Log-linearized form of expressions from last time:

(IS): $y_t = E_t[y_{t+1}] - \sigma r_{t+1}$ (demand is very forward-looking)

(LM): $m_{t+1} - \bar{p}_t = b y_t - c i_{t+1}$

(LS): $w_t - \bar{p}_t = \eta n_t + z_t$, $\eta = 1 + \varphi$

$\underbrace{\text{(PS)}}_{\text{price setting}}$: $p_t = (1-\delta)\beta E_t[p_{t+1}] + \underbrace{(1-\beta(1-\delta))(w_t - z_t)}_{\text{want higher prices if mc is higher}}$

$\bar{p}_t = (1-\delta)\bar{p}_{t-1} + \delta p_t$

$\underbrace{\text{(PF)}}_{\text{production function}}$: $n_t = y_t - z_t$

Combine (PS) and (LS).

$$p_t = (1-\delta)\beta E_t[p_{t+1}] + (1-\beta(1-\delta))(\bar{p}_t + \eta n_t)$$

Let $\hat{y}_t, \hat{n}_t$ be log-deviations of second best output and employment from steady state.

- Let $x_t = y_t - \hat{y}_t$ be the output gap.

Here: $\hat{y}_t = z_t$ and $\hat{n}_t = 0$, so:

- $x_t = y_t - \hat{y}_t = n_t - \hat{n}_t = n_t$

$$\Rightarrow \quad p_t = (1-\delta)\beta E_t[p_{t+1}] + (1-\beta(1-\delta))(\bar{p}_t + \eta x_t)$$

Thus, if we combine equations, we get:

$\underbrace{\text{(PC)}}_{\text{Phillips Curve}}$ $\pi_t = \beta E_t[\pi_{t+1}] + \dfrac{\delta(1-\beta(1-\delta))}{1-\delta}\eta x_t$ • cf Calvo model: $\beta = 1$

- where $\pi_t \equiv p_t - p_{t-1}$

- if $x_t > 0$ (boom), then there is upward pressure on inflation

The New Keynesian model is characterized by:

(IS): $y_t = E_t[y_{t+1}] - a r_{t+1}$

$r_{t+1} = i_{t+1} - E_t[\pi_{t+1}]$

(LM): $m_{t+1} - \bar{p}_t = b \cdot y_t - c \cdot i_{t+1}$

(PC): $\pi_t = \beta E_t[\pi_{t+1}] + d x_t$

$x_t = y_t - \hat{y}_t = y_t - z_t$

- in principle, the central bank can achieve any level of y_t. (No capital accumulation here)
- can choose i_{t+1} $\Rightarrow$ determines r_{t+1}
  - $\Rightarrow$ determines y_t
  - $\Rightarrow$ determines x_t (output gap)
  - $\Rightarrow$ determines π_t

What is the welfare cost of inflation?

- more inflation $\Rightarrow$ more distortion in prices when price staggering
  - $\Rightarrow$ misallocation of output.

Can think of i_{t+1} as the central bank's instrument (since it is related one-to-one with m_{t+1})

all of this was derived from micro-foundations, so we can do welfare analysis.

What if there are technology shocks?

(IS): $y_t = E_t[y_{t+1}] - ar_{t+1}$

(PC): $E_{t-1}[y_t] = E_{t-1}[\hat{y}_t]$ pins down p_t

- don't have to look at (LM)
- assume central bank can choose r_{t+1}.

- Second best output is expected.

Initial steady state: assume $z = 0$ current and expected.

$\Rightarrow \hat{y}_t = y_t = 0$.

- Suppose z_{t+l} goes from 0 to $z > 0$ $\forall l > 0$
- suppose r is held constant.

$\Rightarrow$ by (IS), $E_t[y_{t+1}] \uparrow$ by z, so $y_t \uparrow$ by z.

- positive output gap
- demand boom driven by anticipated future productivity boom.

Optimal central bank policy is to choose r_{t+1} such that $y_t = 0$. Greenspan did effectively this. (ie choose r_{t+1} s.t. $z - ar_{t+1} = 0 \Leftrightarrow r_{t+1} = \frac{z}{a}$)

- make it very attractive to wait to consume.

Suppose central bank has the rule $r_t = b(y_t - \hat{y}_t)$

Then $y_t = \left(\frac{1}{1+ab}\right) z$

- There is a very large role of $E_{t+1}[y_t]$

Limitations of NK (New Keynesian) model:

- Only have nominal price (not wage) rigidities
- No capital accumulation
- No government. How does gov't spending affect demand/supply?
  - Ricardian equivalence / non-Ricardian equivalence
- Open goods / open financial markets
  - exchange rate is important

additionally:

- Heterogeneity of agents (this what 453 is about)
  - incomplete mkts (uninsurable idiosyncratic risk)
  - precautionary savings
- Other distortions
  - imperfect competition in a more rich manner
  - frictions in labor markets: search / matching
    - involuntary unemployment
  - imperfect information in financial / credit mkts.
    - credit vs. interest rate.
    - role for banking system / money