Output, unemployment, inflation

• Dynamics of AS-AD framework:
  – Phillip’s curve
  – Okun’s Law
  – AD

• Medium-run:
  – Monetary neutrality.
  – Inflation is a monetary phenomenon
Key relationships to consider

- **AS**: Relationship between Inflation and Unemployment (Phillips curve)
- **Production**: Relationship between unemployment growth and output growth.
- **AD**: Relationship between money growth and output growth.
Review of Phillips Curve

- Inflation depends on expected inflation and unemployment:
  \[ \pi_t = \pi^e_t - \alpha(u_t - u_n) \]

- If expected inflation well approximated by last period’s inflation:
  \[ \pi_t - \pi_{t-1} = -\alpha(u_t - u_n) \]

- According to the Phillips Curve:
  \[ u_t < u_n \Rightarrow \pi_t > \pi_{t-1} \]
  \[ u_t > u_n \Rightarrow \pi_t < \pi_{t-1} \]
Okun’s Law:

- If output and employment move one for one then:
  
  \[ u_t - u_{t-1} = -g_{yt} \]

  - In words, a 1 percentage point increase in output growth implies a 1 percentage point reduction in unemployment.

- The empirical relationship between unemployment and output implies:

  \[ u_t - u_{t-1} = -0.4(g_{yt} - 3\%) \]
Okun’s Law: Implications

- When output growth is greater (less) than 3%, unemployment is falling (rising).
- A 1 percentage point reduction in output growth leads to a 0.4 percentage point increase in the unemployment rate:
  - Labor hoarding.
  - Not all new hires come from unemployed.
- Using notation:

\[ u_t - u_{t-1} = -\beta(g_{yt} - \bar{g}_y) \]

\[ g_{yt} > \bar{g}_y \Rightarrow u_t < u_{t-1} \]
\[ g_{yt} < \bar{g}_y \Rightarrow u_t > u_{t-1} \]
AD, Money Growth and Output

• AD relation:
  \[ Y_t = Y(M_t/P_t, G_t, T_t) \]

• Consider simple version (constant velocity):
  \[ Y_t = v(M_t/P_t) \]

• In growth rates:
  \[ g_{yt} = g_{mt} - \pi_t \]

• Holding inflation fixed, an increase in money growth causes an increase in output growth.
Summary

- Phillips Curve:

\[ \pi_t - \pi_{t-1} = -\alpha(u_t - u_n) \]

- Okun’s Law:

\[ u_t - u_{t-1} = -\beta(g_{yt} - \bar{g}_y) \]

- AD:

\[ g_{yt} = g_{mt} - \pi_t \]
Medium Run

• Assume constant money growth
• In medium run:
  – Unemployment equals natural rate.
  – Output growth at normal level
  – Inflation is constant.
• Inflation rate depends on money growth relative to output growth:

\[ \pi = \bar{g}_m - \bar{g}_y \]
Medium run: neutrality of money

- Unemployment rate and rate of growth in output determined by real factors in medium run.
- Inflation rate consistent with what is required to maintain a constant ratio of real balances relative to output.
- Inflation is a monetary phenomenon: A 1 percentage point increase in the money growth rate leads to a 1 percentage point rise in inflation.