Makeup Monetary Policy Strategies in an Unequal World

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Introduction

- The low interest rate environment in North America and Europe as well as the experience during the aftermath of the Global Financial Crisis of 2008 has created a lot of interest in alternative monetary policy strategies.
- One intensely debated suggestion to soften the ELB-induced limitations of monetary policy calls for a shift away from inflation targeting towards 'makeup strategies' such as price-level or nominal GDP targeting. These communicate a rule based promise to keep rates lower (or higher) for longer.
- In rational expectation representative agent New Keynesian (RANK) models makeup strategies have been shown to possibly yield great stabilization gains.
- Recent literature on heterogeneous agent New Keynesian (HANK) models suggests different forces that might weaken or strengthen the RANK conclusions, but a systematic analysis of the effects of such rules in HANK models is missing.

Introduction

- In this project we construct and calibrate a HANK model with idiosyncratic unemployment risk, incomplete markets, illiquid assets, and matching frictions.

- Using impulse response functions and longer simulations we show that the stabilization gains depend, among other things, on the availability of liquid wealth/credit/transfers to unemployed and 'at-risk' households - suggesting that the effects of alternative policy strategies are substitutes for fiscal interventions among other things.

- In a low liquidity calibration closer to current U.S. household level data we find larger gains from makeup strategies in terms of stabilizing inflation and reducing average unemployment.

Literature

- **Forward Guidance and Price Level Level Targeting:**
  - Price Level Targeting without ZLB: Svensson (1999), Vestin (2006)
  - Price Level Targeting with ZLB: Woodford & Eggertsson (2003), Nakov (2008), Coibion et al (2012)
  - Surveys: Ambler (2009), Hatcher & Minford (2016)
- **Monetary Policy in HANK:**
  - Monetary Transmission/Forward Guidance/Makeup Strategies in HANK: McKay et al (2016), **Bilbiie** (2019), Werning (2015), **Archarya & Dogra** (2019), Hagedorn et al (2019), Kaplan et al (2018), **Feivesson, Hotchkiss, Gornemann, Mertens, Sim** (2020)
  - Optimal Policy (Rules) in HANK/TANK: Bilbiie (2018), Cairo & Sim (2018), Gornemann et al (2016)

Model: Overview

- Households either work to earn wages and face unemployment risk or run the firms in the economy. They self-insure by trading nominal bonds subject to a borrowing constraint.

- Monopolists produce final goods using hired labor, subject to price adjustment costs.

- Firms hire workers subject to matching frictions. Wages are subject to real wage stickiness.

- Monetary authority sets interest rate following a simple rule.

- Three shocks during simulation: Markup shocks, risk premium shocks, TFP shocks.

Model: Employed Worker

$$
\begin{aligned}
W_t(e, s_i, a) \quad &= \quad \max_{c, a' \geq 0} \Bigg(\frac{c^{1-\sigma}}{1-\sigma} + La' \\
&\quad + \beta_H \mathbb{E}_t^I \left[(1 - \rho(1 - f_{t+1})) W_{t+1}(e_j, s_j, a') + \rho(1 - f_{t+1}) W_{t+1}(u_j, s_j, a') \right] \Bigg) \\
\text{s.t.} \quad & c + a' = w_t s_i (1 - \tau_t) + a \frac{R_{t-1}}{\pi_t} x_{t-1}^b + A\Pi_t \\
& a' \geq 0
\end{aligned}
$$

- W_t value function worker, a bond holdings, s_i worker skill, c_t consumption;
- f_{t+1} job finding rate, w_t wages;
- R_t interest rate, π_t inflation, x_t^b liquidity shock;
- $A\Pi_t$ income from illiquid asset, τ_t transfer.

Model: Unemployed Worker

$$
\begin{aligned}
W_t(u, s_i, a) \quad &= \quad \max_{c, a' \geq 0} \left(\frac{c^{1-\sigma}}{1-\sigma} + La' \right. \\
&\quad \left. + \beta_H \mathbb{E}_t^I \left[f_{t+1} W_{t+1}(e_j, s_j, a') + (1 - f_{t+1}) W_{t+1}(u_j, s_j, a') \right] \right) \\
\text{s.t.} \quad &\quad c + a' = b\bar{w} s_i (1 - \tau_t) + a \frac{R_{t-1}}{\pi_t} x_{t-1}^b + A\Pi_t \\
&\quad a' \geq 0
\end{aligned}
$$

Model: Entrepreneur

$$\begin{aligned} W_t(E, s_3, a) \quad &= \quad \max_{c,a' \geq 0} \left(\frac{c^{1-\sigma}}{1-\sigma} + La' + \beta_H \mathbb{E}_t^I W_{t+1}(E_j, s_j, a') \right) \\ \text{s.t.} \quad & \quad c + a' = E\Pi_t + a \frac{R_{t-1}}{\pi_t} x_{t-1}^b + A\Pi_t \\ & \quad a' \geq 0 \end{aligned}$$

- $E\Pi_t$ Share of profits going to entrepreneurs.

