A Quantitative Model for the Integrated Policy Framework

OCTOBER 2020

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Motivation

- Over the last two decades, many emerging market economies (EMEs) have moved away from fixed exchange rate regimes and adopted inflation targeting (IT) frameworks.

- However, in contrast to advanced economies (AEs), many EMEs with IT frameworks have continued to rely on foreign exchange interventions (FXI), and some also use capital flow management tools (CFMs).

- Why? Because volatile capital flows are a predominant concern for EMEs (Ghosh et al., 2017), which often face policy dilemmas when hit by capital flow shocks. One instrument (policy rate) not enough:
  - Lowering policy rates to deter inflows may lead to domestic credit booms
  - Contractionary monetary policy during capital outflows risks weakening activity

What We Do

- We develop an empirically-oriented New Keynesian model to help quantify how multiple tools, including FXI and CFMs, can improve policy trade-offs.
- Our model captures two key EME characteristics:
  - First, it builds on substantial empirical evidence showing that exchange rate changes tend to have larger and more persistent inflation effects in EMEs than in AEs (IMF WEO, 2018).
  - Second, it includes a balance sheet channel capturing that exchange rate changes may have large effects on domestic financial conditions (Bruno and Shin, 2018)
- Our quantitative approach complements the conceptual model of our IMF colleagues (Basu et al., 2020) who solve analytically for an optimal combination of IPF tools.
  - We account for the dynamics of inflation and work at a quarterly frequency

Presentation Outline

- Overview of model
- Trade-offs associated with exchange rate shocks
- COVID-style scenarios with additional policy tools
- Benefits of Systematic FXI/CFM Policy Rules
- An application to liquidity traps
- Concluding remarks

The Model

Key Features of the Model

- Empirically-oriented New Keynesian model used to quantify how using multiple policy tools can improve policy tradeoffs and outcomes.
- Accounts for balance sheet effects and includes other frictions to match the data for a wide set of countries:
  - Effects of shocks depend on initial conditions and how well inflation expectations are anchored.
- Shocks can have strong non-linear effects under certain conditions (e.g., low global risk tolerance), especially for countries with weak initial conditions.
- Bayesian estimation is ongoing

More Details on the Model

- **Small open economy New Keynesian model** which can capture differing degrees to which inflation expectations are anchored.
  - **Incomplete financial markets** (internationally).
  - **Imperfect exchange rate pass-through** (allows for DCP as special case).
  - **Discounting in IS and Phillips curves** to address FG puzzle.
  - **State-dependent balance sheet channel** (depends on external liabilities).
  - **Sticky wages** (with possibility of inflation becoming unanchored).

- Full model allows for three types of nonlinearities:
  - UIP risk premium
  - Private borrowing spread
  - ELB on the policy rate

Key Model Equations: Aggregate Demand and Monetary Policy

- Aggregate demand is determined by consumption (endogenous), real net exports (endogenous), and government expenditure (exogenous):

$$y_t = (1 - g_y)\left(c_t + \omega_c\left(m^*_{c,t} - m_{c,t}\right)\right) + g_y g_t.$$

- Model abstracts from endogenous capital accumulation, so c_t captures endogenous fluctuations in domestic absorption.

- Monetary policy follows a standard Taylor-type policy rule:

$$i_t = \max\left\{-i, \gamma_\pi\left(\bar{\pi}_{c,t+4|t} + \bar{\pi}_{c,t}\right) + \gamma_y y_t + e_{i,t}\right\},$$

  - where $\bar{\pi}_{c,t}$ is four quarter moving average of core CPI inflation and i_t is the nominal policy rate as deviation from its steady state level, and $e_{i,t}$ is and iid monetary policy shock.

Aggregate Supply: Modeling of Inflation

- Domestic price Phillips curve

$$\pi_t - \iota_d \pi_{t-1} = \beta \delta_\pi (\pi_{t+1} - \iota_d \pi_t) + \kappa_{mc} mc_t$$

- Wage Phillips Curve:

$$\omega_t - \iota_w \pi^L_{c,t} = \beta \delta_\pi (\omega_{t+1} - \iota_w \pi^L_{c,t+1}) + \kappa_w (mrs_t - \xi_{c,t}),$$

