

Macroeconomics II, Lecture XIV: Course Summary and Q&A

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This course

- **Business-cycle frameworks:** RBC, NK
- **Frictional labor markets:** McCall, Burdett-Mortensen, DMP
- **Incomplete asset markets:** Consumption-savings dynamics, Aiyagari

Today

- Summarize the course material, by putting these frameworks together in one model: a Heterogenous-Agent New-Keynesian model with Search And Matching frictions — a **HANK & SAM** model
- Use this “meta model” to understand some questions at the research frontier
- First: some history of >recent< ideas

- **Heterogeneous Agents New Keynesian** models: NK business cycle models with incomplete asset markets (and therefore household heterogeneity)
- Why interesting?
- Consider the vanilla RANK model:

$$\begin{aligned}\hat{i}_t &= \phi\pi_t + \nu_t \\ \pi_t &= \beta E_t \pi_{t+1} + \kappa \hat{y}_t \\ \hat{y}_t &= -(\hat{i}_t - E_t \pi_{t+1}) + E_t \hat{y}_{t+1}\end{aligned}$$

- What is the transmission mechanism of an MP shock?

- Extended representation of the vanilla RANK model:

$$\begin{aligned}\hat{i}_t &= \phi\pi_t + \nu_t \\ \pi_t &= \beta E_t \pi_{t+1} + \kappa \hat{y}_t \\ \hat{c}_t &= -(\hat{i}_t - E_t \pi_{t+1}) + E_t \hat{c}_{t+1} \\ \hat{c}_t &= \hat{y}_t\end{aligned}$$

- What is the transmission mechanism of an MP shock to output? Roughly:
 - Shock: nominal rate i_t up
 - Sticky prices: real rate $\hat{i}_t - E_t \pi_{t+1}$ up
 - Intertemporal substitution: consumption c_t down
 - Market clearing: output y_t down

HANK models: motivation

- Is intertemporal substitution a reasonable theory of fluctuations in aggregate demand?
 - ▶ Macro evidence: No (see, e.g., Yogo, REStat 2004; Canzoneri-Cumby-Dilba, JME 2007)
 - ▶ Micro evidence: Limited, but also no (see Best-Cloyne-Ilzetski-Kleven, REStud 2020)
- Even though evidence shows that wages, unemployment, financial wealth and income risk respond to monetary policy, these responses are close-to-irrelevant to the representative (PIH) households
- This is counterintuitive and at odds with what we know from the micro data
 - ▶ Recall lecture 12: surmounting evidence of high MPCs
- HANK models offer an alternative theory of aggregate demand

HANK models

- HANK models replaces the representative (PIH) household with a distribution of households that faces limited insurance (as in Ayiagari)
 - ▶ Emphasizes building models of household consumption-saving decisions that are consistent with the rich heterogeneity seen in micro data
 - ▶ By so doing, they present a theory of aggregate demand that put fluctuations in household income, wealth, credit and risk at center stage
- Early contributions: McKay-Reis (Ecmtra 2016); Guerrieri-Lorenzoni (AER 2017); Kaplan-Moll-Violante (AER 2018)
- Exploding literature, small excerpt of recent publications (most of it is still in the making):
 - ▶ **Transmission mechanisms:** Auclert (AER 2019); McKay-Wieland (Ecmtra 2021); Maxted-Holm-Laibson (QJE 2024)
 - ▶ **Analytical frameworks:** Broer-Hansen-Krusell-Öberg (REStud 2020); Acharya-Challe-Dogra (AER 2023); Bilbiie (REstud 2025)
 - ▶ **Estimation/Identification:** Auclert-Rognlie-Straub (JPE 2024), Wolf (JPE 2025) Bayer-Born-Luetticke (AER 2024),
 - ▶ **Optimal policy:** Bhandari-Evans-Golosov-Sargent (Ecmtra 2021); Le Grand-{Martin-Baillon}-Ragot (REStud 2025)
 - ▶ **Evidence:** Cloyne-Ferriera-Surico (REStud 2020); Holm-Paul-Tischbirek (JPE 2021); Patterson (AER 2023)

