# R* in East Asia: Business, Financial Cycles, and Spillovers

Pierre L. Siklos, Wilfrid Laurier University (WLU), Balsillie School of International Affairs (BSIA)

Dora Xia, Bank for International Settlements (BIS)

Hongyi Chen, Hong Kong Institute for Monetary and Financial Research (HKIMR)

# What Is the Appropriate Stance of Monetary Policy?

- A frequent, albeit over-simplified, prescription/benchmark is the Taylor rule
  - $R_t = (r_t^* + inflation\_target_t) + a_1\, ygap_t + a_2\, inflation\_gap_t + residual$ [<u>R is the nominal policy rate</u>]
- If $r^* > r$ ($R-\pi$) MP is loose
- If $r^* < r$ ($R-\pi$) MP is tight
- In practice R is likely to be determined by <u>a broader variety of factors</u> and determinants <u>depending on the horizon policy makers</u> have in mind (<u>we consider 2 of them</u>), how open or vulnerable an economy is to external shocks, the nature of the policy regime (e.g., explicit or implicit inflation targeting), to name a few in a long list of potential candidates. This is the starting point of our analysis.

# Which R*?

- The policy rate that neither stimulates nor restricts economic activity
  - Other variants exist: "…the real short-term interest rate expected to prevail when an economy is at full strength and inflation is stable"
  - BUT the 1st definition used is the one that appears most frequently in part because it leaves vague the policy horizon
    - NY Fed: 'Natural' interest Rate (Laubach & Williams; Holston, Laubach & Williams 2017, 2023)
    - ECB 'Natural' (Brand, Lisack & Mazelis, 2025)
    - BoE 'Neutral' (MPR 1/2025, Box A) / BoK (Kim & Park, 2013)
    - BoJ 'Natural" (Okazaki & Sudo, 2018)/ BoK (Do, Ahn, Jung, 2024)/ Nagel (2025)

# Which R*?

- Even if we set aside definitional issues there are (at least) 2 kinds of neutral/natural policy rates
    - R* = nominal rate that satisfies the above definition
    - It is also the one that market participants most frequently refer to
        - "It is extremely doubtful that anyone based their economic decisions on an overnight bank lending rate that is adjusted for inflation measured on a year-to-year basis." (Yardeni, 2024)
    - r*= R*- inflation expectations. No consensus on horizons but (a) either based on past history of observed inflation; (b) medium to longer-term inflation expectations (whose? <u>Professionals</u>, Firms, households?)

# Motivation & Background: What (Some) Policy Makers Say About R*

- "These cannot be seen as a mechanical gauge of appropriate monetary policy at any point in time" (ECB 2025)

- "There is a high degree of uncertainty around this and, as we say, that's why we don't use it for setting interest rates." (BoE 2025)

- R* "...is more like dark matter." (Nagel 2025)

- BUT r* [real] (or R*[nominal]) helps policy makers assess whether monetary policy is stimulative or restrictive and many (well informed) observers repeatedly refer to the concept

# Motivation and Background (Cont'd)

- Estimate R* for 4 countries (CHN, KOR, JPN, USA). Next, estimate $r^*=R^*$ *less* $\pi^e$, where expected inflation ranges from 1 to 10 years depending on horizon (mostly 3-5 yrs, 6 to 10 yrs averages of Consensus forecasts)
- A set of empirical models are specified where R* is determined by ←
  - (Estimated) Factors that summarize a wide variety of influences on R*
  - Alternative: Observables (e.g., output, inflation, credit, TFP, demographic indicator)
- Our methodology effectively assumes the policy maker navigates two policy horizons:
  - A business cycle
  - A financial cycle
- Estimated R*s are predicated on the assumption that equilibrium conditions can be attained over one or both these horizons

"We want the fullest picture possible." (Nagel, 2025)

# Previewing the Results

- Estimates appear 'plausible' in the sense that they capture the influence important changes in economic conditions (e.g., GFC, introduction of Abenomics, shifts in policies by the PBoC, sharp tightening of MP stance in KOR and USA especially)

