Monetary Economics

Lecture 24: final exam review

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Recap of new Keynesian monetary economics

Basic model (sticky prices only)

- Representative household with preferences

$$\mathbb{E}_0 \left[\sum_{t=0}^{\infty} \beta^t U\left(C_t, N_t\right) \right]$$

  implies aggregate consumption, money demand, labor supply

- Budget constraint

$$P_t C_t + Q_t B_t \leq B_{t-1} + W_t N_t + \Pi_t - T_t$$

  where P_t is aggregate price index in numeraire (currency), Q_t is price of one-period zero-coupon bond

Firms

- Monopolistically competitive, differentiated products $j \in [0,1]$

$$C_t = \left(\int_0^1 C_t(j)^{\frac{\varepsilon-1}{\varepsilon}} \, dj \right)^{\frac{\varepsilon}{\varepsilon-1}}$$

- Implies price index

$$P_t = \left(\int_0^1 P_t(j)^{1-\varepsilon} \, dj \right)^{\frac{1}{1-\varepsilon}}$$

- Production technology

$$Y_t(j) = A_t N_t(j)^{1-\alpha}$$

- Market clearing

$$C_t(j) = Y_t(j) \qquad \text{each } j \quad \Rightarrow \quad C_t = Y_t \equiv \left(\int_0^1 Y_t(j)^{\frac{\varepsilon-1}{\varepsilon}} \, dj \right)^{\frac{\varepsilon}{\varepsilon-1}}$$

Pricing

- With *flexible prices*, each firm sets a static markup $\varepsilon/(\varepsilon - 1)$ over marginal cost
- In this case, essentially a classical economy with monetary neutrality etc. Only difference is monopoly distortion but that can be corrected with a subsidy paid by lump-sum taxes
- With *sticky prices*, only some firms adjust each period. Typical assumption is Calvo pricing. With probability θ a firm is stuck with its price from last period
- Forward-looking firms take this into account when setting price

Basic model (sticky prices only)

- Log-linearized around a zero-inflation steady state
- Dynamic IS curve

$$\tilde{y}_t = -\frac{1}{\sigma}\left(i_t - \mathbb{E}_t[\pi_{t+1}] - r_t^n\right) + \mathbb{E}_t[\tilde{y}_{t+1}]$$

- New Keynesian Phillips curve

$$\pi_t = \beta\mathbb{E}_t[\pi_{t+1}] + \kappa\tilde{y}_t, \qquad \tilde{y}_t \equiv y_t - y_t^n$$

- Natural output y_t^n and real rate r_t^n correspond to underlying flexible-price economy, driven by real shocks (e.g., a_t, g_t)
- Model closed with a specification of monetary policy, e.g.,

$$i_t = \rho + \phi_\pi \pi_t + \phi_y \tilde{y}_t + v_t$$

Method of undetermined coefficients

- Endogenous variables linear in the shocks, say

$$\tilde{y}_t = \psi_{yv} v_t + \psi_{ya} a_t$$

$$\pi_t = \psi_{\pi v} v_t + \psi_{\pi a} a_t$$

  with coefficients $\psi_{yv}, \psi_{ya}, \psi_{\pi v}, \psi_{\pi a}$ that must hold for any realizations of the shocks

- Equilibrium conditions of the model imply a set of cross-equation restrictions that pin down the coefficients

- Can then deduce other endogenous variables of interest, e.g., y_t, n_t, r_t, i_t, as well as expected values $\mathbb{E}_t[\pi_{t+1}], \mathbb{E}_t[\tilde{y}_{t+1}]$ etc

Qualitative implications

- Taylor principle: $\phi_\pi > 1$
- If so, expansionary monetary policy shock (an increase in v_t)
  - increases output
  - increases employment
  - increases inflation

  All effects transitory, money is neutral in long run (steady state)

