"The Financial (In)Stability Real Interest Rate, R**".

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Background

Why do we need another *?

- The *natural rate of interest* r* is associated with the notion of macroeconomic stability, the rate consistent with output equaling its natural rate and constant inflation (Wicksell, Woodford,... Laubach and Williams, ...);
- This paper introduces **r****, the *financial (In)Stability real interest rate*, the threshold real rate above which financial instability arises;
- Goal of **r****: map the notion of financial stability onto the interest rate space, and complement r* as a guide to policy.

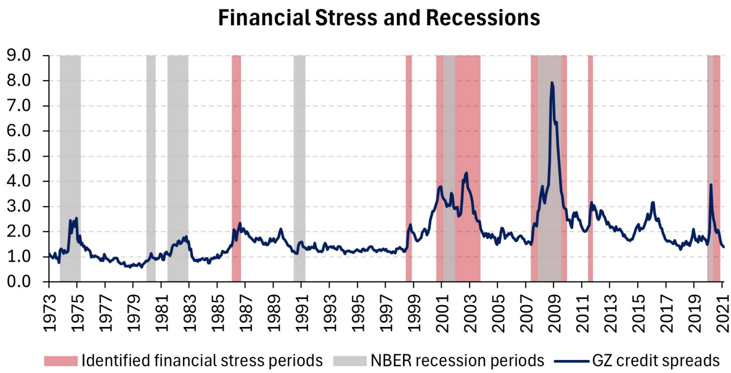
Background

Why should we worry about r more than r*?**

- Nature of economic cycle and changes in the transmission mechanism of monetary policy.
- Structural factors shape economic cycle and how interest rate transmits into the economy (mortgage duration is an example for the U.S.)
- Recessions in the U.S. associated with financial factors.
- Maybe r** more relevant for understanding the working of monetary policy (at least in the U.S.).

Background

Why should we worry about r more than r*?**



- Volcker: monetary policy crunch inflation by "creating bankruptcies"

Outline

- Illustrate r** in the context of a simple macrofinance model with an occasionally binding financing constraint;
- Discuss the drivers and dynamics of r**
  - "financial dominance": persistently low real interest rates generate financial vulnerabilities and an eventual drop in r**, which may constraint monetary policy (monetary policy determines its own boundary)
- Provide and empirical measure of r**.
  - show that the Fed effectively tracked r** in periods of financial stress.

R* and R**

- r^{**} is associated with the notion of financial stability. One interpretation is in terms of policy space.
  - if $r > r^{**}$ we enter a region of financial distress;
  - if $r < r^{**}$ we enter a region of financial stability;
- How does this relate with the notion of macroeconomic stability?
  - if $r^{**} > r^{*}$ macroeconomic stability is compatible with financial stability;
  - if $r^{**} < r^{*}$ macroeconomic stability is not compatible with financial stability.

The Model

Model and mechanism

- Banking sector:
  - Hold risky assets s_t and safe asset b_t
- Household:
  - Consume, supply labor, save in deposit (d_t, R_t^d)
- Real interest rate:
  - Real interest rate on safe asset, R_t follow an exogenous process (think of it in terms of monetary policy)

The core financial intermediary sector

- Simple characterization of the balance sheet of the banking sector with safe assets b_t and interest-rate sensitive assets, s_t, with $Q_t = Q_t(\underset{-}{R_t})$ negatively related to interest rate.

Assets	Liabilities
$Q_t s_t$	d_t
b_t	n_t

- Evolution of net worth

$$n_t = \left(R_t^K - R_{t-1}^d\right) Q_{t-1} s_{t-1} + \left(R_{t-1} - R_{t-1}^d\right) b_t + R_{t-1}^d n_{t-1}$$

- Modified Leverage constraint:

$$\frac{Q_t s_t + b_t}{n_t} \leq \phi \left(\frac{b_t}{b_t + Q_t s_t} \right)$$

Leverage constraint depends on the share of safe assets.