- Estimates for all 4 countries confirm the decline in r* over time but time series behaviour differ, not by a wide margin, published estimates. Our estimates are relatively closer to published TS estimates

- When r* is estimated over the BC and FC we observe the challenge CB face in trading off MP objectives (inflation, real economy) and financial stability objectives (due to changing financial conditions). Viewed through this lens our interpretation of the conduct of MP can be very sensitive to whether the BC or the FC is considered

- Both r* (USA) and r* (CHN) impact r* in the remaining 2 countries. USA's impact is largest on KOR while USA's impact on JPN can be sensitive according to whether CHN's impact is also considered. These results hold whether r* is measured over BC or FC. Spillovers, or global element is a quantitatively important r* determinant for KOR, JPN, and CHN.

# Data & Methodology II: Band Spectrum Regression

- First step: estimate ECONOMIC, FINANCIAL, MONETARY & STRUCTURAL DETERMINANTS VIA FACTOR MODELLING
  - $\mathbf{X}_{ijt} = \boldsymbol{\beta}_{ijt}\mathbf{F}_{ijt} + \boldsymbol{\zeta}_{ijt}$ , $\mathbf{X}$ is the vector of series & $\boldsymbol{\beta}$ are the factor loadings, $\widehat{F}$ are the factor scores estimated via regression estimates* ($\mathbf{F}$ estimated via ML using Bai & Ng (2002) $IC_{p2}$ criterion (Stock & Watson 2016)

- INITIALLY, various determinants are then included in a regression written in the frequency domain as:
  - $PR_\omega^k = \alpha_0 + \alpha_1 ECONOMIC_\omega^k + \alpha_2 FINANCIAL_\omega^k + \alpha_3 MONETARY_\omega^k + \alpha_4 STRUCTURAL_\omega^k + \varepsilon_\omega$
  - Where PR= Policy Rate, REAL, FINANCIAL, MONETARY, STRUCTURAL are the estimated factors, and $\varepsilon$ is an error term;
  - k= KOR, JPN, CHN, USA
  - $\omega$ are the frequencies over which the specified relationship is restricted, namely BUSINESS CYCLE (BC) and FINANCIAL CYCLE (FC)
    - **BC= 2 to 8 years [8Q, 32Q]**
    - **FC= 10 to 20 years [40Q, 80Q]**        Encompasses a vast literature that explores the timing of these cycles

*Independent variables in the regression equation are the standardized observed values of the items in the estimated factors.
These variables are weighted by regression coefficients, which are obtained by multiplying the inverse of the observed variable correlation matrix by the matrix of factor loadings (Thurstone regression)

# Why the BSR Approach?

## PROS

- Allows separate FC and BC estimates unlike other r* estimates
- Typical CB mandate focuses on the BC horizon BUT, especially since the GFC, FC conditions play a more prominent role
    - Our estimates provide a window into the trade-off between financial stability and economic stability objectives
- Our approach allows for potentially a large no. of models to be estimated which goes some way to addressing the model uncertainty problem plaguing r* estimates

## CONS

- Sample sizes could be longer for all countries. The estimation period may not be representative
- FC estimates are less volatile than at the BC but more volatile than SSM or SM estimates.
- The problem of confounding permanent trends with cyclical factors – a common problem that afflicts all r* estimates – is not solved since our estimates are based on levels vs differenced versions of some series
- Since our results are not based on a SSM or a SM there is less 'discipline' on the results (although we seek to minimize the import of this drawback)

# ILLUSTRATING the Factors & Their Composition

- **Economic**: aggregate demand and/or aggregate supply determinants

- **Financial**: variables that define/determine financial conditions

- **Monetary**: variables that determine the monetary policy instruments/stance

- **Structural**: variables that are longer-term/slower to have economic impact

| ECONOMIC | FINANCIAL | MONETARY | STRUCTURAL |
|---|---|---|---|
| Inflation Expectations Net exports Earnings/Wages Sentiment *Property prices Equity returns* Ind. Ption Cap. Util. Retail Sales Oil prices... Econ Pol Uncertainty Geopolitical Risks [28-35] | *Property prices Equity returns* Govt debt Priv. Non-Fin credit Mkt Int. rates Mkt Int. rate exp. Lending survey Credit gap Foreign X Res [14-26] | Shadow policy rate Exchange rate Inflation target Money aggregates CB Balance sheet UMP indicators [6-10] | TFP Age Depend Ratio Life exp. GINI Populations Savings rate Labour force Gross Fixed Cap. Formation [10] |

