New Keynesian models of fluctuations

- IS curve & Phillips curve are the key building blocks of Keynesian & New Keynesian macroeconomics.
- They can be integrated to build dynamic models of fluctuations.
- We will consider two:
  1. A simplified New Keynesian model
  2. The canonical New Keynesian DSGE model

A (very) simplified New-Keynesian model

- IS + PC + Central Bank reaction function
- Simpler than the canonical New Keynesian DSGE model and not microfounded
- But captures the New-Keynesian perspective on fluctuations well.
- Most mainstream policy discussions are implicitly based on this model
- *Romer (2000), Carlin & Soskice (2005), Blanchard (2017).*

A 3-equations economy

- IS Curve:

$$Y_t = A - ar_{t-1} \tag{1}$$

- Accelerationist PC:

$$\pi_t = \pi_{t-1} + \alpha(Y_t - Y^\star) \tag{2}$$

- Central Bank reaction function:

$$r_t = r^\star + \psi(\pi_t - \pi^T) \tag{3}$$

$y =$ output; π = inflation rate; $Y^\star$=potential output; r=interest rate; $r^\star$=equilibrium interest rate; π^T=target interest rate;

Old-Keynesian IS Curve

- Output:

$$Y_t = C_t + I_t + \bar{G}$$

- Consumption:

$$C_t = c_0 + c_1(1-\bar{\tau})Y_t$$

- Housing investment:

$$I_t = a_0 - a_1 r_{t-1}$$

- Short-run equilibrium output:

$$Y_t = A - a r_{t-1}$$

$$\text{where } A = \frac{c_0 + a_0 + \bar{G}}{1 - c_1(1-\bar{\tau})} \text{ and } a = \frac{a_1}{1 - c_1(1-\bar{\tau})}$$

Accelerationist Phillips Curve (1/2)

- Wage setting

$$\frac{W_t}{P_t^e} = 1 - \beta u_t \quad \Rightarrow \quad W_t = P^e(1 - \beta u_t)$$

- Price setting

$$Y_t = N_t \quad \Rightarrow \quad P_t = (1 + m)W_t$$

- Inflation rate

$$P_t = P_t^e(1 + m)(1 - \beta u_t) \quad \Rightarrow \quad \pi_t = \pi_t^e + m - \beta u_t$$

- Medium-run equilibrium unemployment rate

$$\pi = \pi^e \quad \Rightarrow u^\star = \frac{m}{\beta} \quad \Rightarrow \quad \pi - \pi^e = -\beta(u_t - u^\star)$$

Accelerationist Phillips Curve (2/2)

- Phillips curve

$$\pi - \pi^e = -\beta(u_t - u^\star)$$

- Assuming adaptive expectations

$$\pi^e = \pi_{t-1} \quad \Rightarrow \pi_t = \pi_{t-1} - \beta(u_t - u^\star)$$

- Rewrite in terms of output

$$\pi_t = \pi_{t-1} + \alpha(Y_t - Y^\star)$$

- Define equilibrium ('natural') interest rate:

$$Y^\star = A - ar^\star \quad \Rightarrow \quad Y_t - Y^\star = -a(r_{t-1} - r^\star)$$

Central Bank reaction function

- CB minimizes a loss function

$$\min_r \ell = (Y_t - Y^\star)^2 + \gamma(\pi - \pi^T)^2$$

- CB's desired output gap

$$Y_t - Y^\star = -\alpha\gamma(\pi_t - \pi^T)$$

- CB choice of interest rate (*Monetary policy rule*)

$$r_t = r^\star + \psi(\pi_t - \pi^T)$$

$$\text{with } \psi = \frac{1}{a(\alpha + \frac{1}{\alpha\gamma})}$$

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- Equilibrium:

$$y = y^\star; \quad u = u^\star; \quad r = r^\star; \quad \pi = \pi^T$$

Out of equilibrium dynamics

- suppose $y = y^\star$, $r = r^\star$ and $\pi = \pi^T$ initally
- a positive demand shock occurs, eg $c_0 \uparrow$

