



## Motivation and Contribution

Recent empirical evidence on effectiveness and transmission of monetary policy:

1. Monetary policy affects consumption largely through indirect (GE) effects.
2. High-MPC households tend to be more exposed to monetary policy.
3. Forward guidance has relatively weak effects on economic activity.
4. Advanced economies remained stable during long ELB periods.

**Our contribution: The Behavioral Heterogeneous Agent New Keynesian Model**—a new framework that allows for household heterogeneity and bounded rationality in the form of cognitive discounting:

- can account for the empirical facts 1 - 4 jointly
  - ⇒ resolves tension in existing literature
  - ⇒ matters for transmission of supply shocks: 2.5 times as inflationary
- more pronounced trade off for monetary policy: price stability vs. fiscal and distributional consequences of monetary policy

## Model

**Households:** incomplete markets and cognitive discounting

$$V_t(B_{i,t}, e_{i,t}) = \max_{C_{i,t}, N_{i,t}, B_{i,t+1}} \left\{ \frac{(C_{i,t})^{1-\gamma}}{1-\gamma} - \frac{(N_{i,t})^{1+\varphi}}{1+\varphi} + \beta(e_{i,t}) \mathbb{E}_t^{BR} V_{t+1}(B_{i,t+1}, e_{i,t+1}) \right\}$$

subject to

$$C_{i,t} + \frac{B_{i,t+1}}{R_t} = B_{i,t} + W_t z(e_{i,t}) N_{i,t} + d_t(e_{i,t}) - \tau_t(e_{i,t}), \quad B_{i,t+1} \geq 0,$$

$e_{i,t}$  determines idiosync. prod.  $z(e_{i,t})$ , dividends  $d_t(e_{i,t})$ , taxes  $\tau_t(e_{i,t})$  and  $\beta(e_{i,t})$

Bounded rationality:

$$\mathbb{E}_t^{BR} [X_{t+1}] \equiv \underbrace{\bar{X}}_{\text{anchor}} + \underbrace{\bar{m} \mathbb{E}_t [\tilde{X}_{t+1}]}_{\text{expected deviation}}$$

- anchor expectations to stationary equilibrium outcome  $\bar{X}$ 
  - ⇒ absent aggregate shocks households are rational
- $\bar{m} \in [0, 1]$ : cognitive discounting parameter,  $\bar{m} = 1$ : rational expectations
- underreaction of household expectations in data:  $\bar{m} \in [0.6, 0.85]$

**Firms:** standard NK setup, monopolistic competition and nominal rigidity

**Government:** fiscal policy issues bonds, raises taxes, MP rule + MP shocks

## Analytical Results

Special calibration allows for closed-form solution:

- zero liquidity, only two idiosyncratic states with  $\beta(e_1) \ll \beta(e_2)$ 
  - ⇒ share  $\lambda$  of Hand-to-mouth households with consumption  $\hat{c}_t^H = \chi \hat{y}_t$
  - ⇒ Fact 2:  $\chi > 1$

Aggregate IS equation:

$$\hat{y}_t = \psi_f \mathbb{E}_t \hat{y}_{t+1} - \psi_c \frac{1}{\gamma} \hat{r}_t$$

where

$$\psi_f \equiv \bar{m} \left[ 1 + (\chi - 1) \frac{1-s}{1-\chi\lambda} \right] \quad \text{and} \quad \psi_c \equiv \frac{1-\lambda}{1-\chi\lambda}$$