# Which Estimated R* to USE?

- Instead of estimating ONE version of the BSR we end up with multiple BSR estimates (levels vs differenced; full vs time-varying; factors vs observed; domestic only vs domestic and global)
  - With few exceptions, we retain only estimates when estimated coefficients are consistent with theory

- Instead of estimating CI around some estimate we instead resort to the "thick modelling" approach of Granger and Jeon (2004)
  - Settle on comparisons of Mean or Median of estimates
  - <u>Range</u> of estimates provides an estimate of confidence-like intervals
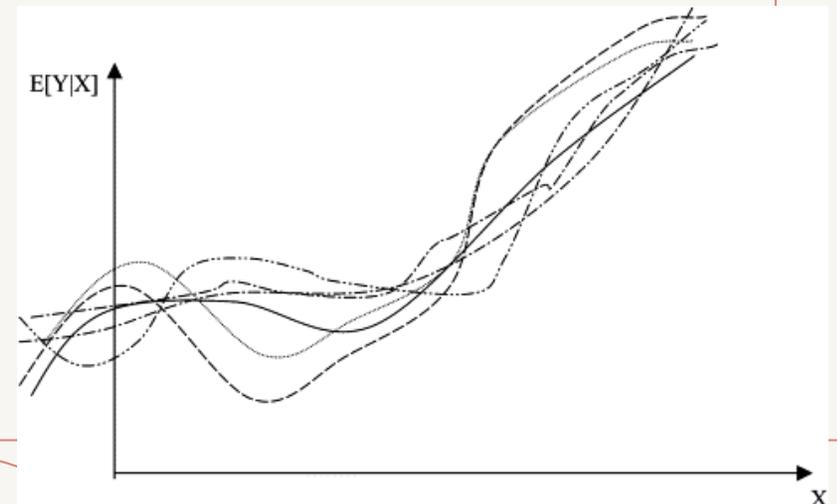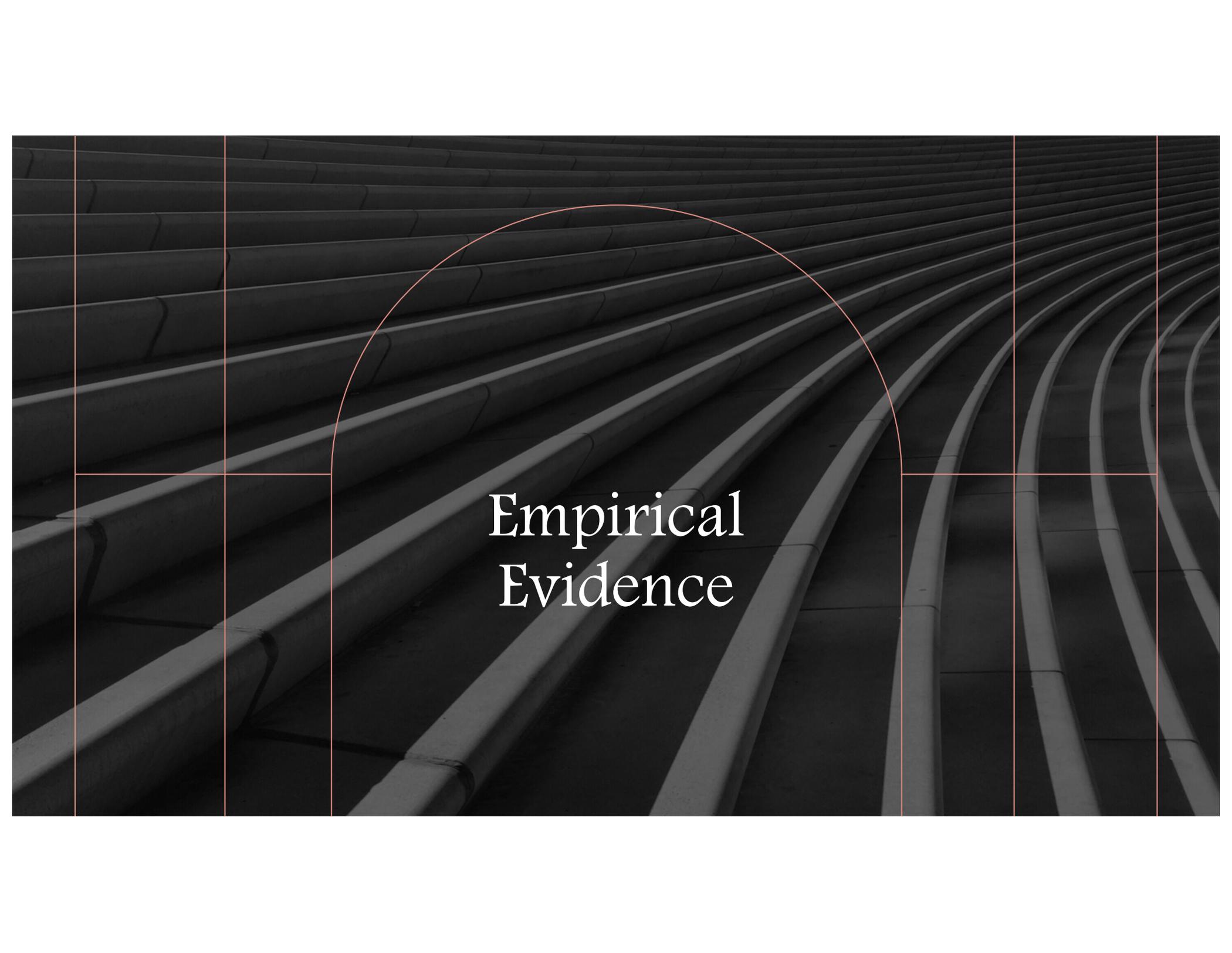
Empirical
Evidence

