign Real Interest Rate (RIR) trend (US RIR trend rstar\_tnd, %)–typically projected exogenously outside the model for 16-20 quarters ahead—enters the model through transmission (UIP) to the domestic RIR trend, r\_tnd (eq. 1), which co-determines the domestic interest rate trend (eq.2a), which in turn co-determines the domestic interest rate in the Taylor rule (eq. 2b). Even if exogenous, the rstar\_tnd needs its equation (eq. 3), i.e., an AR(1) process toward its steady state trend (0% in our current parameter choice).

**r\_tnd** = **rstar\_tnd** + prem + e\_dl\_z\_tnd (1)

**i\_tnd** = r\_tnd + d4l\_cpi\_tar + dl\_rp\_cpi\_core\_tnd (2a)

**i** = c1 \* i{-1} + (1 - c1) \* (i\_tnd + c2 \* d4l\_cpi\_dev..) (2b)

**rstar\_tnd** = r\_rstar\_tnd \* rstar\_tnd{-1} + (1 - r\_rstar\_tnd) \*

ss\_rstar\_tnd + shock\_rstar\_tnd (3)

So far, we have used an independent GPM forecast for the US RIR trend, which is rstar\_tnd in the model. The latest updated version of GMP data forecasts was observed in 2022 with the help of OGR/ZR, but this won’t be accessible henceforth. MINECOFIN may obtain the GPM forecast in another way (via BNR, IMF, other..). Meanwhile, we have looked for alternatives.

**Methodology for the derivation of foreign RIR trend (rstar\_tnd)**

The alternative—first used in the March 2024 round—is a calculated US RIR trend rstar\_tnd, using the US Central Budgetary Office (CBO)[[1]](#footnote-1) quarterly forecasts of:

* 3-month US Treasury bills rate in % (which is also in WEO-GAS projection, used by intMF)
* inflation (measured by the Personal Consumption Expenditure (PCE) index (2017=100), excluding food and energy, in % annualized change
* “implicit” CBO RIR is calculated as the interest rate minus one-quarter ahead inflation rate.[[2]](#footnote-2)

The CBO forecasts are inserted in the addData\_2024\_ .csv file, used by QMFM, readData:

* readData reads from addData\_2024\_ .csv both rstar\_tnd from GPM and rstar\_US\_CBO
* if rstar\_US\_CBO is used, readData calculates the trend using the HP filter, which becomes the new measurement variable:

**dbObs.obs\_rstar\_US\_cbo** = 100 \* log (1 + db.rstar\_US\_cbo/100) (4a)

**dbObs.obs\_rstar\_tnd** = hpf2 (dbObs.obs\_rstar\_US\_cbo) (4b)

The dbObs.obs\_rstar\_tnd is the rstar\_tnd in equation (2a).

**Literature review**

*BNR QPM*- the foreign real interest rate is derived from the nominal interest rate i.e., proxied by the US federal funds rate [[3]](#footnote-3) and expected inflation (PCE or CPI?) observed from the Central Budgetary Office (CBO) and the foreign real interest rate trend is obtained by applying the Kalman Filter (KF) on the calculated real interest rate.

**Issues:**

* Should we use the KF instead of the HP filter to calculate rstar\_tnd? Or can we change the HP smoothing parameters (instead of default I=1600) (suggestion ZR)
* The model uses: cpistar which is trading partner CPI (from WEO\_GEE) in RER equations; and

istar which cis US interest rate on 3-mos T-bills (from WEO)

**rstar** = istar – dl\_cpistar {+1} in the capital inflow equation’ yet

the RIR is based on US projected inflation

* With new rstar\_tnd (CBO-based), we must recalibrate the rstar\_tnd eq., esp. std of shocks (ZR)

