Inflation and the DAD – SAS Model: A General Framework for Macroeconomic Analysis, Part 4

Agenda

• Inflation and the Triangle Model.
• The DAD – SAS Model.
• Inflation Adjustment and the Attainment of General Equilibrium.
• Inflation, Disinflation, and Deflation.

Inflation and the triangle model

• Definition of inflation:

\[ \pi_t = \left\{ \frac{(P_t - P_{t-1})}{P_{t-1}} \right\} \times 100 \]

➢ Where \( P \) is the general price level.

Inflation and the triangle model

• Three explicit factors for explaining inflation.
  ➢ Called the triangle model.

• Inflation, \( \pi \), depends on 3 components:
  ➢ Inflationary expectations, \( \pi^e \).
  ➢ Excess demand, \( \pi^{ED} \).
  ➢ Inflation shocks, \( \pi^z \).
Inflation and the triangle model

• Inflationary expectations, $\pi^e$:
  
  ➢ If people expect a particular level of inflation, that level will likely occur even without any pressure from the output or labor market.

---

Inflation and the triangle model

• Inflationary expectations, $\pi^e$:
  
  ➢ Modeling $\pi^e$ is extremely difficult.
    
    • Rational expectations
      
      ➢ Based on forward-looking behavior.
    
    • Adaptive expectations
      
      ➢ Based on backward-looking behavior
        
        ➢ Dependent on effect of staggered wage and price behavior.

---

Inflation and the triangle model

• Excess demand inflation, $\pi^{ED}$:
  
  ➢ Excess demand is measured by the output gap.
    
    $\pi^{ED} = f(Y - Y^*)$
    
    ➢ Where $f > 0$.
    
    • The bigger is the output gap, the faster is the change in $\pi_t$ for any given $f$.
    
    • The bigger is $f$, the faster is the change in $\pi_t$ for any given output gap.

---
Inflation and the triangle model

- Excess demand inflation, $\pi^{ED}$:
  
  ➢ **Key Assumption**: Because of wage and price stickiness, current excess demand inflation depends on lagged excess demand.
  
  $$\pi^{ED}_t = f ( Y_{t-1} - Y^*_{t-1} )$$

- Inflation shocks, $\pi^Z$:
  
  ➢ **Key Assumption**: Inflation shocks affect inflation contemporaneously.
  
  $$\pi^Z_t = Z_t$$

Inflation and the triangle model

- **Inflation**:

  $$\pi_t = \pi_{t-1} + f ( Y_{t-1} - Y^*_{t-1} ) + Z_t$$

  ➢ Expected inflation, plus
  ➢ Excess demand inflation, plus
  ➢ Inflation shocks.

  • This is also the **new** SRAS curve.
The SRAS curve

- The original SRAS curve was based on P-level adjustment
- The new SRAS curve is now based on \( \pi \) adjustment

The Phillips curve and the SRAS curve

- The expectations-augmented Phillips curve:
  \[ \pi = \pi' - f(u - \bar{u}) \]
- Okun’s Law:
  \[ \frac{(Y^* - Y)}{Y^*} = 2(u - \bar{u}) \]
  or
  \[ u - \bar{u} = 0.5 \frac{(Y^* - Y)}{Y^*} \]

The Phillips curve and the SRAS curve

- Short-run Aggregate Supply (SRAS) curve:
  \[ \pi = \pi' + g(Y - Y^*) \]
  - If
    \[ \pi_t = \pi_{t-1} \]
  - then
    \[ \pi_t = \pi_{t-1} + g(Y_{t-1} - Y_{t-1}^*) \]
The Phillips curve and the SRAS curve

- Short-run Aggregate Supply (SRAS) curve:
  \[ \pi_t = \pi_{t-1} + \frac{1}{g} (Y_{t-1} - Y^*_{t-1}) \]
  ➢ Adding inflation shocks:
  \[ \pi_t = \pi_{t-1} + \frac{1}{g} (Y_{t-1} - Y^*_{t-1}) + Z_t \]
  ➢ and we have the new SRAS curve.