The Unemployment Risk Channel

- One channel that has attracted much attention: **Unemployment-risk channel (URC)**
- In response to some contractionary shock:
 - ① **Households:** Unemployment \uparrow
 - \Rightarrow precautionary saving \uparrow
 - \Rightarrow goods demand \downarrow
 - ② **Firms:** Goods demand \downarrow
 - \Rightarrow labor demand \downarrow
 - \Rightarrow unemployment \uparrow
- Generates a demand-driven multiplier
 - ① *Inefficient* amplification & propagation
 - ② May be mitigated with targeted fiscal policy
- To evaluate the implications of this channel, we need a HANK model with endogenous unemployment dynamics: a **HANK-SAM** model

HANK-SAM models, some examples

- **Ravn-Sterk (JME 2017; JEEA 2021), Rendahl-Riegler-Den Haan (JEEA 2019):** HANK-SAM interaction is a source of amplification
- **McKay-Reis (Ecmtra 2016; REStud 2021), Kekre (REStud 2024):** HANK-SAM interaction raises the value of automatic stabilizers (esp unempl. insurance)
- **Challe (AEJmacro 2020):** HANK-SAM interaction changes optimal monetary policy
- **Broer-Drue Dahl-Harmenberg-Öberg (2025):** A unified framework to evaluate the cost-effectiveness of different fiscal stabilization policies

Research question

Which fiscal policies are most cost effective in stabilizing unemployment?

Motivation

Resurgence of countercyclical fiscal policies as stabilization tool

- Government: expenditures
- Households: cash transfers + UI increases and extensions
- Firms: retention and hiring subsidies

Approach

Compute fiscal multipliers for different fiscal policies in an **HANK-SAM** model with empirically grounded interaction between firm hiring-and-firing decisions and consumption-saving decisions of households.

Our Model

• Households:

- ① **Workers:** can be *employed* or *unemployed*
 - ★ Employed: Earn fixed real wage W , pay labor income taxes
 - ★ Unemployed: enjoy UI benefits
- ② **Capitalists:** collect all firm profits, do not work, risk neutral

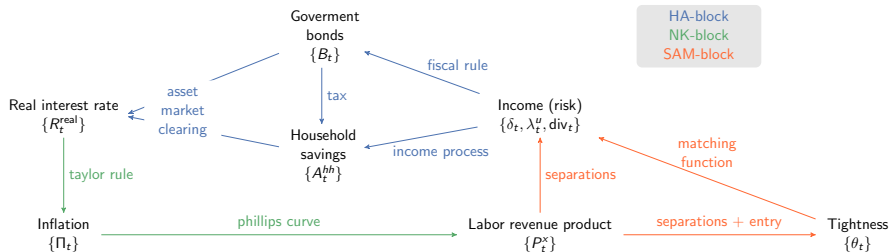
• Producers:

- ① **Intermediate good producers**
 - ★ Labor \Rightarrow intermediate goods
 - ★ Frictional labor market, CRS matching function
 - ★ Sluggish vacancy posting due to idiosyncratic stochastic entry cost
 - ★ Separations due to idiosyncratic stochastic continuation cost
- ② **Wholesale producers**
 - ★ Intermediate goods \Rightarrow differentiated goods
 - ★ Monopolistic competition + Rotemberg price adjustment costs
- ③ **Final producers**
 - ★ Differentiated goods \Rightarrow final good
 - ★ Perfect competition

• Government:

- ① Sets interest rate according to Taylor rule
- ② collects taxes, pays UI, issues debt
- ③ Today: focus on household transfer spending shocks (cash transfers + UI increases and extensions)