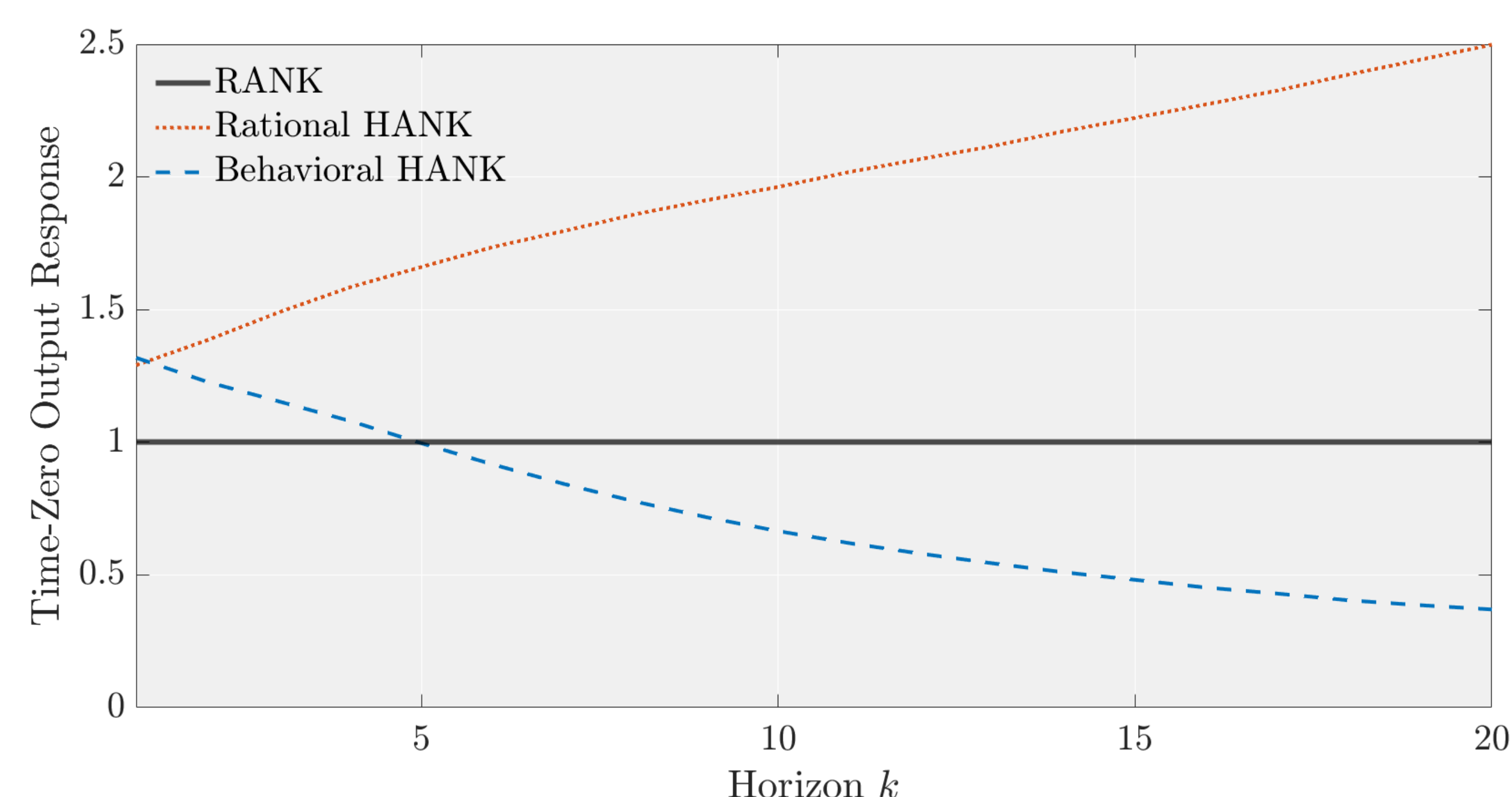
- monetary policy redistributes to  $H$  households ( $\chi > 1$ ) ⇒ transmission and amplification through indirect effects:  $\psi_c > 1$  (fact 1 ✓)
- forward guidance shocks become weaker as the announcement horizon increases:  $\psi_f < 1$  (fact 3 ✓)
- $\psi_f < 1$  also keeps the economy stable at the effective (or zero) lower bound (fact 4 ✓)
- simultaneously having  $\psi_c > 1$  and  $\psi_f < 1$ : not possible in rational TANK/HANK models or without household heterogeneity!
- can derive observationally-equivalent IS equation with sticky wages

## Quantitative Behavioral HANK Model

**Calibration:**

- relax special calibration that was imposed for closed-form solution
- set government debt level to match average quarterly MPC of 0.16
- set dividend shares to match empirical finding of Patterson (AER, 2023): regressing income elasticity of households with respect to aggregate changes in output on HHs' MPC yields regression coefficient of 1.33 (fact 2 ✓)
- $\bar{m} = 0.85$  (upper limit of our empirical estimates)