The AD Curve

- The Aggregate Demand (AD) curve is based on levels of the underlying variables.
  ➢ The level of C, I, G, T, L, and M* =⇒ level of Y and P.
The *DAD Curve*

- The *Dynamic Aggregate Demand* (DAD) curve is based on growth rates of the underlying variables.
  - Growth rate of $C$, $I$, $G$, $T$, $L$, and $M$ => growth rate of $Y$ and $P$ (or $\pi$).

---

General equilibrium in the *DAD-SAS model*

- $\pi$ can occur because of:
  - Demand shocks (shifts in the DAD curve),
  - Inflation shocks (shifts in the SRAS curve), or
  - Supply shocks (shifts in both the SRAS and LRAS curves).
The DAD–SAS model and \( \pi \) adjustment

- Types of DAD Shock:
  - Favorable (increases \( Y \) relative to \( Y^* \)):
    - Rightward shifts in the IS curve and/or the LM curve that increases output relative to full-employment output.
  - Unfavorable (decreases \( Y \) relative to \( Y^* \)):
    - Leftward shifts in the IS curve and/or the LM curve that decreases output relative to full-employment output.

---

The DAD–SAS model and \( \pi \) adjustment

- An increase in government purchases:
  - In Year 0, the economy is in general equilibrium.
    - Denote the general equilibrium level of output by \( Y^* \).

---

An increase in government purchases

- In Year 1, government purchases increase.
  - Assume Ricardian equivalence does NOT hold.
  - An increase in government purchases shifts both the IS and DAD curves to the right.
The DAD–SAS model and π adjustment

- An increase in government purchases:
  - In Year 1, the increase in government purchases increases output but leaves inflation unchanged.
    - Short-run equilibrium at the DAD and SRAS intersection.
      - The labor market is temporarily out of equilibrium.
    - π adjustment does NOT take place in Year 1 because of:
      - Lagged adjustment to excess demand, and
      - Inflationary expectations (which are lagged inflation).

24-29

The DAD–SAS model and π adjustment

- An increase in government purchases:
  - In Year 2, inflation begins to rise.
    - In Year 2, the SRAS curve shifts up because of excess aggregate demand in Year 1, i.e., Y₁ > Y*.
      - How far the SRAS curve shifts up depends on the explicit inflation adjustment process for the economy.
      - Generally it is a multiyear process dependent on the amount of excess aggregate demand.

24-30

The DAD–SAS model and π adjustment

- An increase in government purchases:
  - In Year 2, inflation begins to rise.
    - Higher inflation reduces the real money supply, M₀/P.
      - Alternatively, the purchasing power of the nominal money supply, M₀, has been reduced.
    - A lower real money supply shifts the LM curve to the left, raising the real interest rate.

24-31

The DAD–SAS model and π adjustment

- An increase in government purchases:
  - In Year 2, inflation begins to rise.
    - A higher real interest rate will:
      - Reduce interest-sensitive spending.
      - Reduce output and employment, and
      - Raise the unemployment rate.
The DAD–SAS model and π adjustment

• An increase in government purchases:
  ➢ In Year 3, inflation continues to rise.
    • In Year 3, the SRAS curve shifts up again because of excess aggregate demand in Year 2, i.e., \( Y_3 > Y^* \).
      - Because excess aggregate demand in Year 2 is less than in Year 1, the upward shift of the SRAS in Year 3 will be smaller than in Year 2.

The DAD–SAS model and π adjustment

• An increase in government purchases:
  ➢ In Year 4 and beyond, this process continues until general equilibrium is re-established in both the IS-LM and DAD-SAS models.
    • Output will be at its full-employment level.
    • The real money supply is lower.
    • The real interest rate is higher.
    • Inflation will be permanently higher.

The DAD–SAS model and π adjustment

• Results of demand shocks:
  ➢ The economy reaches \( Y^* \) through the repetition of π adjustment year after year.
  ➢ Each year, conditions in the previous year determine π in the current year:
    • Inflationary expectations and
    • Excess/insufficient demand.