**External block for BNR QPM**

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| --- | --- | --- |
| **Data sources/links** | **Variables/indicators** | **Description** |
| **Eurozone-ECB** ([https://ec.europa.eu/eurostat/databrowser/view/prc\_hicp\_midx\_\_custom\_12131781/default/table?lang=en](about:blank)) | **Harmonized Index of Consumer Prices (HICP):** -actual (mo. index)—observed in levels  -proj. ann. % change. | -foreign cpi for the BNR QPM model is a weighted variable of eurozone & US-CBO, Weights of US--0.6, Euro is 0.4 |
| **-Real GDP: actual (levels), proj. (ann.% change)** | - foreign real GDP for the model is a weighted variable of eurozone & US-CBO  - weight: --US-CBO output gap has 75% |
| **Exchange rate USD vs. EURO: Actual & proj. (levels)** |  |
| **US CBO—Central Budgetary Office**  **-fred.stlouisfed.org** | **inflation Personal Consumption Expenditure:**  -actual (monthly index, levels)..from fred.stlouisfed.org  -proj. (ann. % change) from CBO | **---transformation**  **1. convert --**actual index from Mo to Qo  **2.** Log trans of Qo index  **3. Ann. % change of Qo (d4l/y-o-y)**  d4l\_cpi\_us = (lcpi\_us - lcpi\_us(-4))  **4. %change, Mo-to-Mo or dl**  --merge: act (d4l) with proj.  --re-compute/replicate org data from trans(l\_cpi\_us):  lcpi\_us = lcpi\_us(-4) + d4l\_cpi\_us  cpi\_us = exp(lcpi\_us) |
| **Real GDP: --**actual observed in levels  **--**Proj. observed as ann. % change. | -Actual observed from fred.stlouisfed.org  -And proj. from CBO  So data merge is applied |
| **nominal interest rate (Federal funds rate)—istar:**  **--**actual & proj. (%) observed from CBO and act but also at fred.stlouisfed.org  **---i\_us (istar) =** lag + d4l\_cpi\_us + r\_us\_tnd  **--i\_us:** nominal federal funds rate from CBO  **--cpi\_us :** pce from CBO | **Derivation of Real interest rate (RIR, level & trend):**  **--real (unobserved) (rstar)**  r\_us = i\_us - d4l\_cpi\_us (+1)  **--Trend, gap (rstar\_tnd):**  [r\_us\_tnd , r\_us\_gap] = hpf(r\_us)  **--**r\_us\_tnd = lag + ss\_r\_us |
| **-World Bank Commodity prices from data/pink sheet**  [**https://www.worldbank.org/en/research/commodity-markets**](about:blank)  **-IMF/World Economic Outlook** | **Food inflation—foreign food prices:**  -actual index (monthly indices based on nominal US dollars, 2010=100, 1960 to present)  -proj. observed as ann. index | **-**Actual observed as commodity prices from WB Pink Sheet  **-**Projection observed as annual index from WEO |
| **Energy inflation—foreign energy (Crude oil, average):**  -actual (monthly prices in nominal US dollars, 1960 to present) levels or index  -proj. observed as ann. Index | -Actual observed as commodity prices from WB Pink Sheet  **-**Projection observed as annual index from WEO |

1. February 2024 Baseline Forecast—Data Release (Quarterly)--CBO's February 2024 report *The Budget and Economic Outlook: 2024 to 2034*, [Budget and Economic Data | Congressional Budget Office (cbo.gov)](about:blank), ECONOMIC Economic projections (Febr 2024), quarterly sheet in: [https://www.cbo.gov/system/files/2024-02/51135-2024-02-Economic-Projections.xlsx](about:blank). [↑](#footnote-ref-1)
2. The two series are found in [https://www.cbo.gov/system/files/2024-02/51135-2024-02-Economic-Projections.xlsx](about:blank). The annualized inflation rate for each Q is calculated by CBO as (PCE/PCE{-1})^4-1. The calculated US RIR forecast can be added in the CBO sheet. The 3-mos T-bill interest rate and PCE inflation indexes are also imported into the addData\_2024\_ file (in the QMFM directory) and the RIR is calculated there. Historic data are found in *selected historical economic data* [Budget and Economic Data | Congressional Budget Office (cbo.gov)](about:blank#11). [↑](#footnote-ref-2)
3. The federal funds rate is the interest rate at which depository institutions trade federal funds (balances held at Federal Reserve Banks) with each other overnight. When a depository institution has surplus balances in its reserve account, it lends to other banks in need of larger balances. In simpler terms, a bank with excess cash, which is often referred to as liquidity, will lend to another bank that needs to quickly raise liquidity. The rate that the borrowing institution pays to the lending institution is determined between the two banks; the weighted average rate for all of these types of negotiations is called the effective federal funds rate. The effective federal funds rate is essentially determined by the market but is influenced by the Federal Reserve through open market operations to reach the federal funds rate target. The Federal Open Market Committee (FOMC) meets eight times a year to determine the federal funds target rate. As previously stated, this rate influences the effective federal funds rate through open market operations or by buying and selling government bonds (government debt). More specifically, the Federal Reserve decreases liquidity by selling government bonds, thereby raising the federal funds rate because banks have less liquidity to trade with other banks. Similarly, the Federal Reserve can increase liquidity by buying government bonds, decreasing the federal funds rate because banks have excess liquidity for trade. Whether the Federal Reserve wants to buy or sell bonds depends on the state of the economy. If the FOMC believes the economy is growing too fast and inflation pressures are inconsistent with the dual mandate of the Federal Reserve, the Committee may set a higher federal funds rate target to temper economic activity. In the opposing scenario, the FOMC may set a lower federal funds rate target to spur greater economic activity. Therefore, the FOMC must observe the current state of the economy to determine the best course of monetary policy that will maximize economic growth while adhering to the dual mandate set forth by Congress. In making its monetary policy decisions, the FOMC considers a wealth of economic data, such as trends in prices and wages, employment, consumer spending and income, business investments, and foreign exchange markets. [https://fred.stlouisfed.org/series/FEDFUNDS](about:blank) [↑](#footnote-ref-3)