The core financial intermediary sector

Determinants of R**

Rewrite in the following way with simple functional form:

$$\frac{\frac{Q_t(R_t)s_t}{b_t}+1}{\frac{Q_t(R_t)s_t}{b_t}+1-\frac{d_t}{b_t}}=\theta\left(\frac{1}{1+\frac{Q_t(R_t)s_t}{b_t}}\right)$$

- We construct R^{**}, the financial instability real interest rate, as the threshold interest rate above which leverage constraint is binding.
- What are the determinants of R^{**}?
  - R^{**} is positively related with the share of safe assets.
  - R^{**} is positively related to the value of interest rate sensitive assets.

Intermediaries Sector

Intermediary's problem

$$V(n_t) = \max_{s_t, b_t, d_t} E_t \left[(1-\sigma)\, n_{t+1} + \sigma V_{t+1}(n_{t+1}) \right] + \zeta_t b_t$$

with ζ_t utility holding from safe assets. (could be interpreted as liquidity, preference or safe shock).
subject to

1. Evolution of net worth

$$n_t = (R_{K,t} - R^d_{t-1}) Q_{t-1} s_{t-1} + (R_{t-1} - R^d_{t-1}) b_t + R^d_{t-1} n_{t-1}$$

2. Incentive compatibility constraint

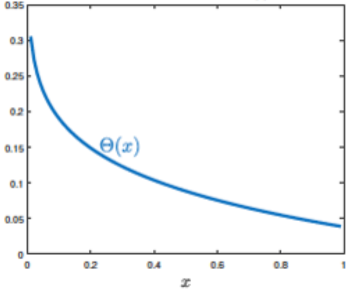
$$V_t(n_t) \geq \Phi(x_t)(Q_t s_t + b_t) \text{ with } x_t = \frac{b_t}{Q_t s_t + b_t} \text{ and } \Phi'(x_t) < 0, \Phi''(x_t) > 0$$

$\rightarrow$ Occasionally binding credit constraint

$$\underbrace{\frac{Q_t s_t + b_t}{n_t}}_{leverage} \leq \underbrace{\frac{V_t(n_t)}{\Phi(x_t)}}_{\max leverage}$$

Function

Figure 1: Functional Form of $\Theta(\cdot)$ Function



- Financial frictions become more severe when portfolio is tilted towards risky assets $\rightarrow$ vulnerabilities $\uparrow$

Financial (In)Stability Regimes

- When the constraint does not bind (financial stability)

$$E_t\left[\Omega_{t+1}\left(R_{k,t+1}-R_t\right)\right]=\zeta_t$$

  - The economy is far away from the constraint. Spreads are low and mainly determined by liquidity shocks.
  - Response of the economy to shocks resembles RBC economy.

- When the constraint bind (financial instability)

  - Bank leverage constraint by net worth;
  - Response of the economy to shocks reflect the nonlinear financial accelerator effect

$$N_t \equiv \left(\int n_t\right)\downarrow \Longrightarrow Q_t \downarrow \Longrightarrow N_t \downarrow$$

  - Spreads are large and volatile

$$E_t\left[\Omega_{t+1}\left(R_{k,t+1}-R_t\right)\right]>\zeta_t$$

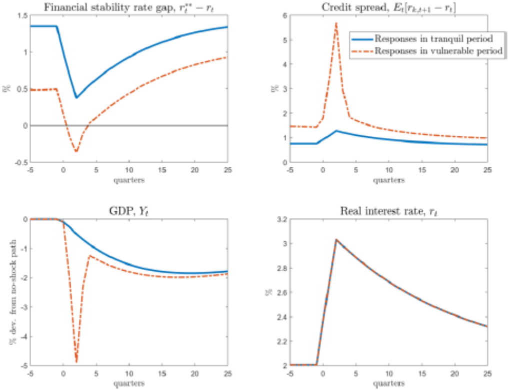
Constructing r**

- If the economy is in the unconstrained (constrained) regime: increase (decrease) R_t just the constraint just binds (or ceases to bind), given the other state variables:
- Construction based on valuation effect: $\uparrow R_t \implies \downarrow Q_t \implies \downarrow n_t \implies$ leverage increases.
  - $\implies r^{**}$ is a threshold : real interest rate below r^{**} ensures the economy remains in the financial stability regime
- Financial stability rate gap, $r^{**} - r$, depends on the evolution of other state variables, e.g.,leverage and the share of risky assets in banks' portfolio.

