Actual GDP and trend GDP for mainland Norway.
Constant 2000 prices. In billions of NOK

Sources: Statistics Norway and Norges Bank
Aggregate Demand and Supply

• How the aggregate output and price are determined.
• How they are affected by the policies.
Aggregate Demand

• Downward sloping
  – Monetarist: Money supply (monetary policy) is the most effective tool to shift the aggregate demand function.
  – Keynesian view: Government spending and/or taxes (fiscal policy) is the most effective tool.
Monetarist View of AD

\[ V = \frac{P \times Y}{M} = \frac{2000}{1000} = 2 \]

Modern Quantity Theory of Money
\[ M \times V = P \times Y \]

**Implication:** \( M \) determines \( P \times Y \) if \( V \) unrelated to \( \Delta M \)

**Deriving AD Curve**
\[ M = 1000, \ V = 2 \Rightarrow P \times Y = 2000 \]

Point A: \( P = 2 \quad Y = 1000 \quad PY = 2 \times 1000 \)
Point B: \( P = 1 \quad Y = 2000 \quad PY = 1 \times 2000 \)
Point C: \( P = .5 \quad Y = 4000 \quad PY = .5 \times 4000 \)

**Conclusion:** \( P \downarrow \ Y \uparrow \), downward sloping AD

**Shift in AD Curve**
\( M \uparrow: P \times Y \uparrow \), so at given \( P \), \( Y \uparrow \Rightarrow AD \) shifts right
The AD Curve
Keynesian View of \( AD \)

\[ Y^{ad} = C + I + G + NX \]

**Downward Sloping \( AD \)**

- \( P \downarrow, \frac{M}{P} \uparrow, i \downarrow, I \uparrow, NX \uparrow, Y^{ad} \uparrow, Y \uparrow \)

**Shift in \( AD \)**

- \( M \uparrow, \frac{M}{P} \uparrow, i \downarrow, I \uparrow, NX \uparrow, Y^{ad} \uparrow, Y \uparrow \)
  \[ \Rightarrow AD \text{ shifts right} \]

- \( C \uparrow \text{ or } G \uparrow \text{ or } T \downarrow \text{ or } NX \uparrow: Y^{ad} \uparrow, Y \uparrow \)
  \[ \Rightarrow AD \text{ shifts right} \]

**Complete Crowding Out**

- \( G \uparrow, i \uparrow \Rightarrow C \downarrow, I \downarrow, NX \downarrow \Rightarrow C + I + G + NX = Y^{ad} \) unchanged

**Partial crowding out:** private spending down, but not fully offsetting \( G \uparrow \)
Aggregate Demand

- AD is downward sloping.
- Monetarist: Monetary policy is the most effective way to shift aggregate demand.
- Keynesian: Fiscal policy is the most effective way to shift aggregate demand.
Aggregate Supply in Short Run

**Upward slope of AS**

In short-run production costs fixed ⇒ $P \uparrow$, profits $\uparrow$, $Y$ produced $\uparrow$

**Shift in AS**

Production costs $\uparrow$: At given $P$, profits $\downarrow$, $Y$ $\downarrow$ ⇒ AS shifts left
Equilibrium in Short Run

Equilibrium: \( AD = AS \)

If \( P > P^* \), \( AS > AD \) \( \Rightarrow \) \( P \downarrow \) to \( P^* \)

If \( P < P^* \), \( AS < AD \) \( \Rightarrow \) \( P \uparrow \) to \( P^* \)
Equilibrium in Long Run

Panel (a): $Y > Y_n$
Wages $\uparrow$: at given $P$, profits $\downarrow$, $Y$ produced $\downarrow \Rightarrow AS$ shifts in until $Y = Y_n$ at long-run AS

Panel (b): $Y < Y_n$
Wages $\downarrow$: at given $P$, profits $\uparrow$, $Y$ produced $\uparrow \Rightarrow AS$ shifts out until $Y = Y_n$ at long-run AS

Activist sees movement to long-run AS (self-correcting mechanism) as slow; nonactivist sees as fast
Summary: Factors that Shift AD

<table>
<thead>
<tr>
<th>Factor</th>
<th>Change</th>
<th>Shift in the Aggregate Demand Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Money supply M</td>
<td>↑</td>
<td><img src="image" alt="Graph showing AD shift" /></td>
</tr>
<tr>
<td>Government spending G</td>
<td>↑</td>
<td><img src="image" alt="Graph showing AD shift" /></td>
</tr>
<tr>
<td>Taxes T</td>
<td>↑</td>
<td><img src="image" alt="Graph showing AD shift" /></td>
</tr>
<tr>
<td>Net exports NX</td>
<td>↑</td>
<td><img src="image" alt="Graph showing AD shift" /></td>
</tr>
<tr>
<td>Consumer optimism C</td>
<td>↑</td>
<td><img src="image" alt="Graph showing AD shift" /></td>
</tr>
<tr>
<td>Business optimism l</td>
<td>↑</td>
<td><img src="image" alt="Graph showing AD shift" /></td>
</tr>
</tbody>
</table>

Note: Only increases (↑) in the factors are shown. The effect of decreases in the factors would be the opposite of those indicated in the “Shift” column. Note that monetarists view only the money supply as an important cause of shifts in the aggregate demand curve.
1. AD shifts right: $Y \uparrow, P \uparrow$ to point 1'
2. $Y > Y_n$: wages $\uparrow$, AS shifts in until reach point 2, where $Y = Y_n$

Conclusion: AD shifts right, $Y \uparrow$ in short run only; in long run only $P \uparrow$
### Summary: Factors that Shift AS