1 Economic boom:

$$y > y^\star, \quad u < u^\star; \quad r^\star \uparrow;$$

2 Accelerating inflation:

$$\pi > \pi^T \text{ and rising}$$

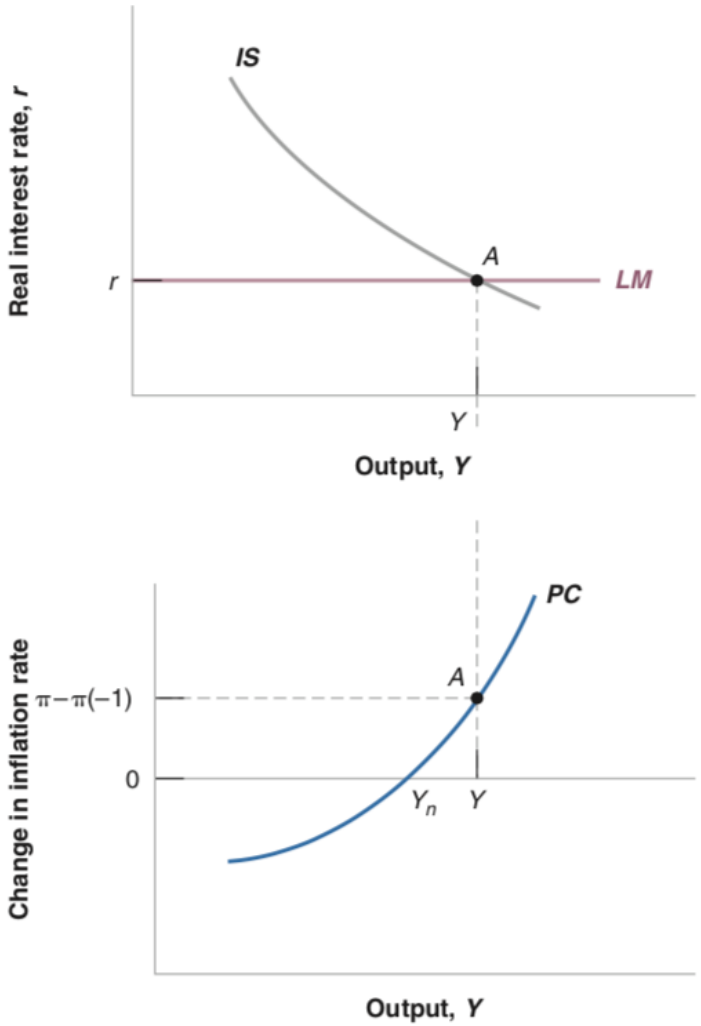
3 CB reaction and downturn:

$$r \uparrow; r > r^\star \quad \Rightarrow \quad Y \downarrow; Y < Y^\star.$$

4 Stabilization:

$$\pi = \pi^T; \quad r = r^\star; \quad Y = Y^\star$$

A short-run equilibrium with output above potential



Challenges for the simplified New Keynesian model

Five critical and potentially problematic assumptions:

1. Monetary policy always effective in increasing output;
2. Policy-makers have a good estimate of a well-defined $u^\star$ and other key parameters;
3. Low unemployment always translates in higher wages & prices;
4. The level of potential output is unaffected by changes in demand;
5. Low interest rates have no negative side-effects

The baseline New Keynesian DSGE model

- New-Keynesian IS curve

$$y_t = E_t[y_{t+1}] - \frac{1}{\theta} r_t + u_t^{IS} \quad \text{with} \quad \theta > 0$$

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- Monetary policy rule

$$r_t = \phi_\pi E_t[\pi_{t+1}] + \phi_y E_t[y_{t+1}] + u_t^{MP} \quad \text{with} \quad \phi_\pi > 0, \quad \phi_y \geq 0$$

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- no constants: deviations from steady-state, normalized to 0

The baseline New Keynesian DSGE model

$$\text{NK IS curve:} \quad y_t = E_t[y_{t+1}] - \frac{1}{\theta} r_t + u_t^{IS} \quad \text{with} \quad \theta > 0$$

$$\text{NK PC:} \quad \pi_t = \beta E_t[\pi_{t+1}] + k y_t + u_t^{\pi} \quad \text{with} \quad 0 < \beta < 1, k > 0$$

$$\text{MP rule:} \quad r_t = \phi_\pi E_t[\pi_{t+1}] + \phi_y E_t[y_{t+1}] + u_t^{MP} \quad \text{with} \quad \phi_\pi > 0, \phi_y \geq 0$$