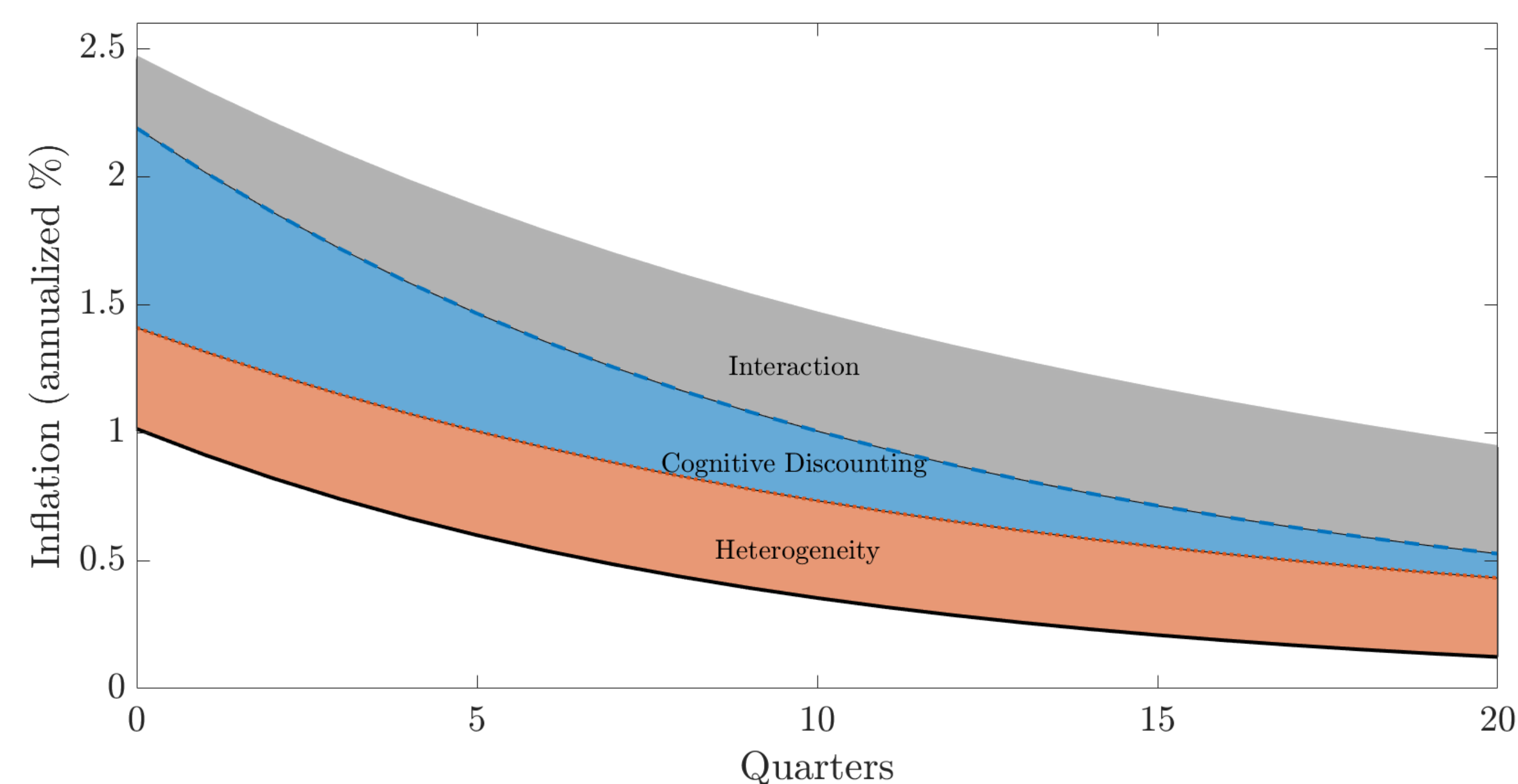
**Results:** Effect of contemporaneous MP shocks ( $k = 0$ ) and of FG shocks of different horizons  $k$  on output today:



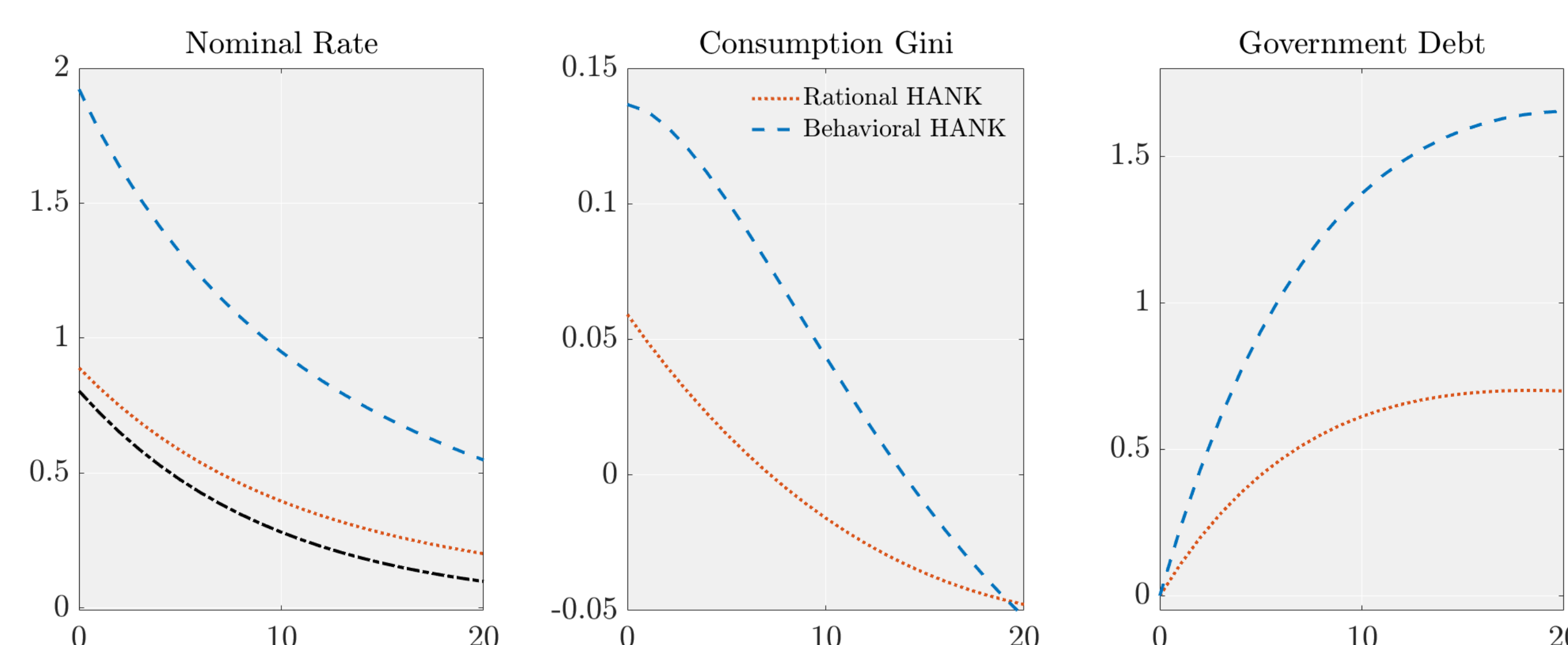
- MP shocks are transmitted and amplified through indirect effects (fact 1 ✓)
- no forward-guidance puzzle (fact 3 ✓)
- forward-guidance puzzle aggravated in rational HANK
- behavioral HANK also remains stable at lower bound (see paper) (fact 4 ✓)

## Amplification of Productivity Shocks

Heterogeneous exposure and behavioral friction increase inflation response and reinforce each other such that inflation increases 2.5 times as much as in RANK (black line):



Can monetary policy impose zero inflation? Yes, but more aggressive rate hikes necessary which implies larger fiscal and distributional consequences compared to rational model:



Details are in the paper—if interested, please scan the QR code at the top to get the latest version of our paper!