Quantitative model and its properties

State Dependent Impulse Responses

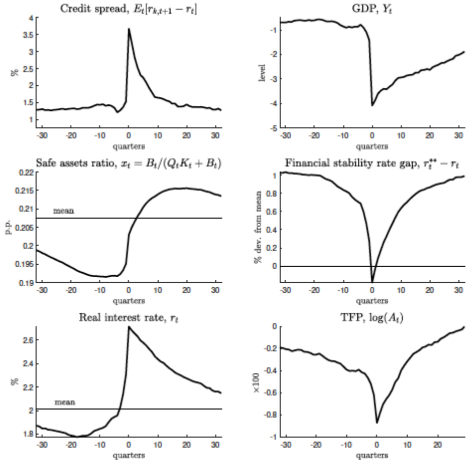
Figure 4: Responses to an interest rate shock in financially vulnerable and non-vulnerable periods



Note: The figure shows the effects of a positive interest rate shock for different initial states of the economy. In the blue solid lines, the economy is initially far away from the constrained region. In the red dashed lines, the economy is initially close to the constrained region.

Average financial crisis in the model

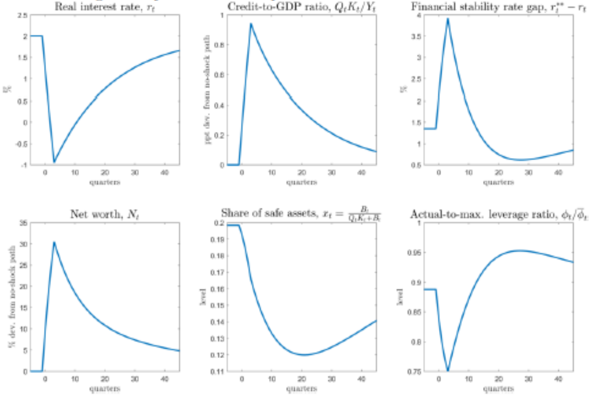
Figure 5: Average financial crisis in the model



Note: A financial crisis event in the model is defined as an event in which banks' constraint binds for at least two consecutive quarters. We simulate the economy for a large number of periods and compute average paths before, during, and after financial crisis events (the crisis starts at time 0 for each path).

Dynamics of r**

Figure 6: Dynamics of r**: response to a decline in real interest rates

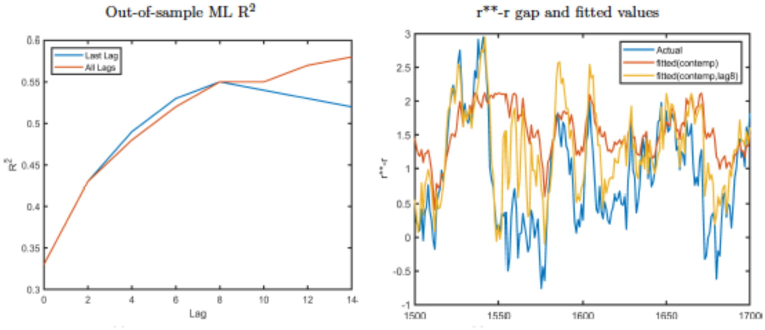


Note: Responses to an unexpected 3 percentage-point fall in the real interest rate, r_t. The economy is at the risk-adjusted steady-state in the initial period. Variables indicated % dev. computed as percent deviations relative to their risk-adjusted steady-state values.