Equilibrium as a Directed Cycle Graph



To a first order, the equilibrium can be written as

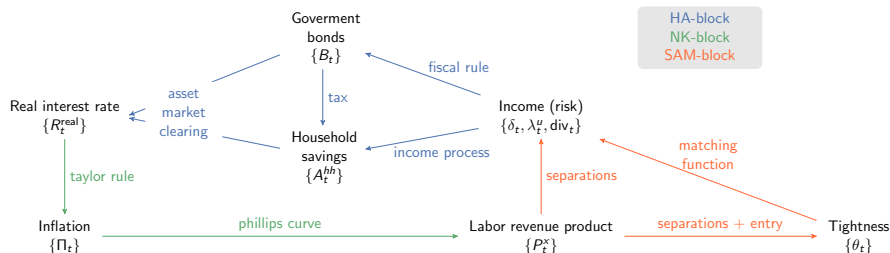
$$\mathbf{r}^{real} = M_{HA} \mathbf{inc} + M_{d,r} \mathbf{d},$$

$$\mathbf{p}^x = M_{NK} \mathbf{r}^{real},$$

$$\mathbf{inc} = M_{SAM} \mathbf{p}^x,$$

and can thus be represented by a *directed cycle graph*.

Equilibrium as a Directed Cycle Graph: solution



To a first order, the solution is given by

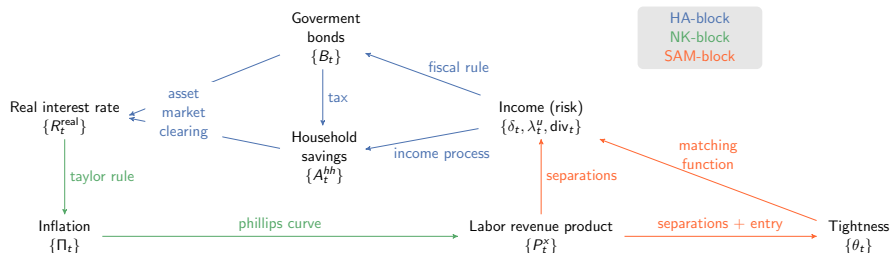
$$\text{inc} = \underbrace{\mathcal{G}}_{\text{GE effect}} \times \underbrace{M_{\text{SAM}} M_{\text{NK}} M_{d,r} d}_{\text{first round PE effect}},$$

direct

where

$$\mathcal{G} = (I - M_{\text{SAM}} M_{\text{NK}} M_{\text{HA}})^{-1}.$$

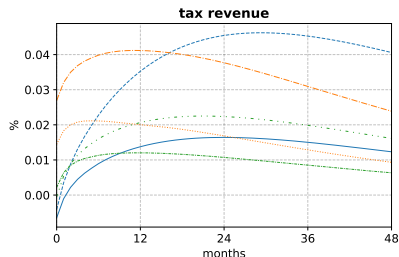
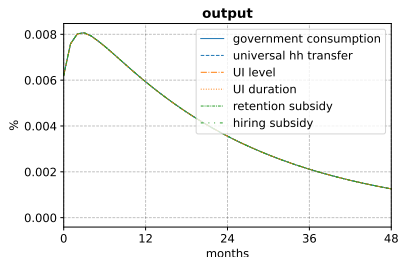
Equilibrium as a Directed Cycle Graph: implications



Implies:

- 1 GE amplification decomposed into three (HA-NK-SAM) blocks, admits partial identification
- 2 Direct effects sufficient for policy comparison
- 3 Relative multiplier of different policies invariant to parameter outside HA block

Policy paths and fiscal costs



- Baseline policy: Persistent **G** shock ($\rho_G = 0.965$).
- Other policies chosen to yield identical output paths
- Yet, starkly different paths of tax revenues \Rightarrow different multipliers

Fiscal multipliers relative to **G**

G [level]	HH transfers			Firm subsidies	
	Transfer	Level	Duration	Retain	Hire
1.0 [0.99]	0.28	0.44	1.03	1.64	0.72