The DAD–SAS model and π adjustment

• Types of Inflation Shocks:
  ➢ Unfavorable (increases π):
    • Higher imported goods and/or raw material prices.
      ➢ Especially oil.
      ➢ Weaker currency.
    • Reduced competitive pressures.
      ➢ Exogenous wage push.
      ➢ Reduced globalization.
      ➢ Increased regulation.
The \textit{DAD–SAS} model and $\pi$ adjustment

• Types of Inflation Shock:
  
  ➢ Favorable (reduces $\pi$):
    
    • Lower imported goods or raw material prices.
      ➢ Especially oil.
      ➢ Stronger currency.
    
    • Increased competitive pressures.
      ➢ Globalization.
      ➢ Decreased regulation.

The \textit{DAD–SAS} model and $\pi$ adjustment

• A short-run adverse inflation shock:
  
  ➢ In Year 0, the economy is in general equilibrium.

A short-run adverse inflation shock

\begin{figure}
\begin{center}
\begin{tikzpicture}
\draw[->] (-2,0) -- (2,0) node[right] {Y};
\draw[->] (0,-2) -- (0,2) node[above] {$\pi$};
\draw (0,0) -- (2,-2) node[below] {DAD$_0$};
\draw (0,0) -- (-2,2) node[left] {SAS$_0$};
\end{tikzpicture}
\end{center}
\end{figure}

The \textit{DAD–SAS} model and $\pi$ adjustment

• A short-run adverse inflation shock:
  
  ➢ In Year 1, imported goods inflation increases.

  • An increase in imported goods inflation \textit{immediately} increases the inflation rate and shifts the SRAS curve \textit{up}.
    
    • Higher inflation reduces the real money supply, M/P.
    
    • A lower real money supply shifts the \textit{LM} curve shifts to the left, raising the real interest rate.
The \textit{DAD–SAS} model and $\pi$ adjustment

- A short-run adverse inflation shock:
  - In Year 1, the increase in imported goods inflation raises the inflation rate and decreases output.
  - A higher real interest rate will:
    - Reduce interest-sensitive spending,
    - Reduce output and employment, and
    - Raise the unemployment rate.

- A lower real interest rate:
  - Increases interest-sensitive spending,
  - Increases output and employment, and
  - Decreases the unemployment rate.

The \textit{DAD–SAS} model and $\pi$ adjustment

- A short-run adverse inflation shock:
  - In Year 2, inflation will begin to fall.
    - In Year 2, the \textit{SRAS} curve shifts down because of the insufficient aggregate demand in Year 1, i.e., $Y_1 < Y^*$.
      - As the \textit{SRAS} curve shifts down, inflation falls.
      - A lower price level increases the real money supply.
      - A higher real money supply shifts the \textit{LM} curve to the right, reducing the real interest rate.

- A short-run adverse inflation shock:
  - In Year 2, inflation will begin to fall.
    - In Year 3 and beyond, inflation continues to fall until general equilibrium is re-established in both the \textit{IS–LM} and \textit{DAD–SAS} models.
      - Output will be at its full-employment level.
      - The real money supply is back to its original level.
      - The real interest rate is back to its original level.
      - Inflation will be back at its original level.
The DAD–SAS model and \( \pi \) adjustment

- Results of inflation shocks:
  - The economy reaches \( Y^* \) through the repetition of \( \pi \) adjustment year after year.
  - Each year, conditions in the previous year determine \( \pi \) in the current year:
    - Inflationary expectations and
    - Excess/insufficient demand.

The DAD–SAS model and \( \pi \) adjustment

- Summary of (Short-term) Effects:
  - Favorable DAD Shock
    - Higher \( Y \) (relative to \( Y^* \)) and \( \pi \).
  - Unfavorable DAD Shock
    - Lower \( Y \) (relative to \( Y^* \)) and \( \pi \).
  - Favorable SAS Shock
    - Higher \( Y \) (relative to \( Y^* \)) and lower \( \pi \).
  - Unfavorable SAS Shock
    - Lower \( Y \) (relative to \( Y^* \)) and higher \( \pi \).