- Long-term inflation

$$\pi^L_{c,t} = \rho_\theta \pi^L_{c,t-1} + \theta \Delta q_{c,t-1}.$$

  - Long-term inflation movements only relevant for EMEs

Parametrization of Model

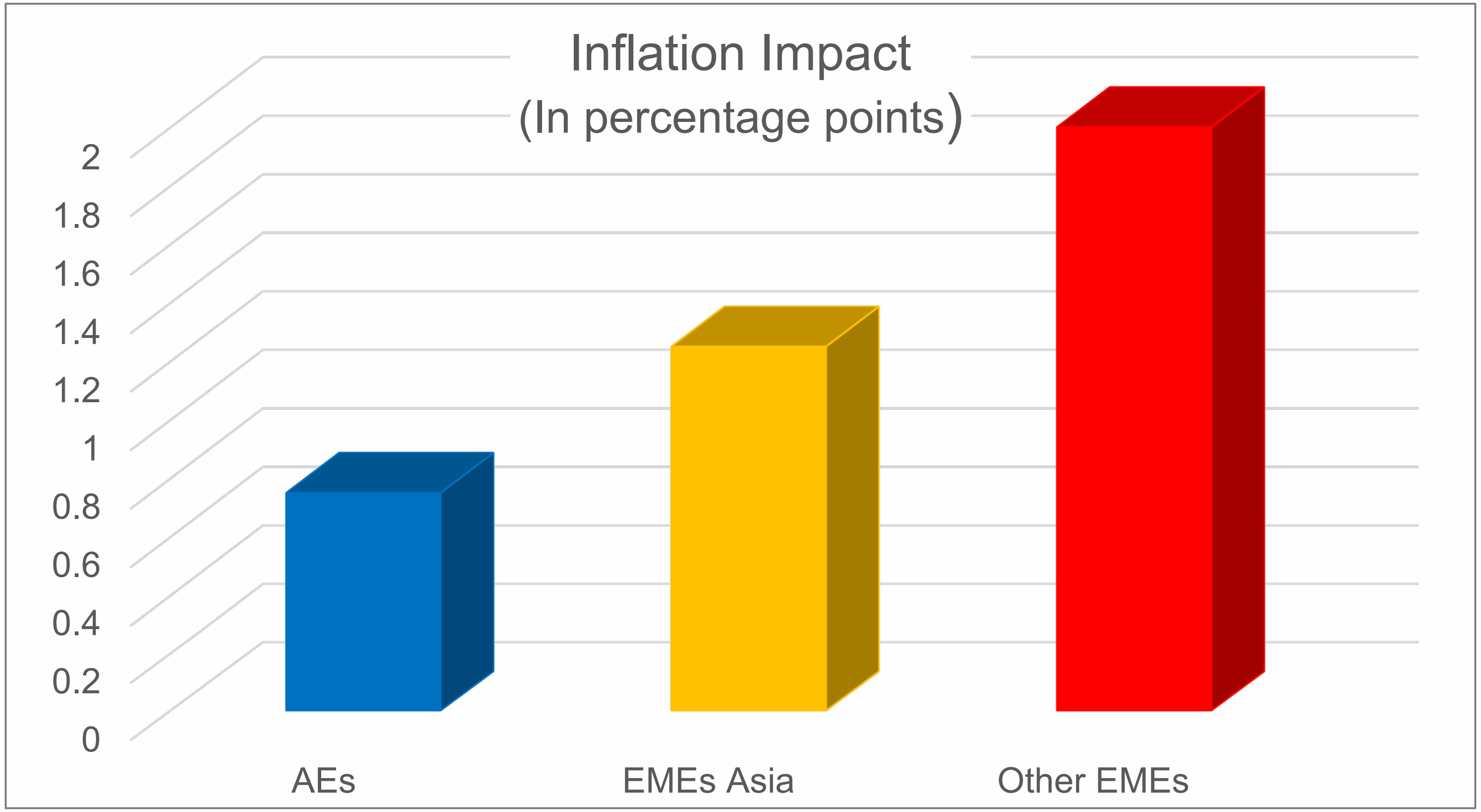
- We adopt standard values for most parameters in the model (same for both AE and EMEs). Openesss 0.2.

- One key difference between AEs and EMEs pertains to the pricing equations:
  - AEs: $\boldsymbol{\kappa}_{mc} = .005$; $\boldsymbol{\kappa}_{w} = 0.02$; $\boldsymbol{\iota}_{d}$=0.5 and $\boldsymbol{\iota}_{w} = 0$
  - EMEs: $\boldsymbol{\kappa}_{mc} = .02$; $\boldsymbol{\kappa}_{w} = 0.03$; $\boldsymbol{\iota}_{d}$= $\boldsymbol{\iota}_{w}$=0.75
  - Similarly, calibration allow for somewhat quicker pass-through of exchange rates to imported and exported good prices in EMEs than in AEs.

- Different parametrization of pricing equations for AEs and EMEs capture the degree to which inflation expectations are anchored
  - Supported by VAR and LP evidence on pass-through of exchange rate shocks (next slide).

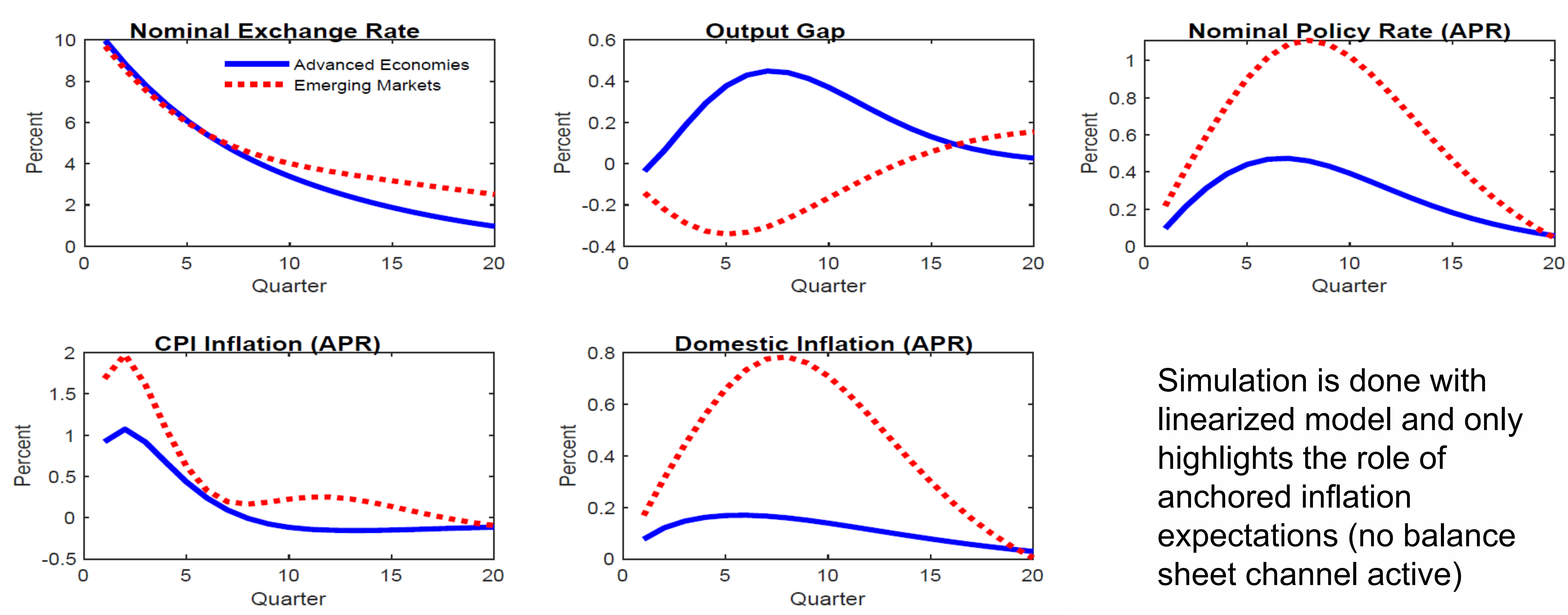
Empirical Evidence on Exchange Rates and Inflation