# SAMPLE & MODEL INFORMATION

| COUNTRY | # estimated models @ BC, FC* | | |
|---|---|---|---|
| CHINA | 8 | | |
| JAPAN | 12 | | |
| KOREA | 5 | | |
| USA | 7 | | |
| *FACTOR MODEL-BASED* | **CHN** | **KOR** | **JPN** | **USA** |
| FINAL SAMPLES | 02Q1-23Q4 | 01Q1-23Q4 | 95Q2-23Q4 | 02Q1-23Q4 |
| *OBSERVABLES* | **CHN** | **KOR** | **JPN** | **USA** |
| FINAL SAMPLES | 02Q1-23Q4 | 00Q1-23Q4 | 96Q1-23Q4 | 96Q1-23Q4 |

<u>Note</u>: Same # models estimated for BC and FC. Hence, for example, a total of 14 models (7 BC, TFC) were estimated for the USA

# Outline of Steps in the Empirical Analysis

1. Transform series and analyze TS properties

2. Create factor groups

3. Estimate factor models and obtain scores in 4 versions: levels and differences, full sample vs time-varying

4. Estimate BSRs, different versions
   a. Both D & S
   b. D only
   c. D & S and add US, then US & CHN

5. Obtain R* estimates (first nominal), generate range of estimates, and mean (or median) of estimates
   ❖ r* is then R*-$\pi^{exp}$, where expected inflation is obtained from a range of professional forecasts (3 to 10Yrs)

6. Perform additional tests and analysis

# JAPAN: r*=R* less inflation expectations



LEGEND:
REAL = real interest rate
PR = policy rate
FH = Consensus 1 year ahead inflation forecast
MT = mean of 3 to 5 year ahead inflation forecasts
MAX, MIN = range of estimates