Monetary policy shock, $v_t > 0$

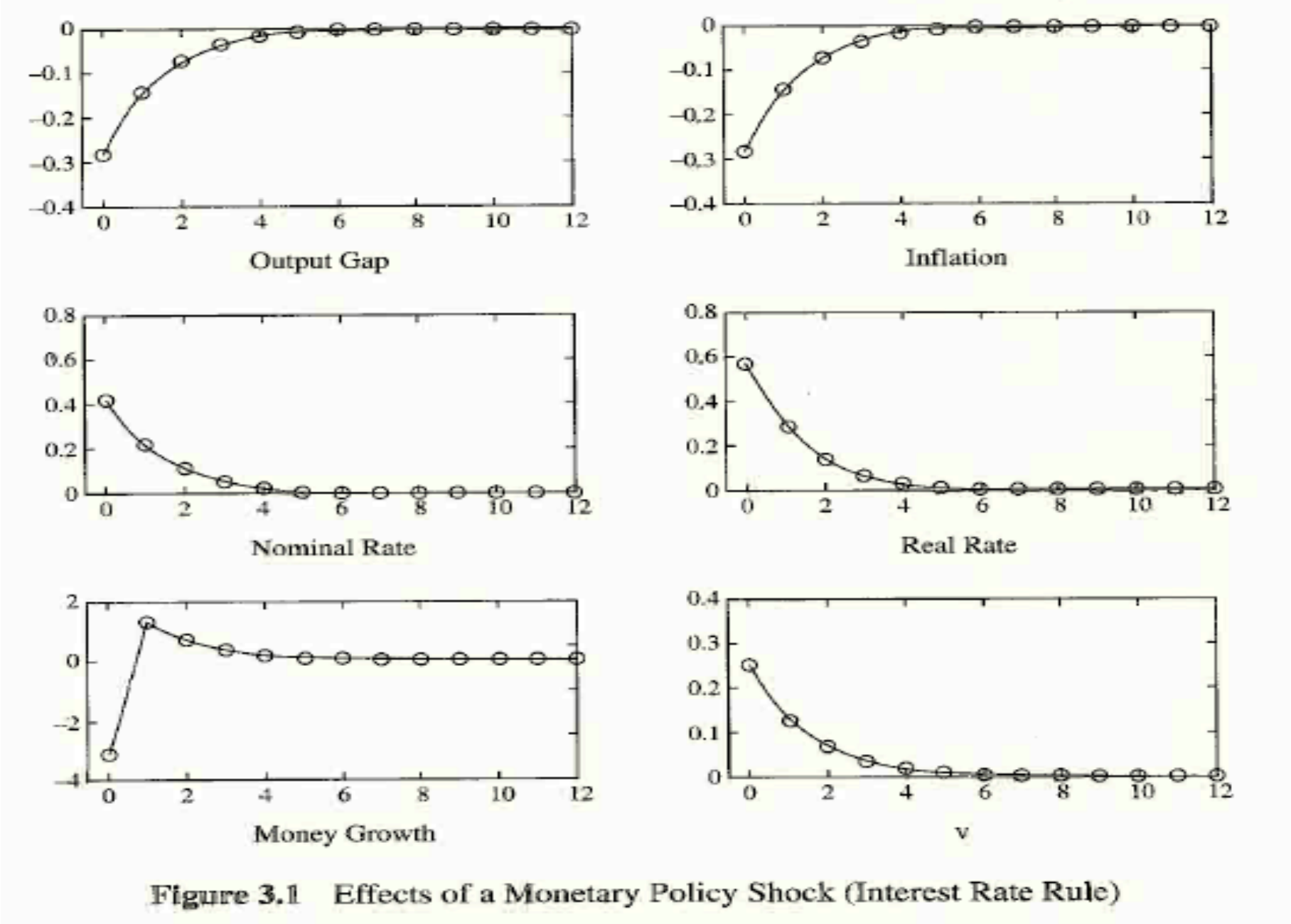


Figure 3.1 Effects of a Monetary Policy Shock (Interest Rate Rule)