Empirical estimates of the effects of a 10 percent exchange rate depreciation on consumer price inflation



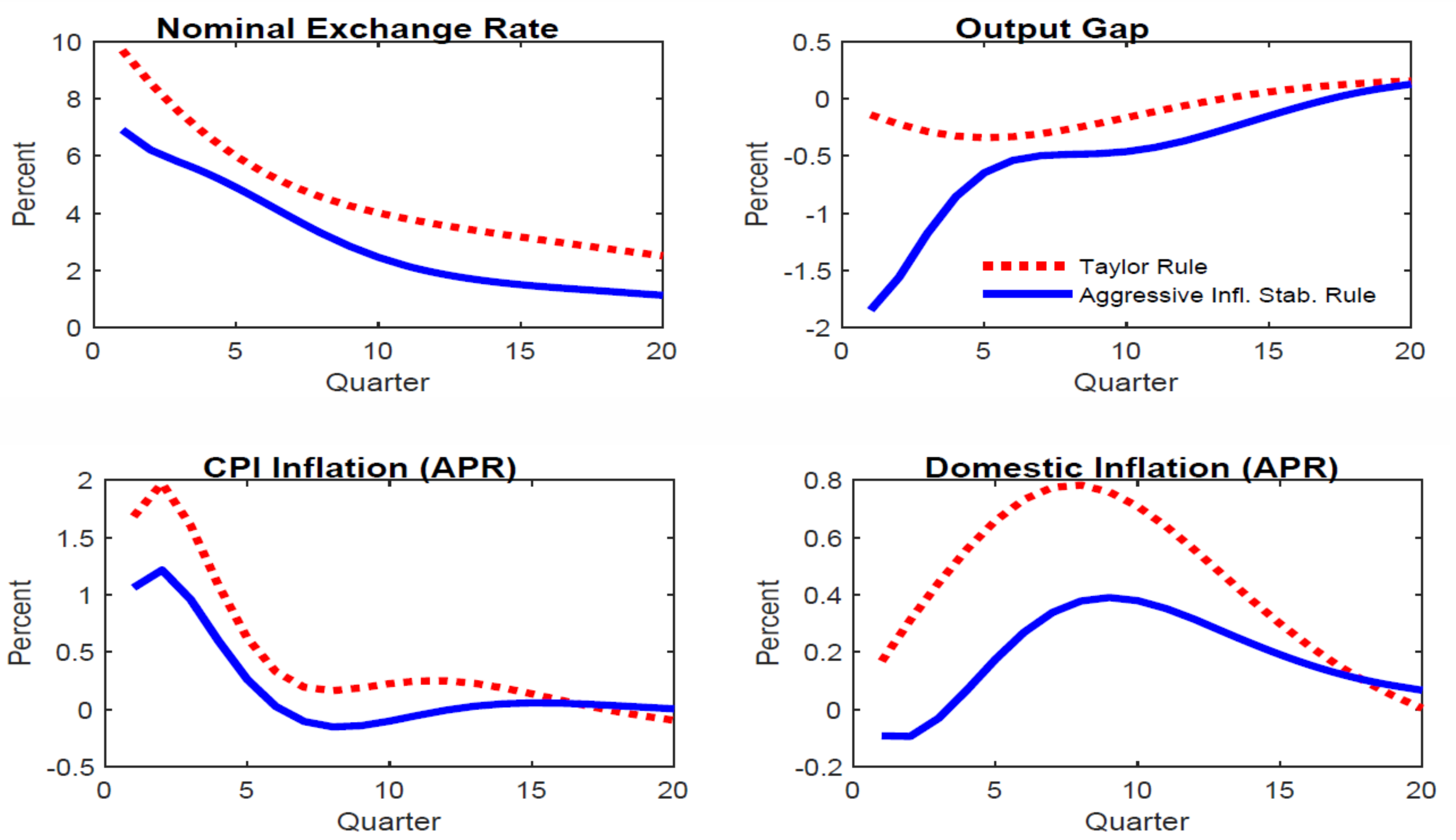
Trade-offs Associated with Exchange Rate Shocks

UIP Risk Premium Shock: AEs vs. EMEs



Simulation is done with linearized model and only highlights the role of anchored inflation expectations (no balance sheet channel active)

The Policy Tradeoff in EMEs



Linearized model for EME calibration with standard rule vs. aggressive rule (CB responding more aggressively to both domestic and imported inflation)

