Macroeconomic Fluctuations With HANK & SAM: An Analytical Approach

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Motivation

- Idiosyncratic income risks are exogenous in standard incomplete market macro models, i.e. HANK
  - assumed to follow some stochastic process
- Search and match (SAM) frictions: one source of endogenous idiosyncratic risks
  - unemployment risk and labor market transitions determined in equilibrium
  - it may be procyclical or countercyclical
- HANK + SAM combined?
  - in general, complex
  - under certain assumptions, analytically approachable

Contribution of the paper

- A tractable HANK+SAM model
- Cyclicality of income risks and macro outcomes
  - a macro amplification mechanism if counter-cyclical (more empirically plausible)
- Determinacy property of the system
  - possibly an ”unemployment trap” due to additional precautionary saving motive
  - Taylor principle is insufficient to eliminate local indeterminacy

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Model summary

HANK + SAM a la DMP

- Households choose c, bond holding b and equity holding h
  - depending on the productivity $z \in \{0, 1\}$ or emp status $\{n, u\}$
  - uninsured unemp risks: separation rate ω and job finding rate η
  - borrowing constraints proportional to income: $b \geq -\psi z w n$
  - no short selling $h > 0$
- Firms set the price P_j and post vacancies v_j
  - nominal rigidity a la Rotemberg (1982)
  - cost per vacancy: κ
  - v cannot be negative
- Macro level
  - job-finding rate η /vacancy filling rate q from a matching function
  - wage w determined via Nash bargaining
  - zero net supply of bonds
  - exogenous aggregate productivity A_t

Value functions of household

Employed worker: $z = 1, n$

$$V^{z=1,n}(x, X) = \max_{c,x'} \quad \frac{c^{1-\mu} - 1}{1-\mu} - \zeta$$
$$+ \beta \mathbb{E}[(1 - \omega(1-\eta'))V^{z=1,n}(x', X') + \omega(1-\eta')V^{z=1,u}(x', X')]$$

- $x = [b_{-1}, h_{-1}]$
- X aggregate asset state

Value functions of households

Unemployed worker: $z = 1, u$

$$V^{z=1,u}(x, X) = \max_{c,x'} \quad \frac{c^{1-\mu} - 1}{1 - \mu}$$
$$+ \beta \mathbb{E}[\eta' V^{z=1,n}(x', X') + (1 - \eta') V^{z=1,u}(x', X')]$$

Value functions of households

Capitalists: $z = 0$

$$V^{z=0}(x, X) = \max_{c, x'} \quad \frac{c^{1-\mu} - 1}{1 - \mu} + \beta \mathbb{E}[V^{z=0}(x', X')]$$

The general solution

- a recursive equilibrium
- individual optimization under perceived laws of aggregate variables
  - the policy functions (c, b, h) for households
  - the policy functions (v, P) for firms
- market clearing of goods, bond, equity and labor market
- aggregate labor market evolves according to the matching function
- the wage solves the Nash bargaining problem
- the central bank implements the policy rule
- consistency: the actual and perceived laws coincide

