# ECON 402 Discussion: Week 9

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# Aggregate Supply-Aggregate Demand (AS-AD) model

(i) Aggregate Demand (AD)

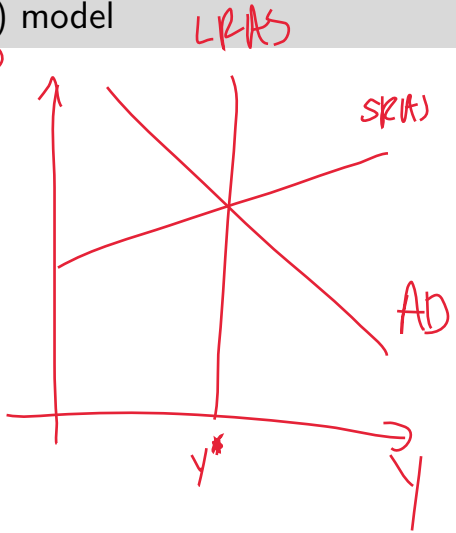
- (IS-LM equilibrium) $Y = f(P; M, \text{other stuff})$
- (simple) $Y = \frac{MV}{P}$

(ii) Short-run Aggregate Supply (SRAS)

- (fully sticky) $P = E[P]$
- (partial sticky) $P = E[P] + \frac{1}{\alpha}(Y - Y^*) + \varepsilon$

(iii) Long-run Aggregate Supply (LRAS)

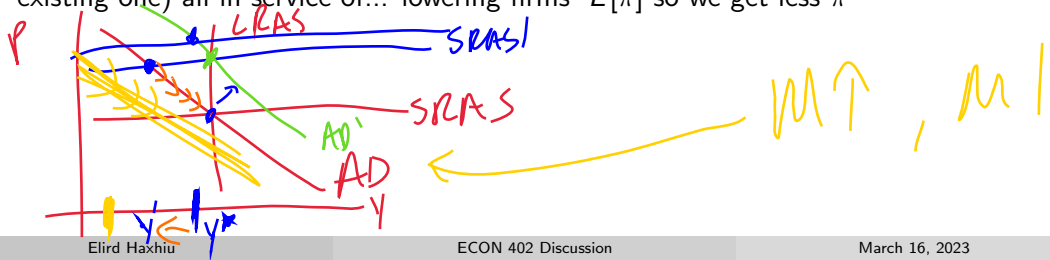
- (real side) $Y = Y^* = F(K, L^*; A)$



# NKPC Example 2: Expectations imply perverse response by govt (imo)

- Suppose cost-push factors lead to recession (and inflation...)
- $E[P]$ immediately adjust upwards, in anticipation of inflation
- Firms then increase their prices... causing (more of) that which they anticipated (lol)

- Not a good idea to stimulate with higher $M$ or higher $G$ or lower $T$... Why?
- It would make $E[P]$ go up even more, causing a spiral
- Should increase interest rates to reduce demand (causing recession or exacerbating existing one) all in service of... lowering firms' $E[\pi]$ so we get less $\pi$



# Monetary Policy: rules, expectations, and credibility

Phillips curve implies short-run trad-off between inflation and unemployment. Central bank's objective function balances these concerns

$$\min_{\pi} \alpha(y-k)^2 + (\pi - \pi^*)^2$$

where

- $y := \frac{Y - Y^*}{Y^*}$ is the output gap
- $\pi := \pi^E + \lambda \cdot y + \varepsilon$ is the Phillips curve
- $\pi^*$ is inflation target by central bank
- $k \geq 0$ is how close central bank wants to be to $Y^*$
- $\alpha \geq 0$ is how much central bank cares about output gap

# Monetary Policy: rules, expectations, and credibility

Phillips curve implies short-run trad-off between inflation and unemployment. Central bank's objective function balances these concerns

$$\min_{\pi} \alpha(y-k)^2 + (\pi - \pi^*)^2$$

Solve for optimal $\pi$, assuming $\pi^* = 0$ and no cost-push shocks $\varepsilon$.