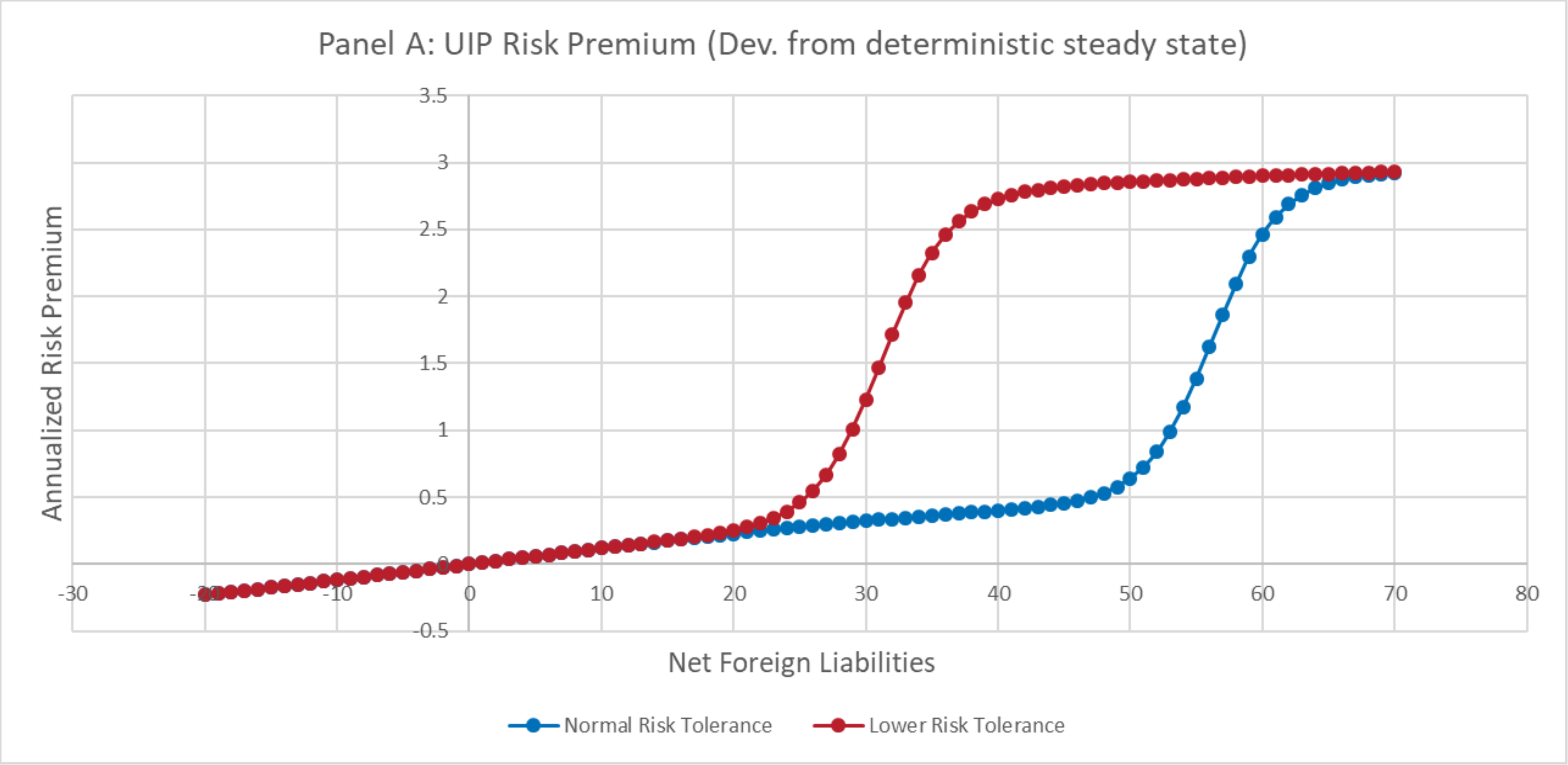
COVID-style Scenarios with Additional Policy Tools

The Risk-centric UIP Condition

- Model features the following risk-centric UIP equation:

$$q_{c,t} = \delta_c q_{c,t+1} + \left(i_t^* - \pi_{c,t+1}^*\right) - \left(i_t - \pi_{c,t+1}\right) + \Phi(d_t, \bar{d}_t, b_t) - \tau_t$$

- $\bar{d}_t$ = risk tolerance/debt limit shock;
- b_t = FXI (effective only when d_t is close to $\bar{d}_t$ as in Chang, 2018);
- τ_t = CFM (Devereux and Yu, 2019);
- Φ_t = risk-premium;