Productivity shock, $a_t > 0$

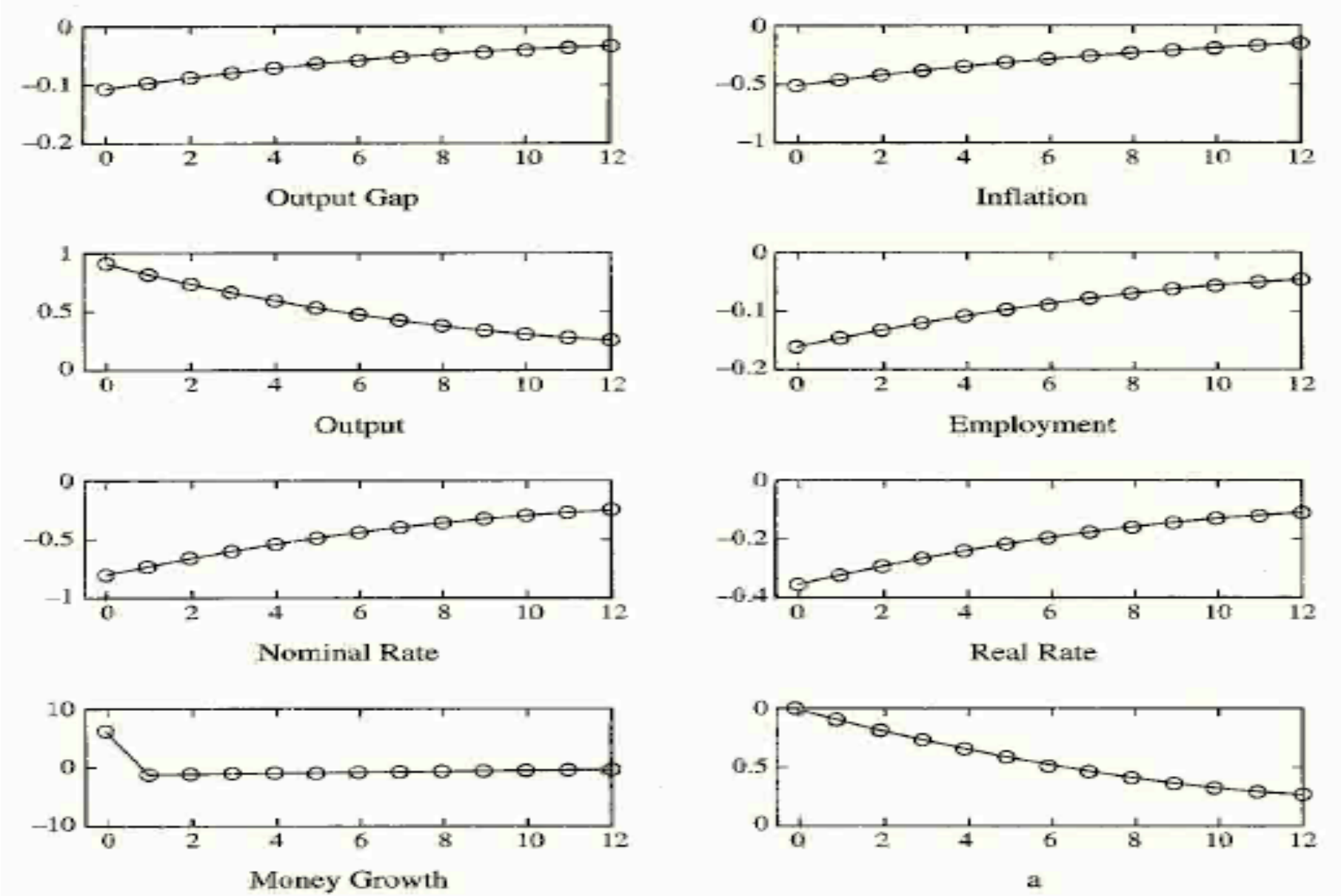


Figure 3.2 Effects of a Technology Shock (Interest Rate Rule)

Optimal monetary policy in the basic model

- Eliminates relative price distortions caused by nominal rigidity
- Under optimal policy $\pi_t = 0$, $\tilde{y}_t = 0$ and $i_t = r_t^n$ *in equilibrium*
  (replicates flexible-price outcomes, "divine coincidence")
- Can be implemented with simple interest rate rules
- Sufficient condition for uniqueness of equilibrium $\phi_\pi > 1$

Fiscal policy and the ZLB

- Outside ZLB, long-run fiscal multiplier in basic sticky-price model is same as in neoclassical benchmark, e.g.,

$$\Gamma = \frac{\sigma}{\sigma + \varphi} \in (0, 1)$$

- Short-run multiplier $\in (\Gamma, 1)$, depends on aggressiveness of monetary policy response