- Persistently low rates today cause vulnerabilities to build up $\Longrightarrow$ reduce monetary policy space for maintaining "financial stability" in the future

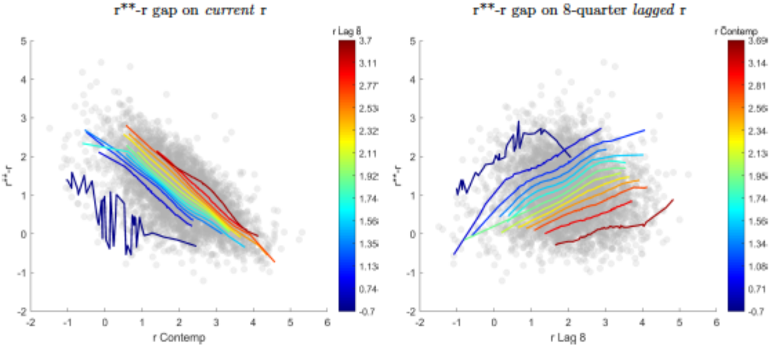
Uncovering R** Properties

Figure 8: Financial stability, current, and lagged real rates



- Model is highly nonlinear so we use machine learning to understand better model relationships.
- Lagged values add quite a bit in terms of explanatory power.

R**-R and Real Interest Rates



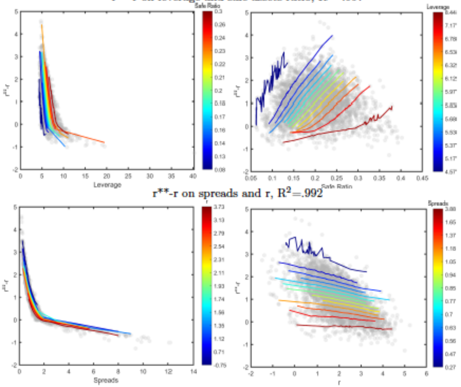
- Non-linear relationship: current policy affects financial vulnerabilities negatively : lower rates ease financial strains, (two years) lagged policy affects financial vulnerabilities positively : lower rates generate financial distress eventually.

Measuring R**

Measuring R**-R

Figure 9: The r**-r gap, financial constraints, and credit spreads

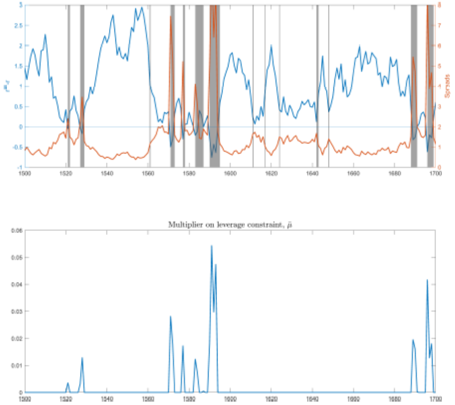
r**-r on leverage and safe assets ratio, R^2=.997



Note: Top panels: leverage and safe ratio. Bottom panel: spreads and the real rate. Estimated relationship between the r**-r gap and one regressor, for given values of the other regressor (the color of the fitted lines varies from dark purple to red, depending on the value of this other regressor). Light gray dots are observations.

Measuring r**-r

Figure 10: Financial stability rate gap, spreads, and financial constraints, simulated from the model

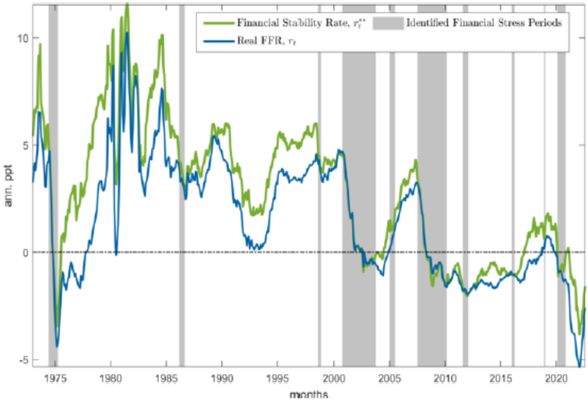


Note: r**-r gap (blue; top panel, left axis), spreads (red; top panel, right axis), and $\bar{\mu}$ (blue; bottom panel), the Lagrange multiplier on the leverage constraint (1), for a section of the simulated data.