Policy generally too tight
r*<r

Policy generally
too tight @ 1YR horizon

MP is very loose
r*>r

Policy
Becomes
Tight @
All horizons
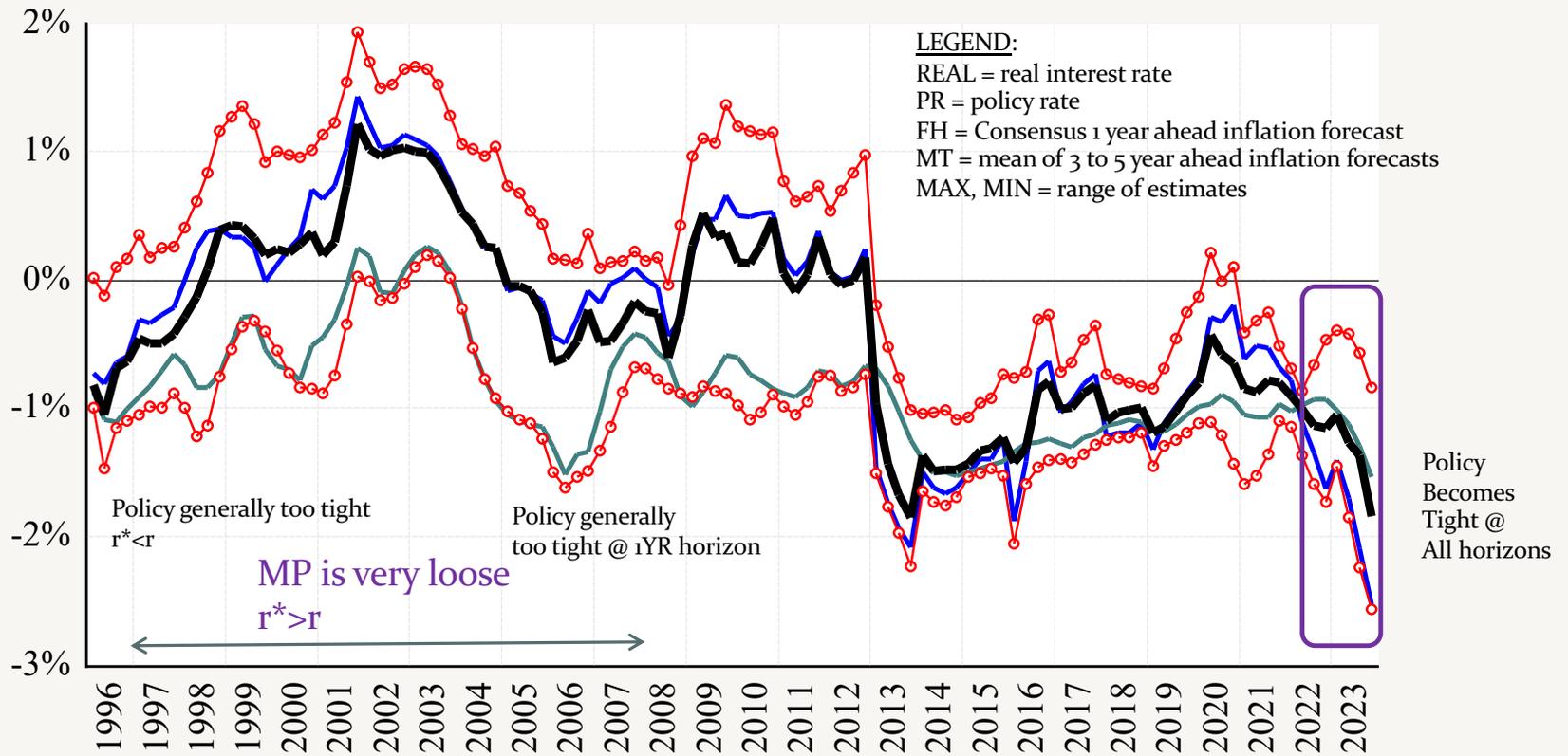
REAL_PR_FH
relies on 1YA
expectations

