# ECON 402 Discussion: Week 6 (LEC)

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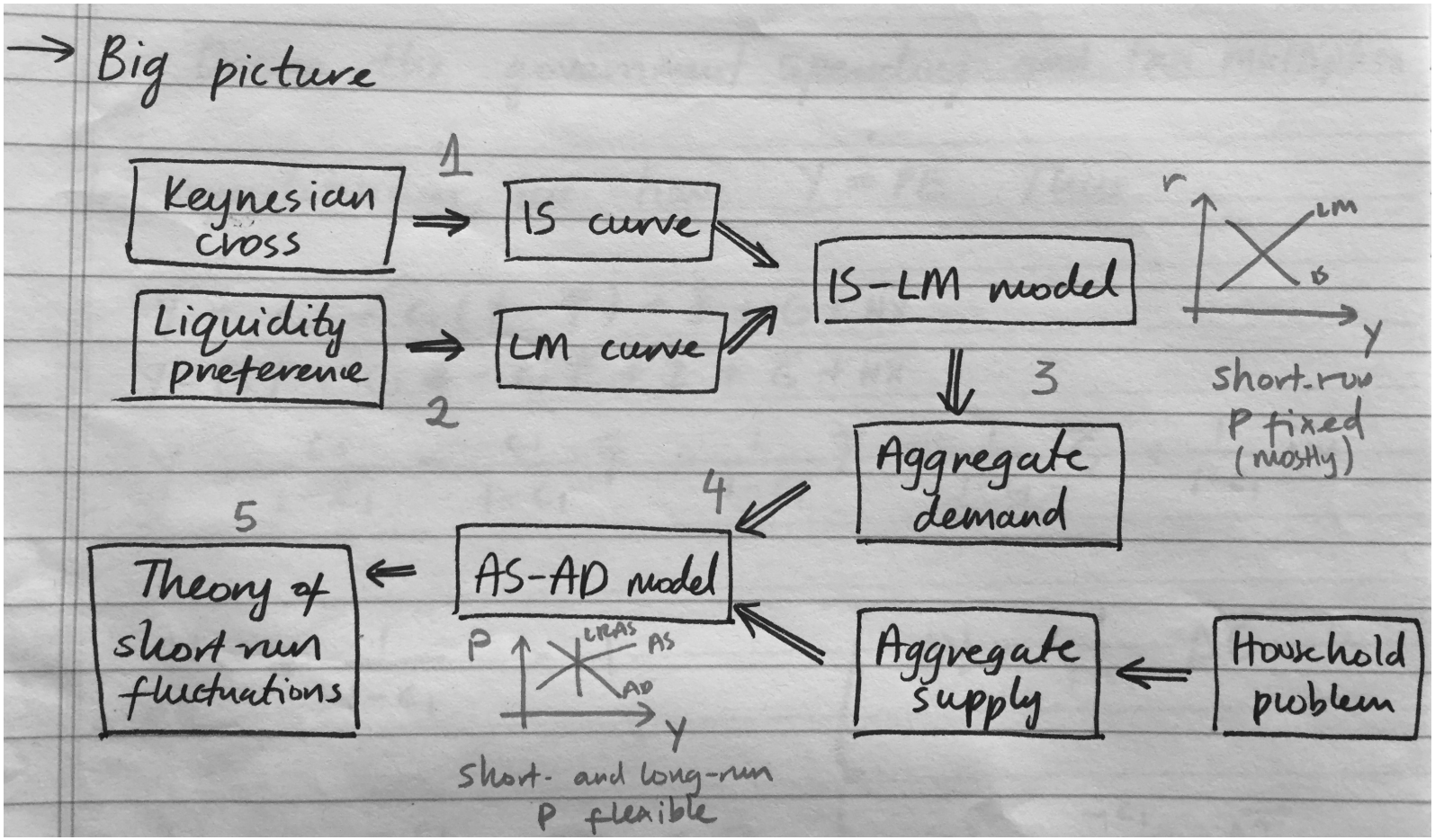
# Announcements

- Quiz 3 available today starting at 4pm.
- Optional/extra credit HW released today, due next Friday!
- Submission: written/typed answers uploaded to Canvas.

- Topics today
  1. DSGE Model
  2. Inflation

# Recall: AS-AD Model



# Recall: AS-AD Model Implications

1. Expansionary policy by the government can increase output and the price level in the short run,
2. In the long-run output remains constant and expansionary policy only causes inflation (increase in price level),
3. Economic growth in the long-run (pushing out the line) comes from other things: productivity increases, innovation, human capital investments, etc. (not the savings rate!),
4. In the short run, negative shocks that reduce output can be combated with expansionary policy to restore long run output levels.
    - Example of negative shock: covid-19 impacts on society.