Assumptions for an analytical solution

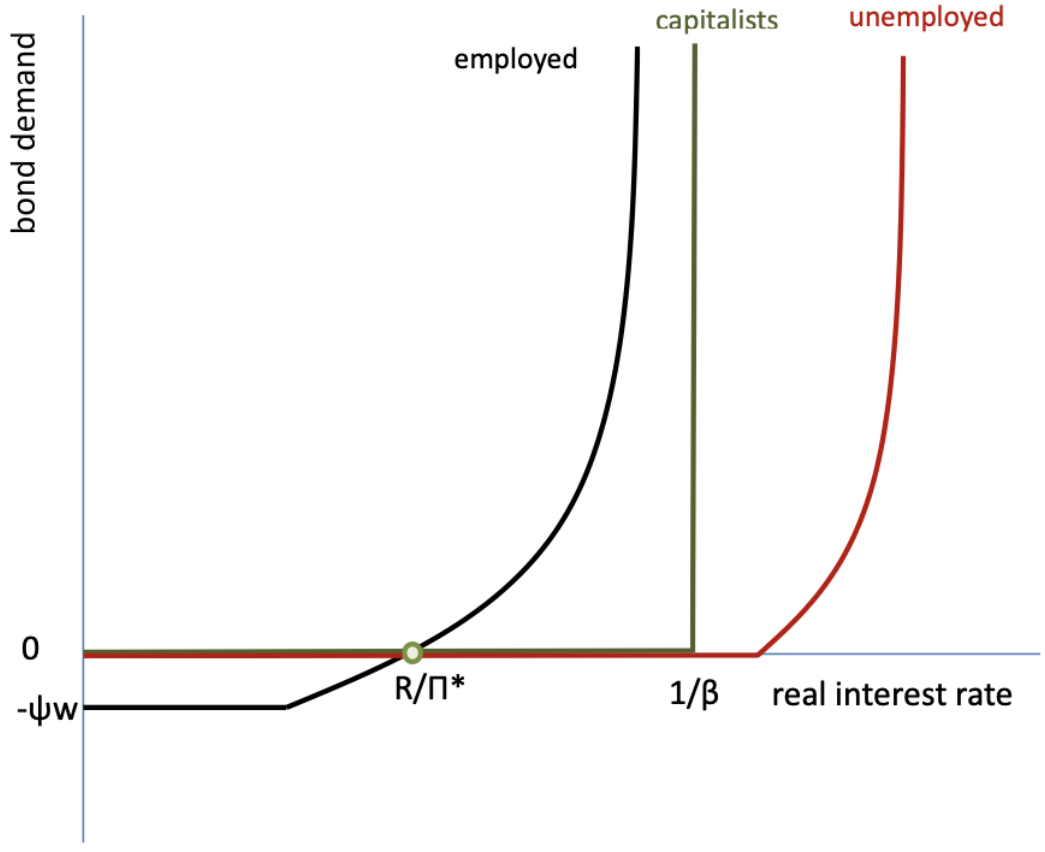
- In general, the distribution of workers in asset holdings and emp status is not a trivial object
- To simplify the solutions, assume the two types of agents have the access to one respective asset market
  - "capitalists": $z = 0$, don't participate in labor market but participate in equity market
  - "workers": $z = 1$, participate in the labor market but have no access to the equity market

Intuition behind the analytical solution (in steady state (SS))

- identical c within each type and emp status
- real rate below $1/\beta$ because of the precautionary saving motive
- all types hold zero b and consume current income
  - "capitalists": better to hold equity
  - unemployed "workers": strong incentive to borrow instead of save, but constrained
  - employed "workers": want bonds for precautionary saving motive but willingly hold zero due to zero net supply
- Euler equation only holds for employed workers
  - capitalists and unemployed workers are both constrained
- goods/asset market clearing trivially holds

Bond demand schedules in steady state

FIGURE 1. Illustration of steady-state bond demand schedules.



Implications of HANK&SAM

- An endogenous income risk channel

$$c_{n,s}^{-\mu} = \beta \mathbb{E}_s \frac{R_s}{\Pi_{s+1}} c_{n,s+1}^{-\mu} \left[1 + \underbrace{\omega \left(1 - \eta_{s+1}\right) \left(\left(\vartheta / w_{s+1}\right)^{-\mu} - 1 \right)}_{\text{precautionary saving motive}} \right]$$

- Can be pro-cyclical or counter-cyclical depending on the competing force between
  - risk of unemployment
  - loss of earnings given job loss
- Determinacy of the model
  - Unemployment trap
  - Taylor principle may not be enough

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On the paper

- The key of the tractability is to make agents hands-to-mouth, therefore no need to track asset distributions
  - Or put it differently, make all types except one constrained
- Combining incomplete market macro and SAM is a promising field
- I anticipate to see quantitative models of HANK & SAM soon
- More research is needed for understanding the source of income risks, especially earning risks