$$\min_{\pi}\left(\alpha(y-k)^2+\pi^2\right) \rightarrow \pi = \pi^E + \lambda y \Rightarrow y = \frac{1}{\lambda}\left(\pi - \pi^E\right)$$

$$\min_{\pi} \alpha\left[\left(\frac{1}{\lambda}\pi - \frac{1}{\lambda}\pi^E - k\right)\right]^2 + \pi^2$$

$$\text{FOC: } 2\alpha\left[\frac{1}{\lambda}\pi - \frac{1}{\lambda}\pi^E - k\right]^1 \cdot \frac{1}{\lambda} + 2\pi \doteq 0 \Rightarrow \boxed{\pi = \frac{\alpha\left(\pi^E + \lambda k\right)}{\alpha + \lambda^2}}$$

$$= \pi$$

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$k>0$

Solve for optimal $\pi$, assuming $\pi^* = 0$ and no cost-push shocks $\varepsilon$.

Under rational expectations $\pi^E = \pi$, what is the optimal solution for $\pi$? $\Rightarrow Y=0, \pi$

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Under rational expectations $\pi^E = \pi$, how could central bank do better? $\Rightarrow$ set $\pi = 0$!

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Under rational expectations $\pi^E = \pi$, how could central bank do better? $\Rightarrow$ set $\pi = 0$!

If they promise $\pi = 0$ and *then* set $\pi$ according to the optimal rule, can do even better!

This implies dynamic inconsistency: optimal to promise one thing, do something else...

- Gold standard
- Currency peg
- Central bank independence, credibility as inflation haters 

# Monetary Policy

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$$\min_i \alpha y^2 + (\pi - \pi^*)^2$$

Relax simplifications from before

- Allow for non-zero inflation target $\pi^*$
- Allow for cost-push shocks $\varepsilon$ in the Phillips curve

- Model *real* interest rates via IS equation on demand side $y = -\phi(r - r^*) + g$
- Model *nominal* interest rates via Fisher effect $i = r + \pi^E$

# Monetary Policy

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Solve for optimal monetary policy rule by substituting Phillips curve into objective function, minimizing with respect to output gap $y$, and substituting into IS and Fisher equations.

$$i = r^* + \pi^* + \left[1 + \frac{\lambda}{\phi(\alpha + \lambda^2)}\right] \cdot (\pi^E - \pi^*) + \frac{\lambda}{\phi(\alpha + \lambda^2)} \cdot u + \frac{1}{\phi} \cdot g$$

# Some implications from the model

- Absent shocks to the economy, we get neutral interest rate $i = r^* + \pi^*$...
  must return to this level in the long-run, always
- In the short-run, rates differ when aggregate demand exceeds potential output ($g > 0$),
  cost-push shocks to supply ($\varepsilon > 0$), or inflation expectations exceed target ($\pi^E - \pi^* > 0$)

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- Optimal $i$ reacts to high levels of $\pi^E$ more than 1-for-1...
- Central bank wants to increase real interest rates to "cool the economy down" when $\pi^E$ is high, but since $r = i - \pi^E$ they must raise rates by more than level increase in $\pi^E$
- If the increase is not large or fast enough, then may get "inflation spiral" where lower real rates stimulate more demand, leading to more inflation, leading to...

# Discussion

Implications are due to structure of New-Keynesian Phillips Curve

1. Inflation expectations enter real inflation 1-for-1
2. Unexpected inflation positively correlated with output gap, negatively correlated with unemployment gap

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Only reason to believe 1: contrived, unrealistic contracts that compel *some* producers to sell as much output as demanded at pre-specified prices, inducing concerns about future inflation when setting prices (today, for tomorrow and beyond, because contract demands it)

Only reason to believe 2: producers that can change their prices somehow perfectly know value of output gap and respond instantly... less contrived, still unrealistic