The DAD–SAS model and \( \pi \) adjustment

- (Long-run) Supply shocks:
  - Supply shocks occur when there are permanent changes in:
    - Productivity.
    - Competitive pressures.
  - (Long-run) Supply shocks change \( Y^* \):
    - Because \( Y^* \) changes, the \( \pi \) adjustment process is altered.
    - and permanently change \( \pi \).

The DAD–SAS model and \( \pi \) adjustment

- A long-run adverse supply shock:
  - In Year 0, the economy is in general equilibrium.
The DAD–SAS model and \( \pi \) adjustment

- A long-run adverse supply shock:
  - In Year 1, there is a decrease in productivity.
    - A decrease in productivity shifts **BOTH** the SRAS curve up and the LRAS curve (and the \( FE \) line) to the left.
      - The short-run effects could be:
        » Greater than,
        » Equal to, or
        » Less than the long-run effects.

The DAD–SAS model and \( \pi \) adjustment

- A long-run adverse supply shock:
  - In Year 1, the upward shift of the SRAS curve:
    - Increases inflation,
    - Reduces the real money supply,
    - Shifts the LM curve to the left,
    - Raises the real interest rate,
    - Reduces interest-sensitive spending, and
    - Reduces output and employment.

- In Year 1, the leftward shift of the LRAS curve also reduces the economy’s full-employment level of output.
  - Which reduces general equilibrium output.
The DAD–SAS model and π adjustment

• A long-run adverse supply shock:
  ➢ In Year 2, if the short-run effects are less than the long-run effects, then:
    • Output in Year 1 is greater than the new, lower full-employment level of output, i.e., $Y_1 > Y^*_1$.
    • So there is excess aggregate demand and the SRAS curve will shift up and inflation will rise.
  ➢ This process continues until general equilibrium is re-established.

Aggregate Demand and Aggregate Supply

• A long-run adverse supply shock:
  ➢ Once general equilibrium has been re-established:
    • Output is at its new, lower full-employment level.
    • Inflation will be permanently higher.

The DAD–SAS model and π adjustment

• An adverse supply shock:
  ➢ The economy moves to its new $Y^*$ and results in a permanent change in $\pi$.
  ➢ It is likely that the new $Y^*$ will be reached through a repetition of $\pi$ adjustment year after year.
  ➢ Each year, conditions in the previous year determine $\pi$ in the current year:
    • Inflationary expectations and
    • Excess/insufficient demand.

Inflation & Deflation

• The key to understanding rates of change in inflation is the π adjustment equation.
  $$\pi_t = \pi_{t-1} + g(Y_{t-1} - Y^*_{t-1}) + Z_t$$

• This equation can describe the process of:
  ➢ Steady inflation,
  ➢ Accelerating inflation,
  ➢ Disinflation, or
  ➢ Deflation
Inflation, disinflation and deflation

- Stable inflation, \( \pi_t = \pi_{t-1} \):
  \[ \text{Inflation stabilizes when } Y_{t-1} = Y^*_t. \]
  \[ u = \overline{u}. \]

- Accelerating inflation, \( \pi_t > \pi_{t-1} \):
  \[ \text{Inflation accelerates when } Y_{t-1} > Y^*_t. \]
  \[ u < \overline{u}. \]

- Deflation, \( \pi_t < 0 \):
  \[ \text{Prices declines generally requires that } Y_{t-1} \text{ be substantially below } Y^*_t. \]
  \[ u > \overline{u} \text{ by a substantial amount and } \]
  \[ \text{for a sustained period of time.} \]

- Disinflation, \( \pi_t < \pi_{t-1} \):
  \[ \text{Inflation decelerates when } Y_{t-1} < Y^*_t. \]
  \[ u > \overline{u}. \]

  \[ \text{Policy makers can choose a disinflationary path.} \]
  \[ \text{The deeper the recession, the faster the disinflation} \]
  \[ \text{The shallower the recession, the slower disinflation} \]
  \[ \text{Either way, } u \text{ must rise above } \overline{u}. \]