Model: Monetary Policy

- Monetary policy rule: $R_t = max\left(\bar{R}\left(\frac{R_{t-1}}{\bar{R}}\right)^{\rho_R}\left(m_t y_t^{\phi_y}\right)^{1-\rho_R}, 1\right)$
  - Under inflation targeting $m_t = \left(\frac{\pi_t}{\bar{\pi}}\right)^{\phi_\pi}$
  - Under price level targeting $m_t = (p_t)^{\phi_\pi}$,
    $log(p_t) = (log(\pi_t) - log(\bar{\pi})) + log(p_{t-1})$
  - Under nominal GDP targeting $m_t = (g_t)^{\phi_\pi}$,
    $log(g_t) = ((log(\pi_t) - log(\bar{\pi})) + (log(y_t) - log(y_{t-1}))) + log(g_{t-1})$.

Transmission Intuition

- Prices are sticky so reducing nominal rates will reduce real rates. Firms in our model are forward looking - price setters respond to lower future rates and higher expected inflation by raising prices and posting more vacancies today.
- The consumption of a representative agent in our model would mainly respond to current and future interest rates and changes in permanent income. In our environment the former dominates in magnitude.
- Households facing idiosyncratic risk and incomplete markets tend to respond less to these, and more to current income (risk).
- Quantitative question if this strengthens or weakens monetary transmission.

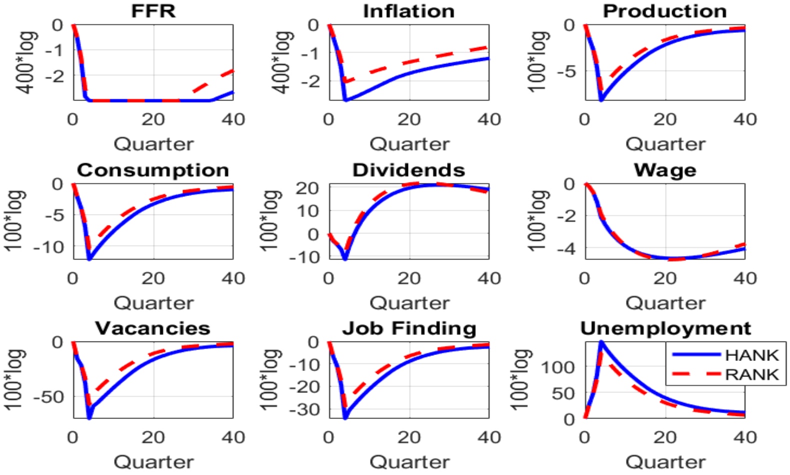
Calibration

- We calibrate the model by matching steady state targets for most parameters. We estimate the shock processes using maximum likelihood and data on U.S. inflation, consumption growth, unemployment, and the federal funds rate in the RANK model.

- Our RANK model is the same at the aggregate level for all but one equation - interest rates are determined by the RANK Euler equation instead of HANK Euler equations and asset market clearing.