# Introduction

- Today, we will explore the possibility that expansionary fiscal and monetary policy can lead to inflation, and what the consequences are.
- To do so, we study and solve a dynamic stochastic general equilibrium (DSGE) model of the macroeconomy.
  - Essentially mathematical version of the AS-AD model from last week!
  - One key difference: consumption (and hence output, given our assumptions) determined by dynamic optimization.
- We will solve a simplified version of the model and describe features.
- End with an example of the Philips curve, and associated "pain" of dealing with high inflation. Relevant today...?

# DSGE Model

- Definition: A dynamic stochastic general equilibrium model includes
  1. Supply curve from Lucas model:

$$\begin{aligned} y_t &= \overline{y} + b\left[\pi_t - E_{t-1}(\pi_t)\right] + v_t \\ \Leftrightarrow \pi_t &= E_{t-1}(\pi_t) + \phi(y_t - \overline{y}) + v_t \end{aligned}$$

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  2. Demand (IS) curve w/ consumer optimization but w/o physical capital:

$$y_t = \overline{y} - \alpha \cdot [i_t - E_t(\pi_{t+1}) - \rho] + \varepsilon_t$$

  where $\varepsilon_t$ denotes a mean zero shock and $\overline{y}$ is long-term output.

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  3. Real interest rate $r_{t+1} = i_t - E_t(\pi_{t+1})$ and nominal interest rate

$$i_t = \pi_t + \rho + \theta_\pi(\pi_t - \pi^*) + \theta_y(y_t - \overline{y})$$

     set by the monetary authority to minimize quadratic loss function in output and inflation relative to long-run potential levels.

# DSGE Model

- Assuming backward looking expectations

$$E_t(\pi_{t+1}) = \pi_t$$

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and substituting the interest rate rule into the IS curve, we can express the short-run equilibrium with the following equations

$$\begin{aligned} y_t &= \overline{y} - \frac{\alpha\theta_\pi}{1+\alpha\theta_y}(\pi_t - \pi^*) + \frac{1}{1+\alpha\theta_y}\varepsilon_t \\ \pi_t &= \pi_{t-1} + \phi(y_t - \overline{y}) + v_t \end{aligned}$$

# DSGE Model

- Example: Suppose we have the following simplified macroeconomy

$$\begin{aligned} y_t &= \overline{y} - a(\pi_t - \pi^*) + \varepsilon_t \\ \pi_t &= \pi_{t-1} + \phi(y_t - \overline{y}) + v_t \end{aligned}$$

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- Part a: Find the steady state of this system.
- Solution: After plugging in $\pi_t$ into the first equation, we get

$$y_t = \overline{y} - \frac{a}{1 + a\phi}(\pi_{t-1} - \pi^*) + \frac{\varepsilon_t - a v_t}{1 + a\phi}$$

which gives output as a function of contemporaneous shocks and lagged inflation. In steady state, we have $y_t = \overline{y}$ and $\pi_t = \pi^*$.

# DSGE Model

- Part b: Compute the dynamic effects of a positive shock to $\varepsilon_t$ and $v_t$ on steady state values using spreadsheet software.
- Solution:

# Inflation, and the Phillips Curve

- Recall that demand side equilibrium in DSGE models implies that

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- Note that we can (alternatively) write supply as

$$\begin{aligned} y_t &= \alpha(L - u_t) \\ \Rightarrow \overline{y} &= \alpha(L - u^*) \end{aligned}$$

where $L$ is the labor force and $u_t$ is the unemployment rate.

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  where $L$ is the labor force and $u_t$ is the unemployment rate.
- This implies a relationship between inflation and unemployment:

$$\pi_t - \pi_t^e = a(u^* - u_t)$$

- The (in?)famous Phillips curve!

# Inflation

- Example: Suppose we have a simple Phillips curve given by

$$\pi_t - \pi_t^e = 0.5(u^* - u_t)$$

where $u^* = 3\%$ and $\pi_t^e = \pi_{t-1}$. Assume the government wants to reduce inflation from 12% to 6%.

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| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| $\pi_t$ | 12 | 12 | 12 | 12 | 6 | 6 | 6 | 6 | 6 | 6 |
| $\pi_t - \pi_t^e = \pi_t - \pi_{t-1}$ | | | | | | | | | | |
| $u_t = u^* - 2 \cdot (\pi_t - \pi_t^e)$ | | | | | | | | | | |

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