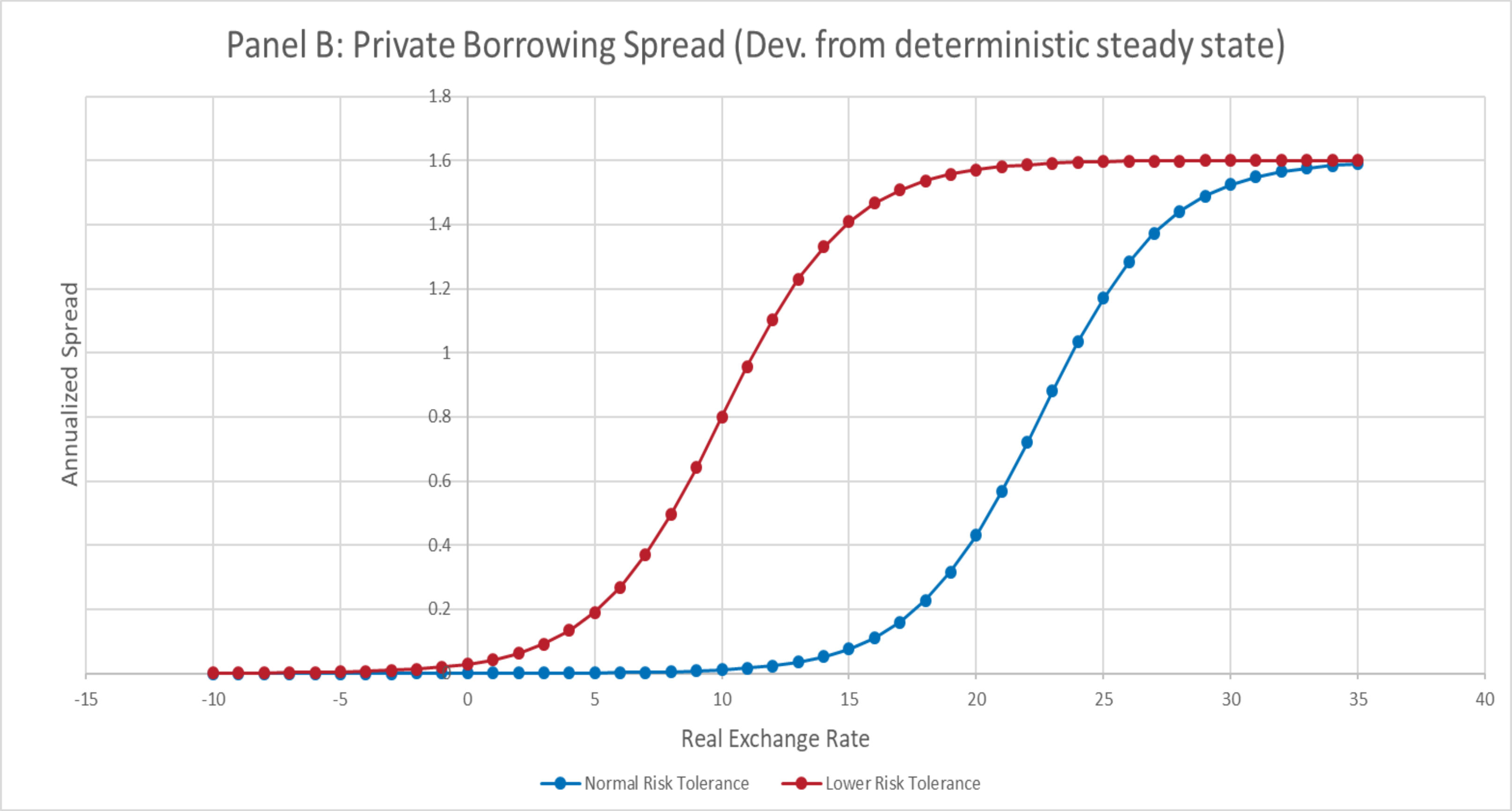
The Balance Sheet Channel

- Private borrowing spread Ψ_t enters the consumption Euler equation:

$$c_t - \varkappa_c c_{t-1} - \varepsilon_{c,t} = \delta_c \left(c_{t+1|t} - \varkappa_c c_t - \varepsilon_{c,t+1|t} \right) - \sigma \left(i_t - \pi_{c,t+1} + \Psi_t \right)$$

- Private borrowing spread is a nonlinear function of the real exchange rate:

$$\Psi_t = f(q_{c,t}, \bar{q}_t)$$



Debt Accumulation

- Net foreign liabilities are governed by

$$d_t = (1 + r_{d,t})\, d_{t-1} - m_y(m^*_{c,t} + \gamma_t^{x,*} - m_{c,t})$$

- The effective interest rate is given by:

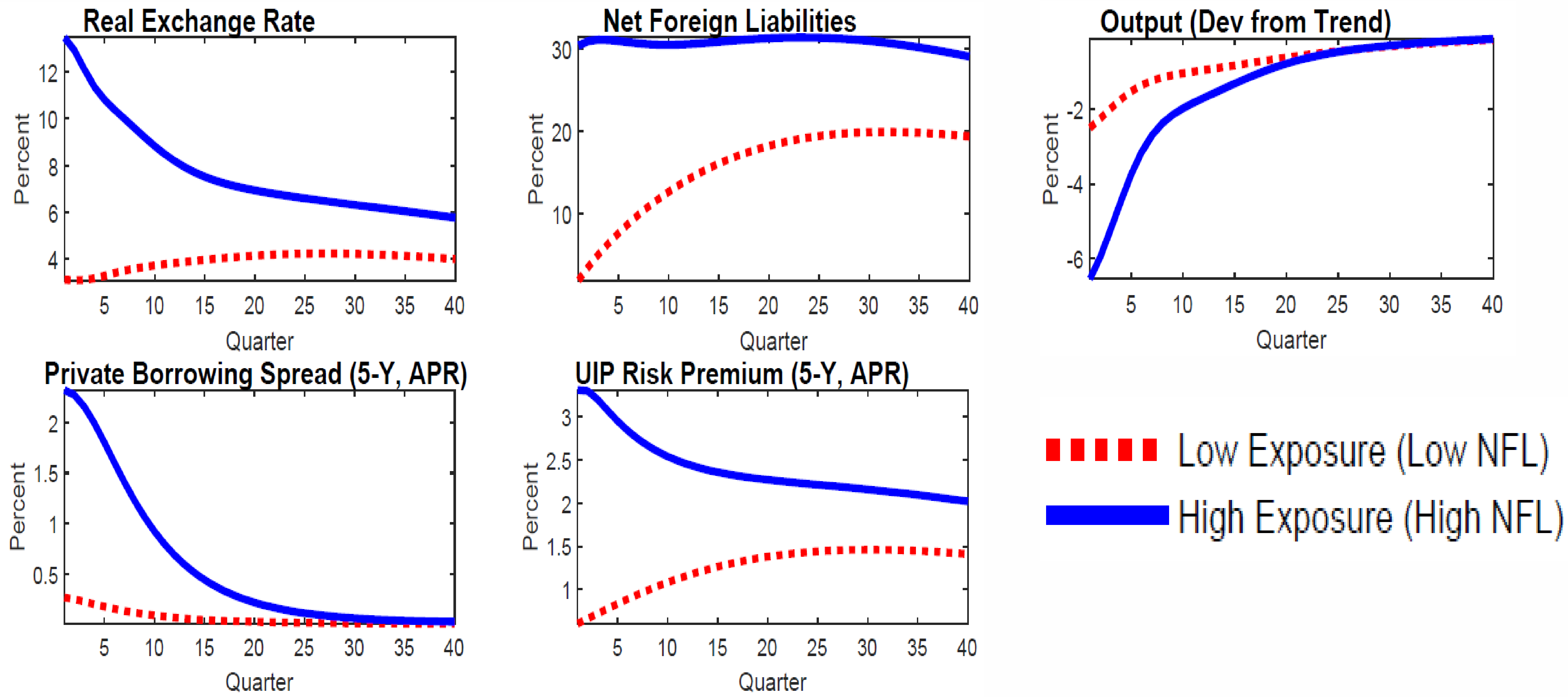
$$1 + r_{d,t} = \frac{1 + i^*_{t-1}}{1 + \pi_{d,t}} \frac{S_t}{S_{t-1}} \left[1 + \Phi(d_{t-1}, \overline{d}_{t-1}, b_{t-1})\right]$$

Use of FXIs and CFMs in Stress Scenario

- Analyze how economies with weak initial conditions (high debt, weak monetary policy credibility, foreign currency mismatch) can be more vulnerable.