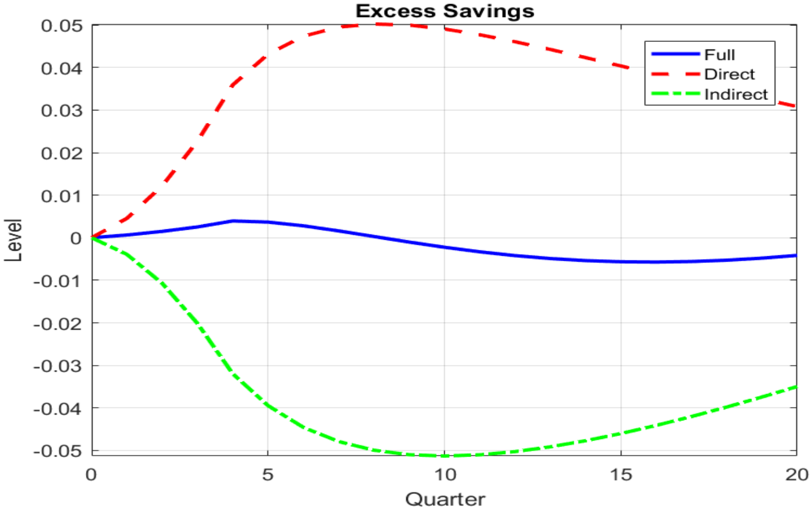
IRF Risk Premium Shock ELB

We begin by comparing our HANK and RANK models after a sequence of risk premium shocks.



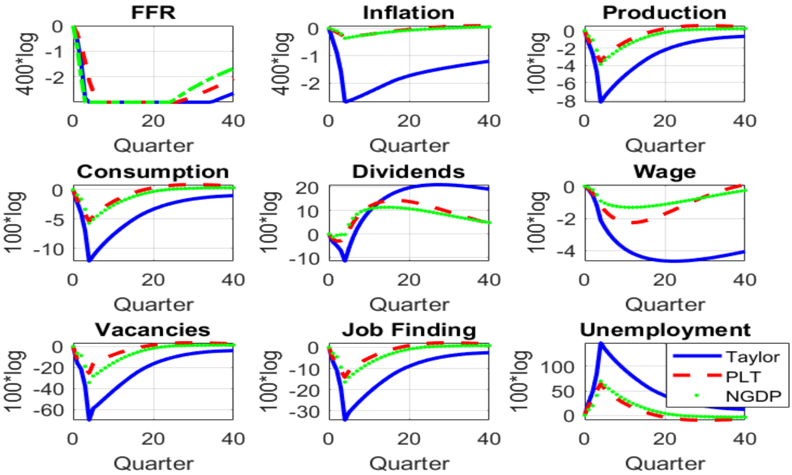
IRF Risk Premium Shock Excess Savings

What explains the difference between the models? Differences in savings choices.



IRF Risk Premium Shock Makeup

Makeup strategies help stabilize the economy after a demand shock.

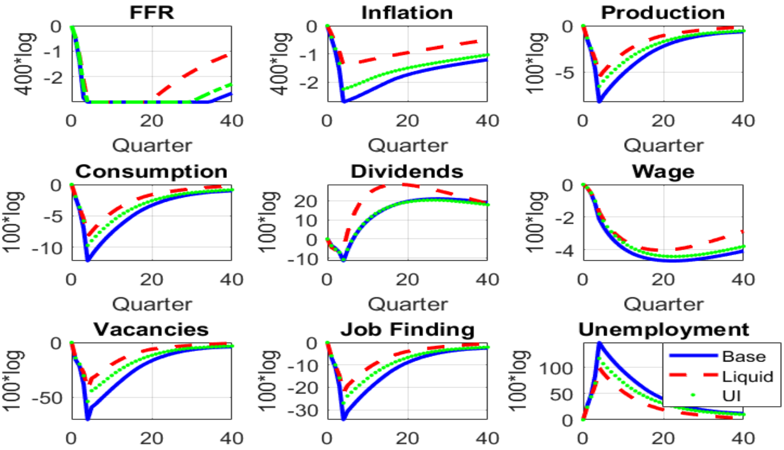


Makeup Strategies - Summary of Results

- Looking at IRFs and Moments we find that
  1. the HANK model shows more amplification during ELB periods;
  2. make-up strategies in both models, especially NGDP targeting, helps stabilize the economy and reduce average unemployment;
  3. make-up strategies are stronger in our HANK model, however, this has to be compared to the deeper recessions to begin with.

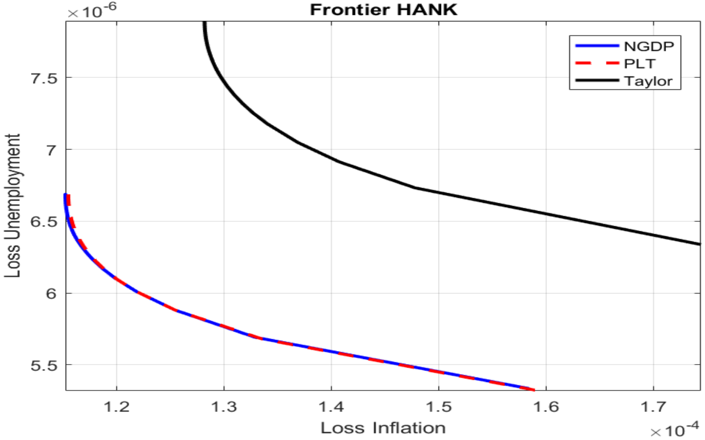
IRF Risk Premium Shock - more consumption insurance

Our HANK results depend on the amount of consumption insurance in the model - if households have more liquid assets or if unemployment benefits are higher, amplification declines.