REAL_PR_FH ——— REAL_PR_MT ——— RSTAR_BC_MAX
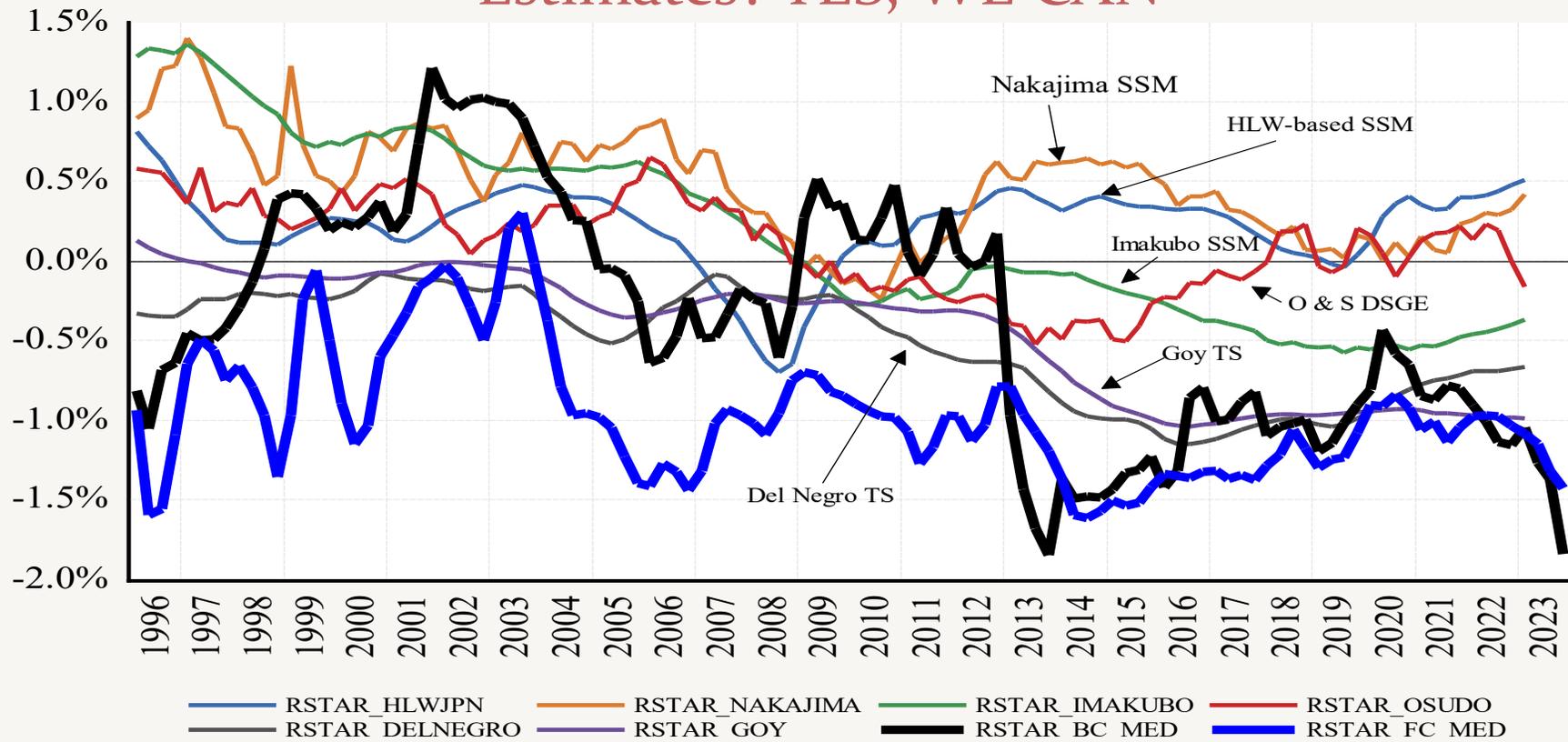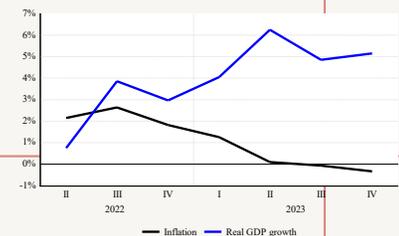
RSTAR_BC_MED ——— RSTAR_BC_MIN