<table>
<thead>
<tr>
<th>Factor</th>
<th>Shifts in the Aggregate Supply Curve</th>
<th>Factor</th>
<th>Shifts in the Aggregate Supply Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Y &gt; Y_n$</td>
<td><img src="image1" alt="Graph" /></td>
<td>Wage push</td>
<td><img src="image2" alt="Graph" /></td>
</tr>
<tr>
<td>$Y &lt; Y_n$</td>
<td><img src="image3" alt="Graph" /></td>
<td>Positive supply shock</td>
<td><img src="image4" alt="Graph" /></td>
</tr>
<tr>
<td>Rise in expected price level</td>
<td><img src="image5" alt="Graph" /></td>
<td>Negative supply shock</td>
<td><img src="image6" alt="Graph" /></td>
</tr>
</tbody>
</table>
1. Negative supply shock: AS shifts in, $Y \downarrow P \uparrow$ to point 2
2. $Y < Y_n$: wages $\downarrow$, AS shifts out until return to point 1

Conclusion: AS shifts in, $Y \downarrow P \uparrow$ in short run, but in long run $Y$ and $P$ are unchanged
## Vietnam War Buildup: 1964–70

### Table 3  Unemployment and Inflation During the Vietnam War Buildup, 1964–1970

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployment Rate (%)</th>
<th>Inflation (Year to Year) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964</td>
<td>5.0</td>
<td>1.3</td>
</tr>
<tr>
<td>1965</td>
<td>4.4</td>
<td>1.6</td>
</tr>
<tr>
<td>1966</td>
<td>3.7</td>
<td>2.9</td>
</tr>
<tr>
<td>1967</td>
<td>3.7</td>
<td>3.1</td>
</tr>
<tr>
<td>1968</td>
<td>3.5</td>
<td>4.2</td>
</tr>
<tr>
<td>1969</td>
<td>3.4</td>
<td>5.5</td>
</tr>
<tr>
<td>1970</td>
<td>4.8</td>
<td>5.7</td>
</tr>
</tbody>
</table>

*Source: Economic Report of the President.*

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployment Rate (%)</th>
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<th>Year</th>
<th>Unemployment Rate (%)</th>
<th>Inflation (Year to Year) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>4.8</td>
<td>6.2</td>
<td>1978</td>
<td>6.0</td>
<td>7.6</td>
</tr>
<tr>
<td>1974</td>
<td>5.5</td>
<td>11.0</td>
<td>1979</td>
<td>5.8</td>
<td>11.3</td>
</tr>
<tr>
<td>1975</td>
<td>8.3</td>
<td>9.1</td>
<td>1980</td>
<td>7.0</td>
<td>13.5</td>
</tr>
</tbody>
</table>

*Source: Economic Report of the President.*
## Positive Supply Shocks 1995–99

### Table 5 Unemployment and Inflation During the Favorable Supply Shock Period, 1995–2000

<table>
<thead>
<tr>
<th>Year</th>
<th>Unemployment Rate (%)</th>
<th>Inflation (Year to Year) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>5.6</td>
<td>2.8</td>
</tr>
<tr>
<td>1996</td>
<td>5.4</td>
<td>3.0</td>
</tr>
<tr>
<td>1997</td>
<td>4.9</td>
<td>2.3</td>
</tr>
<tr>
<td>1998</td>
<td>4.5</td>
<td>1.6</td>
</tr>
<tr>
<td>1999</td>
<td>4.2</td>
<td>2.2</td>
</tr>
</tbody>
</table>

What can monetary policy do?

• The self-correcting mechanism is slow. So exogenous shocks may keep the economy out of its long-run trend for prolonged periods.
• We can use the policy instrument to restore long-run output by shifting the aggregate demand.
Conduct of Monetary Policy

• Choice of monetary instrument
  – Monetary Aggregates, or
  – Interest Rate
  – Can you choose both?
    • No! After you choose one, the other one is automatically determined by the market.
  – Which monetary instrument is currently used by the central banks?
    • Interest rate
How to set the interest rate?

- Taylor rule (John Taylor, Stanford)

\[ i_t = i + \alpha(\pi_t - \pi) + \beta(y_t - y) \]

- \( i_t \) — interest rate of time \( t \)
- \( i \) — targeted long-run interest rate
- \( \pi_t \) — inflation rate of time \( t \)
- \( \pi \) — targeted long-run inflation rate
- \( y_t \) — output (GDP) of time \( t \)
- \( y \) — targeted long-run output (GDP)
How well the Taylor rule captures the monetary policy in U.S.?
How Taylor rule is followed in reality

- Countries explicitly follow “Taylor rule”
  - Australia, New Zealand, U.K.
- U.S.
  - Greenspan: No commitment to any “monetary rule”.
  - Bernanke: Expected to follow the “rule” more explicitly.
Debates on the Taylor Rule

• How much should the interest rate react to inflation and output?
  – What are the optimal values for $\alpha$ and $\beta$ in the Taylor rule?
• What should be included in the Taylor rule?
  – Current inflation rate, lagged inflation rate or expected inflation rate?
  – Is output stabilization necessary?
  – Should the exchange rate be included in an open economy?
• Should the central bank adjust interest rate gradually?
  – If the Fed wants to increase interest rate by 1 percentage point, should it increase the interest rate by 25 basis points each time during the next 4 months or increase the interest rate by 1 percent immediately.
Shifts in Long-Run Supply

$Y_n$ grows over time, but is shown as fixed in $AD/AS$ diagram

Real Business Cycle Theory
1. $Y_n$ fluctuates a lot due to aggregate supply (real) shocks
2. Shifts in $AD$ small
3. Conclusion: Business cycles due to real shocks
4. Supports nonactivism

Hysteresis
1. $AD$ shifts in, natural rate of unemployment $\uparrow$, $Y_n$ shifts in
2. Unemployment stays high
3. Supports activism