- shocks structure:

$$u_t^{IS} = \rho_{IS} u_{t-1}^{IS} + e_t^{IS}, \qquad -1 < \rho_{IS} < 1$$

$$u_t^{\pi} = \rho_{\pi} u_{t-1}^{\pi} + e_t^{\pi}, \qquad -1 < \rho_{\pi} < 1$$

$$u_t^{MP} = \rho_{MP} u_{t-1}^{MP} + e_t^{MP}, \qquad -1 < \rho_{MP} < 1$$

Solving the 3-equations model

- Express the model in terms only of shocks and expectations;
- plug the MP rule into the IS curve:

$$y_t = -\frac{\phi_\pi}{\theta} E_t[\pi_{t+1}] + \left(1 - \frac{\phi_y}{\theta}\right) E_t[y_{t+1}] + u_t^{IS} - \frac{1}{\theta} u_t^{MP}$$

- plug the equation above into the NK PC:

$$\pi_t = \left(\beta - \frac{\phi_\pi k}{\theta}\right) E_t[\pi_{t+1}] + \left(1 - \frac{\phi_y}{\theta}\right) k E_t[y_{t+1}] + k u_t^{IS} + u_t^{\pi} - \frac{k}{\theta} u_t^{MP}$$

Special case: no serial correlation in shocks

- Assume $\rho_{IS} = \rho_{\pi} = \rho_{MP} = 0$.
- So the following is a solution:

$$E_t[y_{t+1}] = E_t[\pi_{t+1}] = 0$$

$$y_t = e_t^{IS} - \frac{1}{\theta} e_t^{MP}$$

$$\pi_t = k e_t^{IS} + e_t^{\pi} - \frac{k}{\theta} e_t^{MP}$$

$$r_t = e_t^{MP}$$

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$$r_t = e_t^{MP}$$

- shows effect of demand, monetary policy and inflation shocks;
- *no internal propagation mechanisms*: without assuming serial correlation in shocks, we don't get any persistence (just like RBC).

The general case

- Method of undetermined coefficients;
- Educated guess:

$$y_t = a_{IS} u_t^{IS} + a_\pi u_t^\pi + a_{MP} u_t^{MP}$$

$$\pi_t = b_{IS} u_t^{IS} + b_\pi u_t^\pi + b_{MP} u_t^{MP}$$

- Plug these into the y_t and π_t functions derived earlier;
- solve the resulting system of equations to get the a's and b's;
- we will skip the algebra and directly discuss implications for the effects of shocks;

Implications of the general case

- Assumptions:
  - A period is a quarter;
  - $\theta = 1$ in utility function;
  - $k = 0.172$ & $\beta = 0.99$ in PC;
  - $\phi_\pi = 0.5$ & $\phi_y = 0.125$ in MP;
  - $\rho = 0.5$ for all shocks.

- Effect of *MP* shock:
  - $y_t = -1.54 u_t^{MP}$;
  - $\pi_t = -0.53 u_t^{MP}$;
  - $r_t = 0.77 u_t^{MP}$

- Effect of *IS* shock:
  - $y_t = 1.54 u_t^{IS}$;
  - $\pi_t = 0.53 u_t^{IS}$;
  - $r_t = 0.23 u_t^{IS}$.

- Effect of π shock:
  - $y_t = -0.76 u_t^{\pi}$;
  - $\pi_t = 1.72 u_t^{\pi}$;
  - $r_t = 0.38 u_t^{\pi}$.

Application:

Monetary policy rules and macroeconomic stability: Evidence and some theory

by Clarida, Gali and Gertler (2000)

- Uses the canonical NK model to explain disinflation in the US in the 1980s
- Argues that a change in the conduct of monetary policy explains the stabilization of inflation.
- Available on Keats

- All kinds of extensions in the literature, but this remains the basic model
- Some problems:
  - No unemployment (workers are on their supply curve)
  - All consumers are forward-looking and unconstrained by liquidity.
  - No internal propagation mechanisms (effects of shocks are not persistent except by assumption).
  - Implications of the NK PC about effect of anticipated disinflation are wildly unrealistic.
  - *Forward guidance puzzle*: announced temporary interest rate reduction in the distant future has an enormous effect on inflation today (pretty weird)

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DSGE models: optimistic vs pessimistic views

The optimistic view:

- DSGE describe reasonably well the behavior of macro aggregates...
- ... and are micro-founded so their parameters are plausibly policy-invariant;
- Extensions are making them more realistic, and technology allows analysis of ever more sophisticated versions (including HANK);
- macroeconomists should all focus on further improving DSGE models.

Pessimistic view:

- The baseline model actually produces embarrassing predictions...
- ...and only large ad-hoc modifications just designed to make the models' implications more reasonable attenuate that;
- macroeconomists should seek radically different alternatives (back to old-school Keynesian? agent-based models? no all-encompassing model at all? a type of model that has not been conceived yet?).