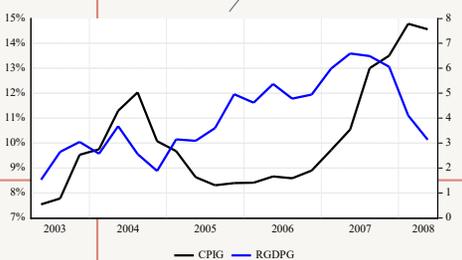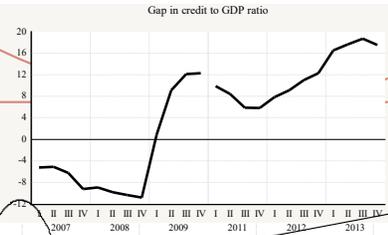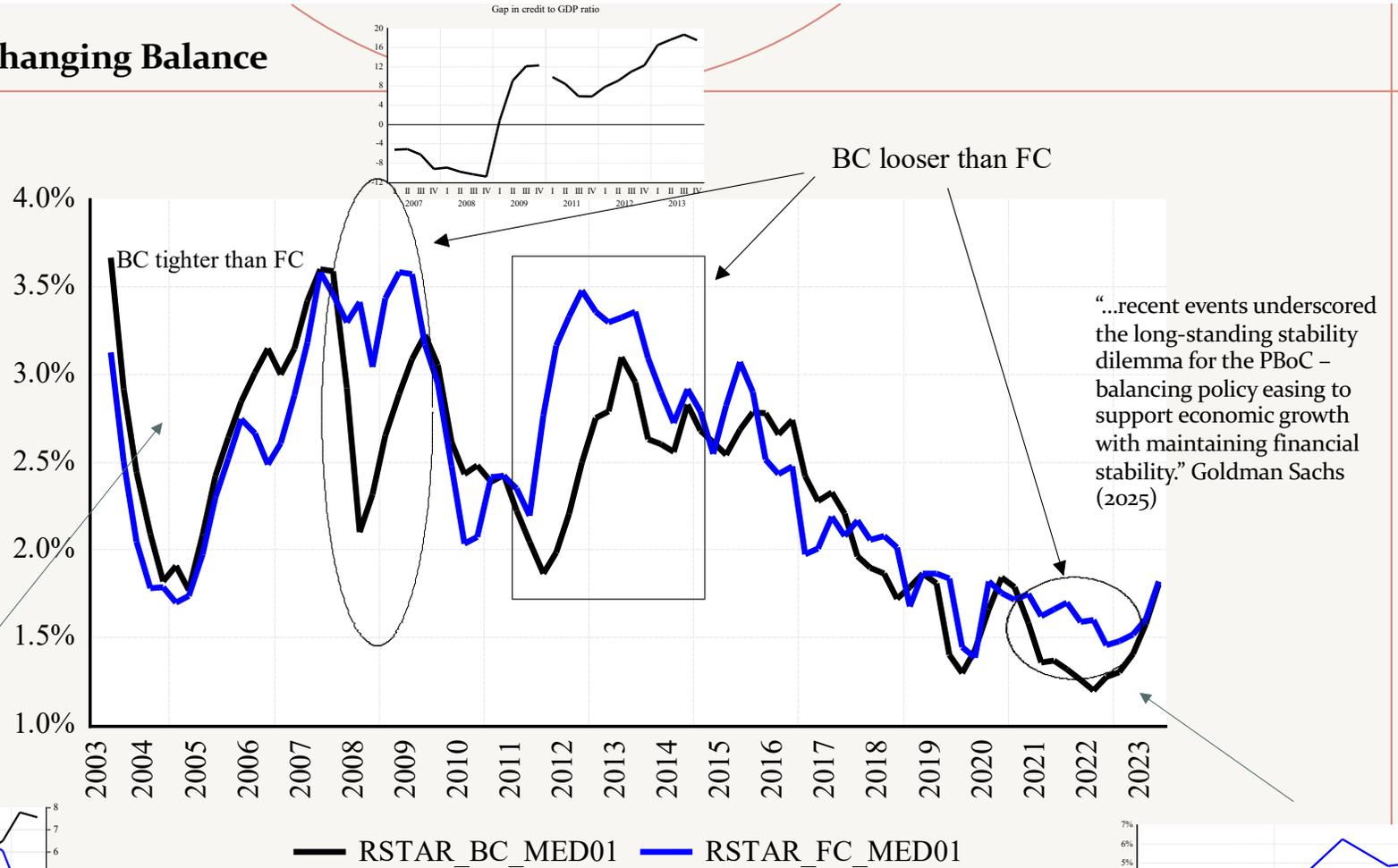REAL_PR_MT relies on 3-5 YA expectations