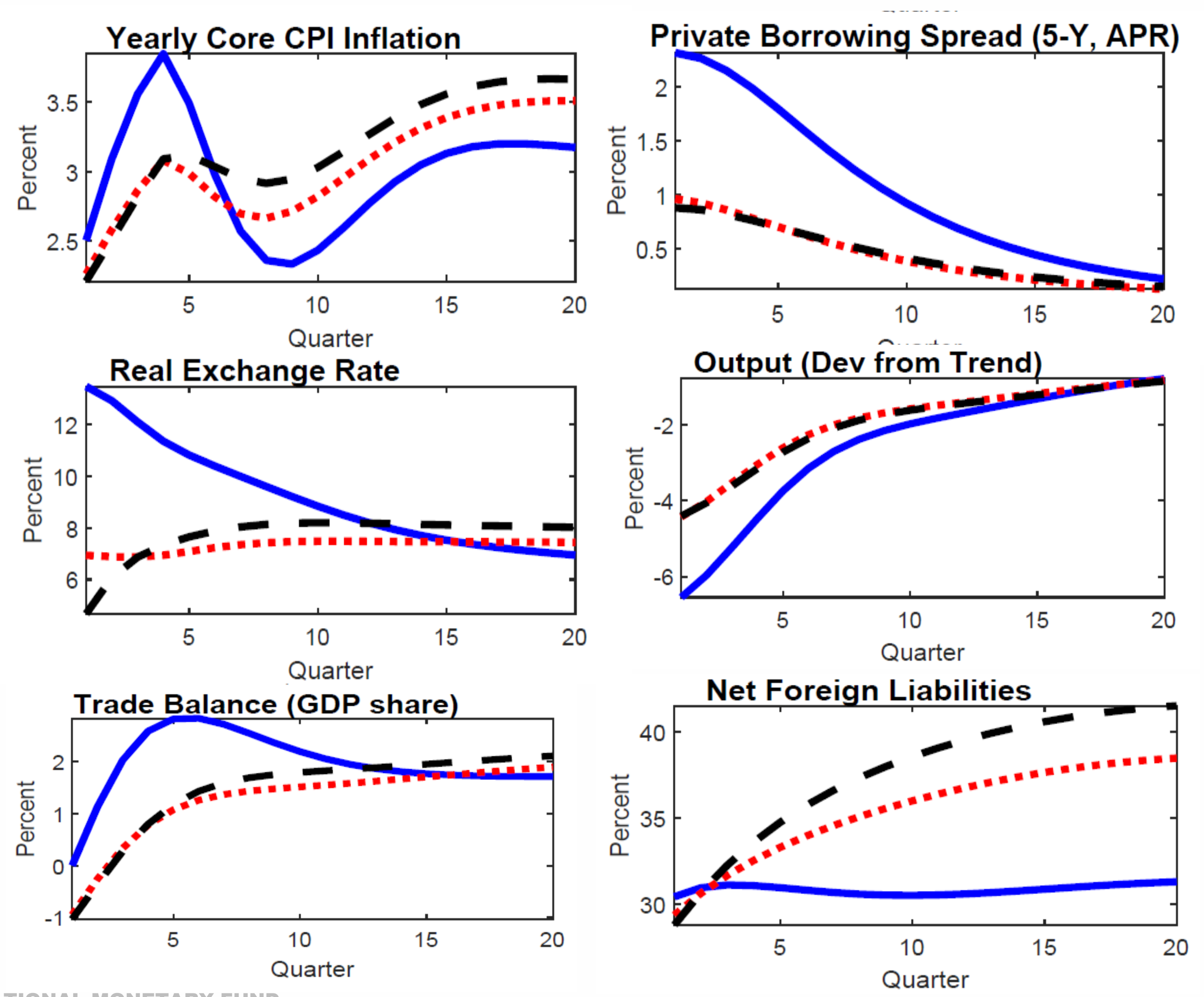
- Use the full model with balance sheet channels and FX mismatch to analyze a COVID style stress scenario with heightened global risk aversion and falling export revenues.
  - Compare economies with different initial conditions: **low vs. high debt for EME calibration**.

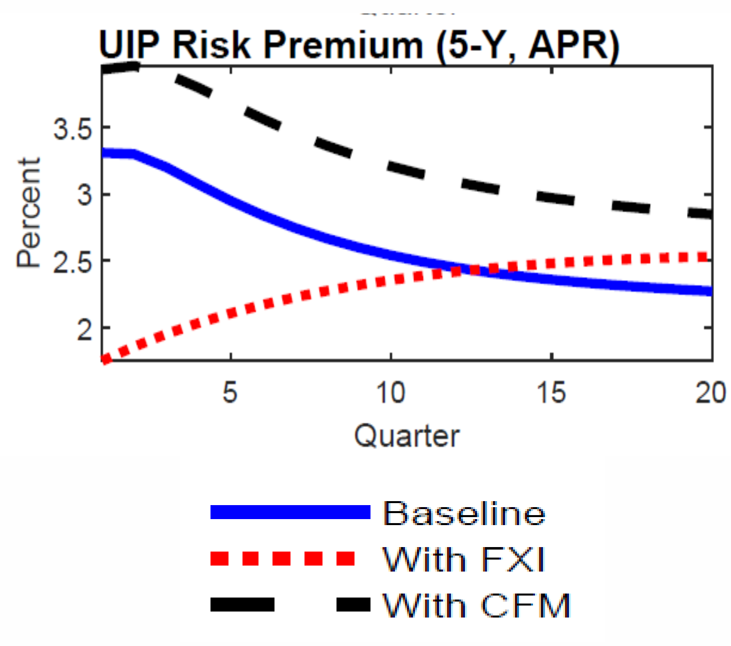
COVID-style Scenario Given Different Initial Conditions



- Output decline in vulnerable EME much larger as higher inflation means less scope to cut policy rate, and FX mismatch leads to tighter financial conditions.