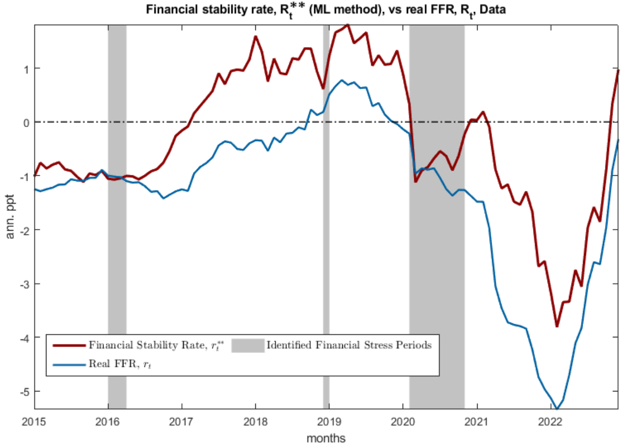
- Financially constrained regime: spreads are very volatile and correlated with multiplier.
- Unconstrained regime: spreads only loosely correlated with the proximity of the constraint

The Financial Stability Interest Rate R** in the Data

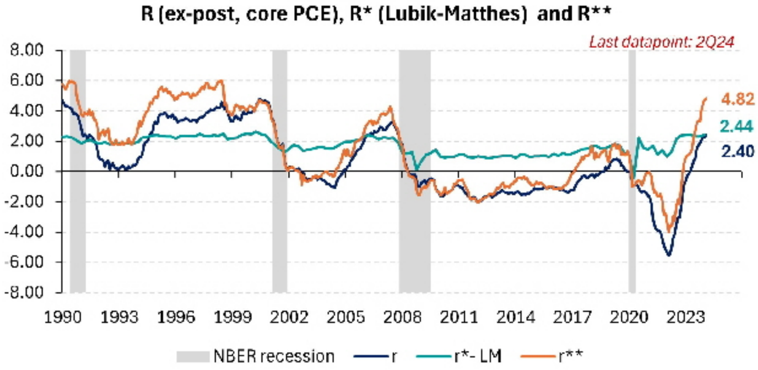
Figure 12: The financial stability rate r_t^{**} and the real rate r_t in the data



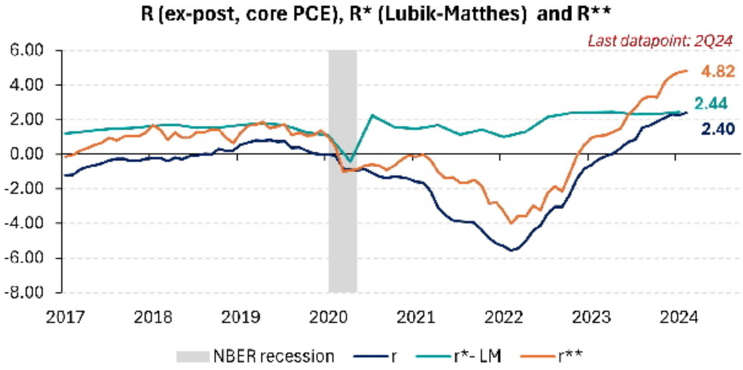
The Financial Stability Interest Rate R** in the Data



The Financial Stability Interest Rate
R**, R* and R



The Financial Stability Interest Rate R**, R* and R



Conclusions: R**

- Introduce a new concept: r**
  - threshold real interest rate above which the tightness of financial conditions may generate financial instability.
- r** enables us to translate financial vulnerabilities into an object comparable to the monetary policy rate and to the natural real interest rate.
- Importance of Financial channel in understanding the transmission mechanism of monetary policy.