- At ZLB, nominal interest may not respond $(= 0)$ and if so fiscal multiplier may be > 1. Increased inflation expectations lowers real rate, increases current output more than one-for-one

- But size of multiplier depends on duration of fiscal stimulus (especially once ZLB crisis is over)

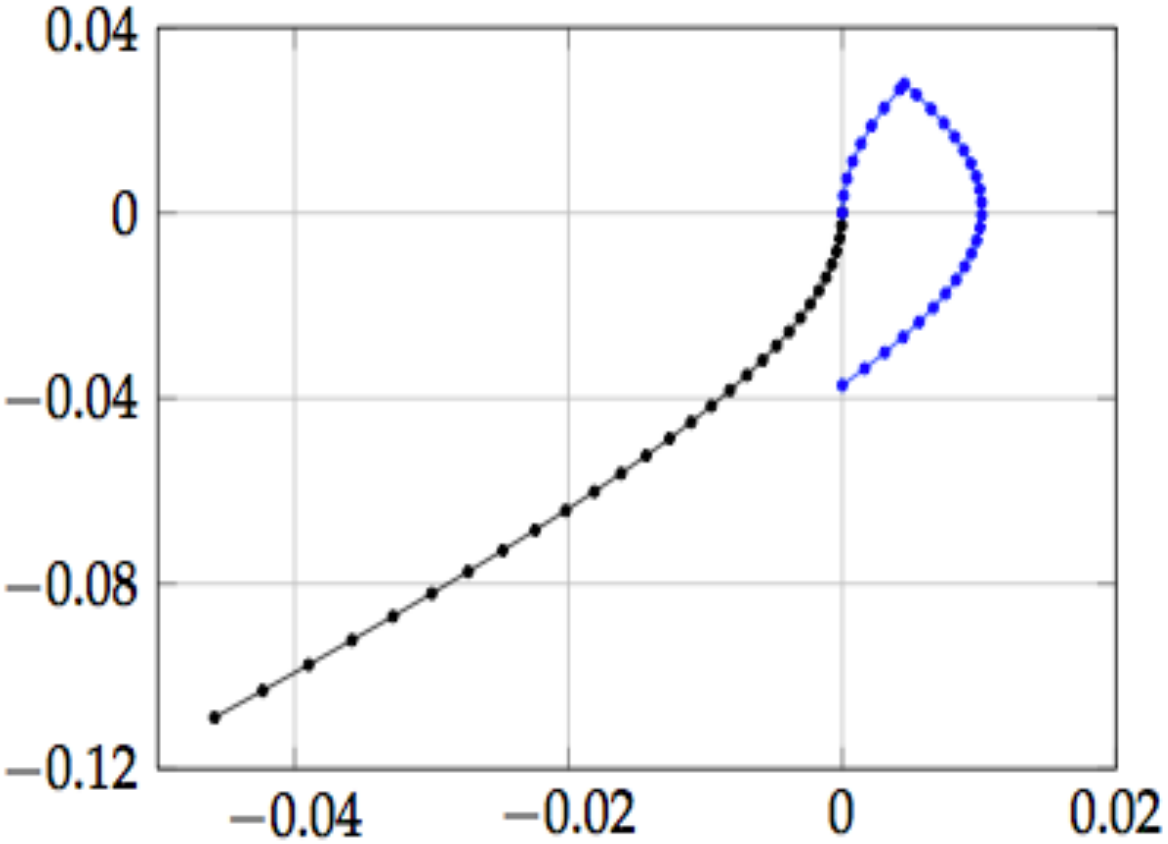
Optimal policy and the ZLB

- **Without commitment:** deflation and negative output gap (recession). Both gradually alleviated as liquidity trap ends
- Severity of deflation and recession are increasing in length of trap
- Intuition: real interest rate is too high during liquidity trap. Suppresses consumption and output, makes forward-looking inflation even lower, exacerbates situation
- Paradoxically, more flexible prices only make things worse
- Key problem: inability to commit to policies *after* the liquidity trap, in particular, inability to commit to other than usual zero inflation and zero output gap outcomes

Optimal policy and the ZLB

- **With commitment:** optimal policy avoids deflation, features zero interest rates even after liquidity trap
- Commitment to extended period of zero interest rates in order to deliver boom, not to deliver inflation
- Candidate time-paths for inflation and output gap have:
  - inflation positive at some point, may be positive throughout (depending on parameters)
  - output gap both positive and negative (changing signs)

With and without commitment



Inflation on horizontal axis, output gap on vertical axis. Commitment path in blue, no-commitment path in black.