CFMs and FXIs Beneficial for Vulnerable EME





- *b* (red dotted) and τ (**black dashed**) shocks with AR(1) roots 0.85.
- CFMs/FXIs supports output while reducing near-term inflationary pressures.

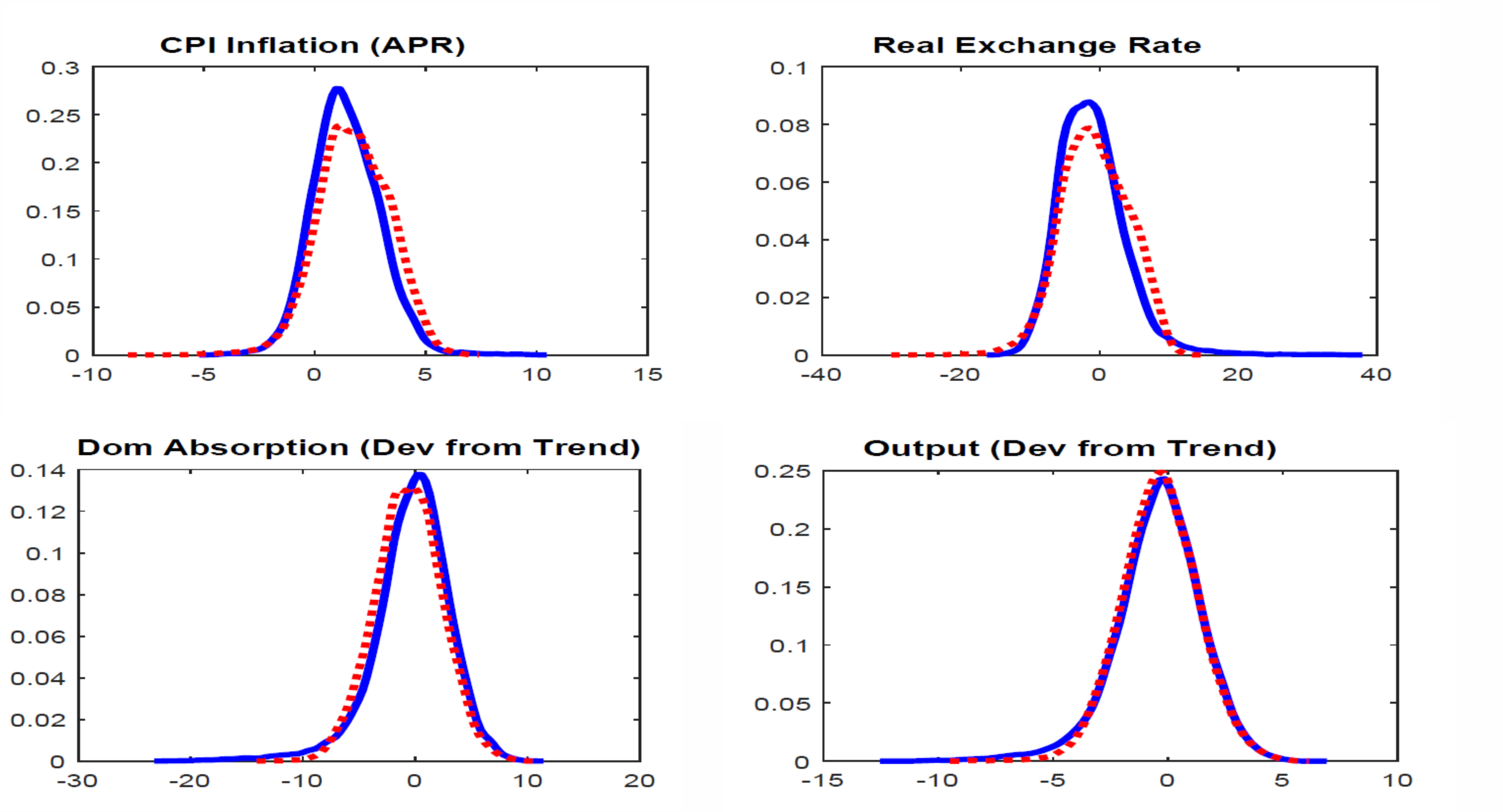
Benefits of Systematic FXI/CFM Policy Rules

Cushioning Downside Risks

- Deploying FXI or CFMs systemically when risk spreads widen can reduce downside risks to output
- Effective policy rules respond aggressively when UIP risk premiums and/or private borrow spreads are elevated above their fundamental values
  - Both CFMs and FXIs may be useful
  - Credible commitment to well-communicated policy rules may imply that smaller interventions are needed to achieve objectives (relative to a discretionary policy)
- We do stochastic simulations of the model with and without a CFM/FXI policy rule and compare outcomes on next slide

Cushioning Downside Risks Cont.