HANK Policy Frontiers

So far we just looked at one parameterization of the policy rules - what if a planner chooses them to minimize deviations of unemployment and inflation from their target.



Conclusion

- We constructed a HANK model to study stabilization gains from makeup strategies.
- We found, consistent with the literature on forward guidance, that the gains, relative to a RANK model depend on the amount of liquid assets, among other things.
- In preferred calibration, gains likely larger than in the RANK case.
- Fiscal or credit interventions are substitutes for makeup strategies in the HANK model.

Model: Retailer

$$\max_{(y_{i,t})_{i\in[0,1]}} \quad y_t - \int_0^1 p_{i,t} y_{i,t} di$$

$$\text{s.t.} \qquad y_t = \left[\int y_{i,t}^{\frac{\gamma_t - 1}{\gamma_t}} di \right]^{\frac{\gamma_t}{\gamma_t - 1}} .$$

- y_t final good used for government expenditures, consumption, hiring costs, fixed costs;
- $y_{i,t}$ intermediate good use of variety i;
- $p_{i,t}$ price of intermediate good i;
- γ_t elasticity of substitution, subject to shock;

Model: Production/Intermediate Good Producer

$$J_{P,t}(P_{i,t-1}) = \max_{P_{i,t}} \left\{ \left[\left(\frac{P_{i,t}}{P_t} \right)^{1-\gamma_t} - h_t n_{i,t} - \frac{\theta_p}{2} \left(\frac{P_{i,t}}{P_{i,t-1}} \frac{1}{\bar{\pi}} - 1 \right)^2 \right] y_t + \mathbb{E} \beta_F J_{P,t+1}(P_{i,t}) \right\}$$

$$\text{s.t.} \qquad y_{i,t} = \left(\frac{P_{i,t}}{P_t} \right)^{-\gamma_t} y_t = z_t n_{i,t}.$$

- $J_{P,t}$ value function intermediate good producer;
- $P_{i,t}$ price intermediate good i;
- h_t shadow value worker;
- π_t inflation;
- P_t aggregate price level;
- $n_{i,t}$ employed used by firm i;
- z_t TFP Level;

Model: Labor Market Flows

- Unemployed after separations:

$$\tilde{u}_t = u_{t-1} + (1 - u_{-1})\rho.$$

- Matching function:

$$m_t := m(\tilde{u}_t, v_t) = \frac{\tilde{u}_t v_t}{(\tilde{u}^l + v_t^l)^{\frac{1}{l}}}.$$

- Unemployment end of period:

$$u_t = \tilde{u}_t - m_t.$$

- Job finding rate: $p_t = \frac{m_t}{\tilde{u}_t}$, Job filling rate: $q_t = \frac{m_t}{v_t}$

Model: Vacancy posting

- Value of a match to producer:

$$J_t = h_t - w_t + (1-\rho)\mathbb{E}_t[\beta_F J_{t+1}].$$

- Free Entry:

$$J_t = \frac{\varphi}{q_t}.$$

Model: Wage Setting

- Wages are determined through Nash bargaining between the labor agency and a representative labor union upon matching.

- Value of labor union: $U_t = w_t^* - \underline{w}_t + (1-\rho)\mathbb{E}_t[\beta_F U_{t+1}]$

- Outside option union: $\underline{w}_t = b + (1-\rho)\mathbb{E}_t[\beta_F f_{t+1} U_{t+1}]$

- Wage set by wage splitting rule: $w_t = \arg\max_{w_t} W_t^{\kappa} J_t^{1-\kappa}$

- Resulting wage rule: $w_t^* = \kappa h_t + (1-\kappa)b + \kappa(1-\rho)\mathbb{E}_t\left[\beta_F \varphi \frac{f_{t+1}}{q_{t+1}}\right]$

- Assume wage rigidity: $w_t = \rho_w w_{t-1} + (1-\rho_w) w_t^*$