Unemployment and sticky wages

- Real wage rigidities give rise to a steady-state level of unemployment $\overline{u}$
- Sticky prices alone give rise to fluctuations in output, employment etc but *not* fluctuations in unemployment
- Sticky wages give rise to fluctuations in unemployment u_t around $\bar{u}$

Sticky wage model

- Dynamic IS curve

$$\tilde{y}_t = -\left(i_t - \mathbb{E}_t[\pi^p_{t+1}] - r^n_t\right) + \mathbb{E}_t[\tilde{y}_{t+1}]$$

- Price- and wage inflation Phillips curves

$$\pi^p_t = \beta\mathbb{E}_t[\pi^p_{t+1}] + \kappa_p\tilde{y}_t + \lambda_p\tilde{\omega}_t$$
$$\pi^w_t = \beta\mathbb{E}_t[\pi^w_{t+1}] + \kappa_w\tilde{y}_t - \lambda_w\tilde{\omega}_t$$

- Wage gap identity

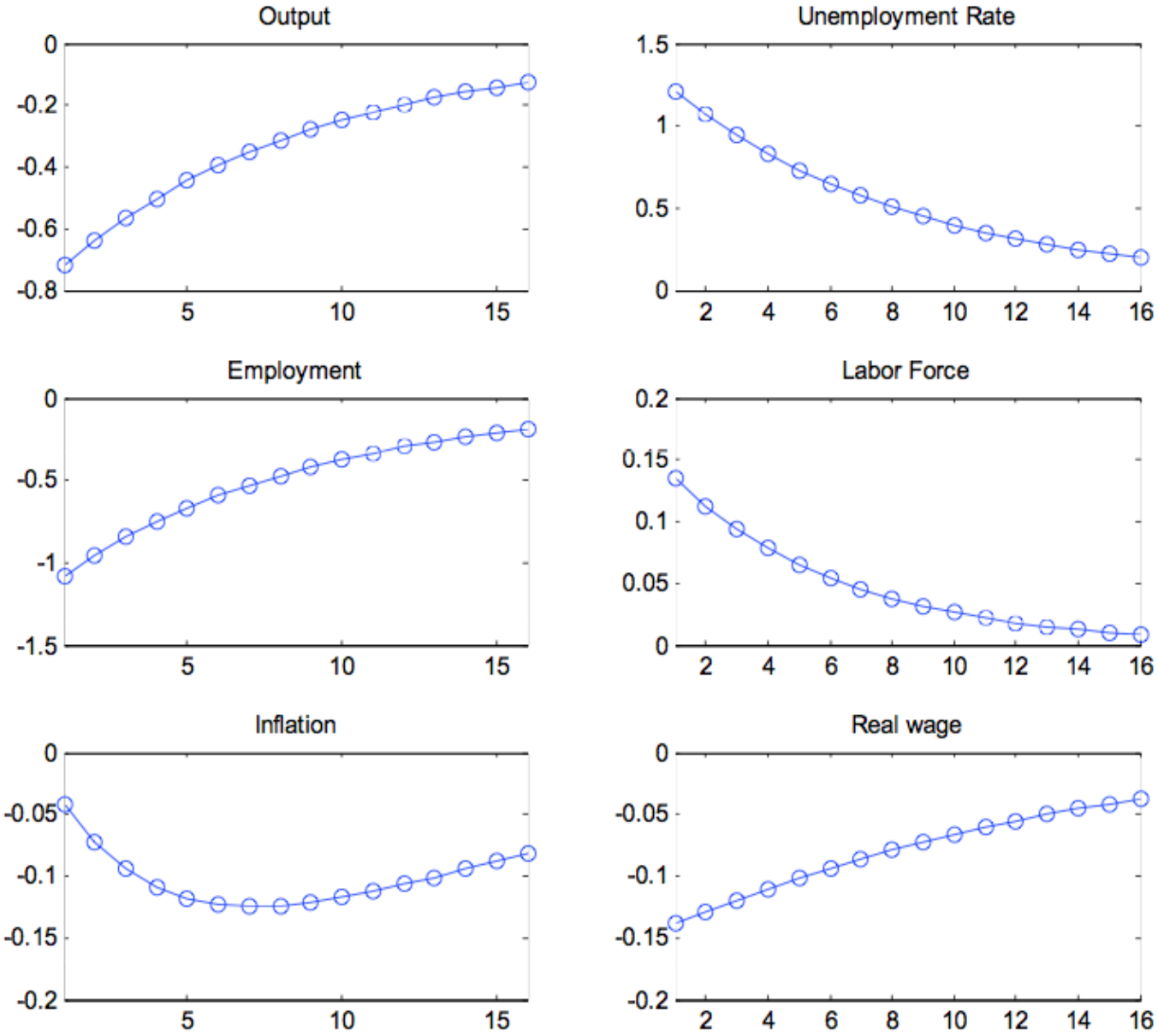
$$\tilde{\omega}_t = \tilde{\omega}_{t-1} + \pi^w_t - \pi^p_t - \Delta\omega^n_t$$