- Fiscal Multiplier = $\frac{\sum output_t}{\sum spending_t}$
- Strong dispersion in multipliers.
- Retention subsidies most, universal transfers least stimulative

Determinants of fiscal multipliers

- Identify determinants by reducing frictions one-by-one

Determinants of fiscal multipliers

	G [level]	– Household transfers –		Firm transfers		
		Transfer	Level	Duration	Retain	Hire
1. Baseline	1.0 [0.99]	0.28	0.44	1.03	1.64	0.72
2. Less sticky P ($\phi=178$)						
3. Reactive mp ($\delta_\pi=2$)						
4. Representative agent						
5. Fewer HtM (17.4%)						
6. Reactive tax ($\omega=0.10$)						
7. Ex. separations ($\psi=0$)						
8. Free entry ($\xi=\infty$)						
9. Wage rule ($\eta_e=0.50$)						
10. 95% of div. to PIH						

Benchmark **G** multiplier

	G [level]	– Household transfers			– Firm transfers	
		Transfer	Level	Duration	Retain	Hire
1. Baseline	1.0 [0.99]	0.28	0.44	1.03	1.64	0.72
2. Less sticky P ($\phi=178$)	1.0 [0.61]					
3. Reactive mp ($\delta_\pi=2$)	1.0 [0.64]					
4. Representative agent	1.0 [0.54]					
5. Fewer HtM (17.4%)	1.0 [0.80]					
6. Reactive tax ($\omega=0.10$)	1.0 [0.84]					
7. Ex. separations ($\psi=0$)	1.0					
8. Free entry ($\xi=\infty$)	1.0					
9. Wage rule ($\eta_e=0.50$)	1.0					
10. 95% of div. to PIH	1.0					

- Government-consumption multipliers increase with ...

- ▶ Nominal rigidity, passive MP, debt-financing, less-Ricardian HHs (Auclert et al 2024, Hagedorn et al 2023)

Benchmark **G** multiplier

	G [level]	— Household transfers —			Firm transfers	
		Transfer	Level	Duration	Retain	Hire
1. Baseline	1.0 [0.99]	0.28	0.44	1.03	1.64	0.72
2. Less sticky P ($\phi=178$)	1.0 [0.61]					
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6. Reactive tax ($\omega=0.10$)	1.0 [0.84]					
7. Ex. separations ($\psi=0$)	1.0 [0.13]					
8. Free entry ($\xi=\infty$)	1.0 [0.54]					
9. Wage rule ($\eta_e=0.50$)	1.0 [0.73]					
10. 95% of div. to PIH	1.0 [0.82]					

- Government-consumption multiplier increases with ...
 - ▶ Nominal rigidity, passive MP, debt-financing, less-Ricardian HHs
 - ▶ SAM frictions, wage rigidity, MPC o/o profits

Relative HH-transfer multipliers: non-HA frictions

	G [level]	— Household transfers —			Firm transfers	
		Transfer	Level	Duration	Retain	Hire
1. Baseline	1.0 [0.99]	0.28	0.44	1.03		
2. Less sticky P ($\phi=178$)	1.0 [0.61]	0.30	0.47	1.03		
3. Reactive mp ($\delta_\pi=2$)	1.0 [0.64]	0.30	0.47	1.03		
4. Representative agent	1.0 [0.54]	0.00	0.00	0.00		
5. Fewer HtM (17.4%)	1.0 [0.80]	0.19	0.41	1.11		
6. Reactive tax ($\omega=0.10$)	1.0 [0.84]	0.19	0.40	1.10		
7. Ex. separations ($\psi=0$)	1.0 [0.13]	0.35	0.52	1.02		
8. Free entry ($\xi=\infty$)	1.0 [0.54]	0.31	0.47	1.03		
9. Wage rule ($\eta_e=0.50$)	1.0 [0.73]	0.29	0.46	1.03		
10. 95% of div. to PIH	1.0 [0.82]	0.28	0.43	0.99		