# Can We Compare Our BC Estimates with any Published Estimates? YES, WE CAN



LEGEND: SSM (semi-structural model); TS (time series model); DSGE (dynamic stochastic GE model)

Sources: Authors' calculations and Nakano (2024)

# CHINA: The Changing Balance



Gap in credit to GDP ratio

BC looser than FC

BC tighter than FC

"...recent events underscored the long-standing stability dilemma for the PBoC – balancing policy easing to support economic growth with maintaining financial stability." Goldman Sachs (2025)

**—— RSTAR_BC_MED01   —— RSTAR_FC_MED01**

CPIG   RGDPG

Inflation   Real GDP growth

Also, see Chen & Siklos (2025)
Burdekin & Siklos (2024)

**USA r\*=R\* - Inflation Expectations [1Yr or 3 to 5Yr for BC; 10 Yr for FC]**

Since 2015 gap between BC and FC have persisted. For example, r*(BC) > r*(FC) is interpreted as reflecting the reaction to inflation's surge while FS considerations keep r* around 2%

Gaps between BC and FC are most apparent when major shocks take place

LEGEND:
RSTAR = neutral real rate
BC = business cycle
FC = financial cycle

LEGEND:
Mean/Mean = average of all BSR estimates
SXC=Siklos-Xia-Chen
LM= Lubik & Matthes

Percent

*Mean of LW, HLW, LM r\* estimates*

RSTAR_MEAN_BC_SXC          RSTAR_MEAN_FC_SXC          RSTAR_MEAN2
RSTAR_LM_UPPERB            RSTAR_LM_LOWERB

# Conclusions & Extensions

Estimate r* for CHN, JPN, KOR, USA but argue these differ depending on BC vs FC horizons are estimated

Shifts by CB in emphasis on traditional objectives (i.e., inflation, real economic outcomes) and financial stability motives over time are discernible in the data

USA and CHN influence r* in JPN & KOR and USA impacts CHN's r*
- Impact can be much larger at BC than at FC
- Impact of USA is twice as large as CHN's at BC
- IMPACT much larger on KOR than either JPN & CHN reflecting KOR's SOE status

Our r* differ for the USA from LW & HLW and LM but broadly remain within CI estimated by LM

Our estimates at FC are more precise than at BC (i.e., range of estimates @FC relatively smaller than @BC)

There is a little bit of evidence that r* may be an anchor for the PR @ BC BUT NOT @ FC

A SEPARATE "UNCERTAINTY" FACTOR? AN EXTENSION
- EPU, VIX, Treasury Term Premia, GSCI (already included in REAL or FINANCIAL)
- Forecast disagreement, data constructed from LLMs, financial stress indexes, …

MORE COUNTRIES WOULD BE HELPFUL BUT DATA CONSTRAINTS LOOM LARGE

OUR ESTIMATES ARE MORE VOLATILE THAN OTHER MODELS BUT COME CLOSEST TO ALT TS MODEL ESTIMATES

Vintage estimates would be nice but only possible for a few countries (data intensive)