- Model with FXI/CFM rules (red dotted) cushion against large RER depreciations and mitigate Growth at Risk relative to model without interventions (blue solid)

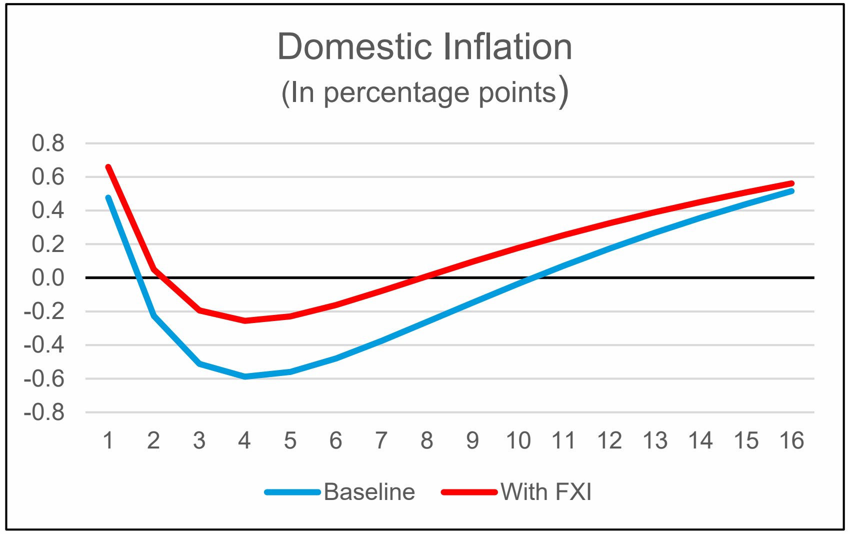


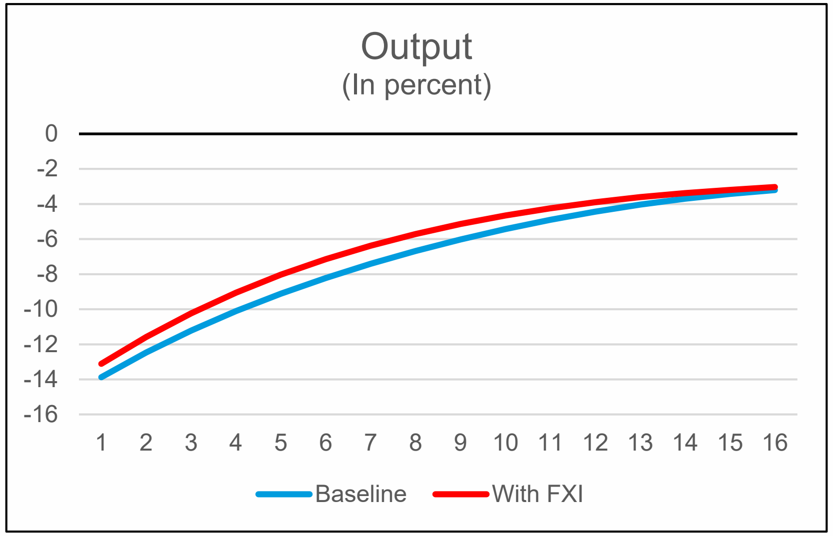
An Application to Liquidity Traps

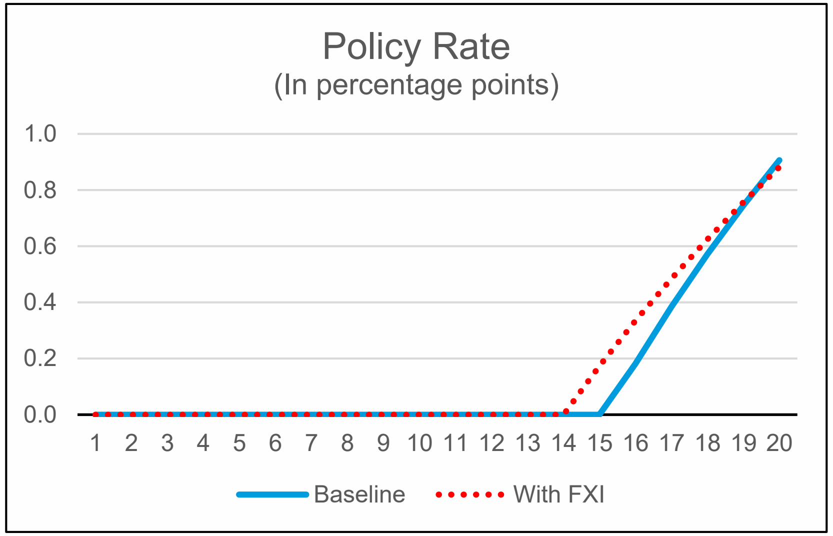
Dealing with a Liquidity Trap

- FXI can boost inflation and output in an economy with low inflation and policy rate at its effective lower bound.
  - Useful if other unconventional policy tools cannot provide sufficient stimulus.
  - May cause domestic demand to expand in a liquidity trap, rather than drop as in normal times.
  - May be even more helpful for EMEs than AEs (larger inflation effects lower real rate more).

Effects of FXI which depreciates exchange rate by 10% in a liquidity trap







Conclusions and Future Work

Concluding Remarks

- Economies with less well anchored inflation expectations and significant foreign currency mismatch can potentially benefit from using FXIs or CFMs
- We do, however, underscore that medium- and longer-term costs need to be accounted for when deciding whether or not to utilize these tools systematically.
  - For instance, use of FXIs and CFMs may slow the development of FX derivatives markets, and encourage FX debt.
- Future analytical work is needed to quantify these risks and to incorporate them into structural models.

Future Work

- There are several additional ways in which we would like to extend our model and further enrich the policy analysis:
  - Micro-founding FXIs a' la Chang (2018)
  - Inclusion of macroprudential policy
  - Different dimensions of fiscal policy and their interplay with IPF tools
  - International spillovers
  - Understanding the empirical transmission of IPF tools
- Model is currently being estimated for a group of emerging and advanced small open economies to deepen understanding of the quantitative tradeoffs that are relevant for different economies

Thank you!