- Relative HH transfer multipliers \approx unaffected by non-HA frictions

Relative HH-transfer multipliers: HA frictions

	G [level]	— Household transfers —			Firm transfers	
		Transfer	Level	Duration	Retain	Hire
1. Baseline	1.0 [0.99]	0.28	0.44	1.03	1.64	0.72
2. Less sticky P ($\phi=178$)	1.0 [0.61]	0.30	0.47	1.03		
3. Reactive mp ($\delta\pi=2$)	1.0 [0.64]	0.30	0.47	1.03		
4. Representative agent	1.0 [0.54]	0.00	0.00	0.00	1	
5. Fewer HtM (17.4%)	1.0 [0.80]	0.19	0.41	1.11		
6. Reactive tax ($\omega=0.10$)	1.0 [0.84]	0.19	0.40	1.10		
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9. Wage rule ($\eta_e=0.50$)	1.0 [0.73]	0.29	0.46	1.03		
10. 95% of div. to PIH	1.0 [0.82]	0.28	0.43	0.99		

- Ricardian households: zero transfer multipliers
- Lower MPC lowers transfer multipliers & raises duration multiplier
- Same holds for more tax financing

Relative firm-subsidy multipliers: non-SAM frictions

	G [level]	— Household transfers —			Firm transfers	
		Transfer	Level	Duration	Retain	Hire
1. Baseline	1.0 [0.99]	0.28	0.44	1.03	1.64	0.72
2. Less sticky P ($\phi=178$)	1.0 [0.61]	0.30	0.47	1.03	3.43	1.15
3. Reactive mp ($\delta_\pi=2$)	1.0 [0.64]	0.30	0.47	1.03	3.33	1.13
4. Representative agent	1.0 [0.54]	0.00	0.00	0.00	1.92	0.57
5. Fewer HtM (17.4%)	1.0 [0.80]	0.19	0.41	1.11	1.80	0.69
6. Reactive tax ($\omega=0.10$)	1.0 [0.84]	0.19	0.40	1.10	1.70	0.67
7. Ex. separations ($\psi=0$)	1.0 [0.13]	0.35	0.52	1.02	1.39	3.38
8. Free entry ($\xi=\infty$)	1.0 [0.54]	0.31	0.47	1.03	1.50	1.21
9. Wage rule ($\eta_e=0.50$)	1.0 [0.73]	0.29	0.46	1.03	1.55	0.74
10. 95% of div. to PIH	1.0 [0.82]	0.28	0.43	0.99	0.72	0.16

- Relative multipliers of subsidies \approx unaffected by non-SAM frictions
- Less nominal rigidity: subsidies more effective wrt HH transfers/G

Relative firm-subsidy multipliers: SAM frictions

	G [level]	— Household transfers —			Firm transfers	
		Transfer	Level	Duration	Retain	Hire
1. Baseline	1.0 [0.99]	0.28	0.44	1.03	1.64	0.72
2. Less sticky P ($\phi=178$)	1.0 [0.61]	0.30	0.47	1.03	3.43	1.15
3. Reactive mp ($\delta_\pi=2$)	1.0 [0.64]	0.30	0.47	1.03	3.33	1.13
4. Representative agent	1.0 [0.54]	0.00	0.00	0.00	1.92	0.57
5. Fewer HtM (17.4%)	1.0 [0.80]	0.19	0.41	1.11	1.80	0.69
6. Reactive tax ($\omega=0.10$)	1.0 [0.84]	0.19	0.40	1.10	1.70	0.67
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9. Wage rule ($\eta_e=0.50$)	1.0 [0.73]	0.29	0.46	1.03	1.55	0.74
10. 95% of div. to PIH	1.0 [0.82]	0.28	0.43	0.99	0.72	0.16

- Hiring subsidy more effective with higher entry/lower separation elasticity
- Lower MPC o/o profits weakens both subsidies