- Monetary policy rule

$$i_t = \rho + \phi_\pi\pi^p_t + \phi_y\tilde{y}_t + v_t$$

plus exogenous processes that pin down y^n_t, r^n_t, ω^n_t corresponding to underlying flexible-price economy

Monetary policy shock $v_t > 0$, revisited



Optimal monetary policy with sticky wages

- No divine coincidence, genuine tradeoff between inflation and output gap volatility
- Still, optimal policy again tries to replicate flexible-price outcomes as best possible

Macroeconomics with financial market frictions

Diamond/Dybvig

- Financial intermediation involves tension between efficient risk-sharing/liquidity provision and exposure to bank runs
- Banks' liquid liabilities allow for efficient risk sharing; investors who may need liquidity prefer to invest in bank rather than hold an illiquid asset directly
- But efficient risk-sharing with liquid liabilities is only one equilibrium. There is also another equilibrium where investors panic and inefficiently withdraw deposits
- In short, bank runs are a form of coordination failure

Costly state verification

- Costly monitoring of private information, agency costs
- Nontrivial financial structure, Modigiliani-Miller does not apply
- Optimal financial structure minimises social monitoring costs
- Borrowers pay premium for external finance, pins down amount of debt, leverage, rate of return on internal funds etc

Brunnermeier/Sannikov

- Nonnegativity constraint introduces effective risk aversion. Dynamics summarised by expert's share of aggregate wealth
- Asset prices relatively insensitive to state near stochastic steady-state
- But asset prices much more sensitive to state when expert's wealth share falls, amplifies loss
- Dynamics local to deterministic steady-state may miss important features of the global dynamics
- Endogenous risk, does not vanish even when fundamental (exogenous) risk is low ('volatility paradox')
- Endogenous risk is greater when market liquidity is low

Stiglitz/Weiss

- Credit rationing due to adverse selection
- Borrowers convex payoff function, expected payoff increasing in risk (since keep upside value, but limited liability below)
- Lenders concave payoff function, expected payoff decreasing in risk
- High interest rates screen out low-risk borrowers, reduce quality of loan applicant pool
- Equilibrium interest rate may not equate demand and supply, i.e., may have excess demand for loans

Brunnermeier/Pedersen

- Speculators trade with customers to help share risk, trades funded with margin loans from outside investors backed by speculators' own wealth

- Loan margins set so as to protect investors against losses due to adverse price movements

- If investors symmetrically informed, margins are stabilising
  — e.g., if asset prices fall, changes in margins subsidise long positions and tax short positions

- But if investors uninformed, margins are destabilising
  — e.g., if asset prices fall, changes in margins tax long positions and subsidise short positions, amplifying price falls

Geanakoplos

- Fluctuations in leverage ratios more important than interest rates
- Buyers heterogeneous in beliefs, borrowing allows most optimistic to leverage their beliefs, driving up asset prices
- Scary bad news (that lowers mean but increases variance) tightens lending margins, reduces leverage, amplifies fall in asset prices

Good luck!