Theories of the exchange rate:
1) Long run: monetary approach (PPP)
2) Short run: asset approach (UIP)

Fundamental equation of the asset approach:

\[ i^s = i^e + \frac{E_e^i - E^e}{E^e} \]

Says: given the interest rate \( i^s, i^e \)
and expectations about future spot exchange rate \( E^e/V_e \)
Then this tells us the value for \( E^e/V_e \), current spot exchange rate.

So...

What pins down:
1) \( E^e/V_e \): use our long-run theory based on monetary approach (in expectation form)

\[ E^e/V_e = \frac{e^s}{M^s} / \frac{e^e}{M^e} \]

\[ (e^s/V^s) / (e^e/V^e) \]
2) interest rates:
in short run, use the "money market" model, but applied in the short run sense:

\[ \frac{M^uS}{P^uS} = L^*(i^u) \cdot Y^uS \]

For our short-run analysis, we assume:
1) prices are fixed (P)
2) nominal interest rates adjust to clear the money market

Says: given \( P \), \( M^uS \) and \( Y^uS \), then this equation determines \( i^u \).
Suppose a rise in money supply (temporarily) from $M'_{US}$ to $M^2_{US}$.

At the price level ($P_{US}$), this raises real money supply, shifting vertical supply curve right.

This lowers the equilibrium interest rate from $i^1_s$ to $i^2_s$.

This lowers the domestic returns line in the foreign exchange market.

And this makes the dollar depreciate in the short run ($\uparrow E_{S/£}$).
Suppose a permanent increase in money supply.

U.S. money market:

- $M_{us}$
- $M_{us}^2 / P_{us}$
- Real money

Foreign exchange market:

- $E_{1+} \, \eta + \frac{E_{2^2 - E}}{E}$
- Domestic returns, $E_{SR}$
- Foreign returns, $E_{SR}^2$

Short-run response:

$\uparrow M_{us} \rightarrow \uparrow \frac{M_{us}}{P} \rightarrow \downarrow i \%$

$\uparrow E_{SR} \rightarrow \uparrow \eta \, S_{/E}$

by monetary approach

Shifts expected foreign returns curve right (up)

Note: permanent shock shifts the foreign returns curve right, so the equilibrium exchange rate rises more than in the temporary case.

Long-run response: Prices rise

$\uparrow P = \frac{M_{us}}{P_{us}}$

returns to its original level

$\rightarrow i \%$ returns to its original level.
note: £ stays at its new level, so the foreign returns curve stays at its new position, so the spot exchange rate, £/$ in long run returns only part way.
Permanent decrease in real money demand.

U.S. money market

Foreign exchange market

recall: monetary approach equation with expectations form

\[ E_{t+1}^{e} \cdot \frac{\text{Mus}}{P_{t+1}} = \frac{M_{\text{us}}^{e}}{M_{\text{ev}}^{e}} \times \frac{(L_{e}(i_{t+1})Y_{ev})/(L_{e}(i_{t+1})Y_{ev})}{(L_{e}(i_{t+1})Y_{ev})} \]
Short-run effect

Money market: fall in real money demand is a leftward shift in L(1,y) vs curve → fall in equilibrium US interest rate.

Foreign exchange market:

$ \downarrow \rightarrow$ shifts down the domestic returns line.

Also, since the fall in money demand is permanent, the monetary approach says \( \uparrow E_t \) in long run, so \( \uparrow E_{tE} \) shift the foreign returns curve right, so equilibrium implies a large rise in \( E_{tE} \) ($ depreciates immediately).

Long-run

Money market: prices rise overtime

→ lowers real money supply \((M/p)\) and interest rate returns to original level.
"Time plot" of exchange rate:

\[ \text{Exchange rate overshooting} \]

exchange rate moves more in the short run than in the long run.

This behavior of exchange rate satisfies both PPP in the long run (\( E^{LR} \) higher in long run than \( E^{1/L} \)),

and also UIP (a dollar appreciates over time, to compensate for low \$ interest rate).
Things to understand about overshooting

1) how do our theories of UIP and PPP come into play?
2) what role does price stickiness play?

3) why do expected foreign returns cause shift in short run
4) and why stay shifted out in long run?
more time pbti.

\[ \frac{M}{P} \]

\[ \frac{M}{P} \]

\[ \frac{M}{P} \]
Fixed exchange rates

most common method of fixing an exchange rate:

- The central bank maintaining a commitment to always be willing to trade national currency for foreign currency with anyone at the official rate.

- This implies that it responds to excess supply of its currency in the foreign exchange market by buying domestic currency in exchange for foreign currency (raising the value of the domestic currency to equal the desired rate).

- Note: This requires the central bank to have holding of reserves of the foreign currency assets.
**Balance Sheet of Central Bank**

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign currency assets</td>
<td>Deposits held by private banks</td>
</tr>
<tr>
<td>kr 1000</td>
<td>kr 500</td>
</tr>
<tr>
<td>Domestic currency assets</td>
<td>Currency in circulation</td>
</tr>
<tr>
<td>kr 1500</td>
<td>kr 2000</td>
</tr>
<tr>
<td>kr 1400 (7)</td>
<td>kr 19,00 (14)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
<tr>
<td>kr 2500</td>
<td></td>
</tr>
<tr>
<td>kr 2400 (14)</td>
<td></td>
</tr>
</tbody>
</table>

Open market operation (monetary policy)

Suppose the central bank wants to reduce the money supply in circulation.

Sale of domestic assets in the domestic money market, where the buyers pay with domestic currency.

As the central bank takes currency as payment, it implicitly is removing currency from circulation.
Foreign exchange intervention

Aimed at eliminating an excess demand for foreign currency assets, (to support a high value of our currency in the foreign exchange market)

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>foreign curr. assets kr 1,000</td>
<td>private bank deposits kr 500</td>
</tr>
<tr>
<td>domestic curr. assets kr 500</td>
<td>currency in circulation kr 2,000</td>
</tr>
</tbody>
</table>

Note: the foreign exchange intervention lowers the currency in circulation just like the open market operation. It reduces money supply just like monetary policy.

Lesson:
For a country to fix its exchange rate, it loses the ability to control its national monetary policy.
Another way to see this lesson

use VIP

\[ i_{KR} = i_e + \frac{E^e_kr/\epsilon - E_kr/\epsilon}{E_kr/\epsilon} \]

under a fixed exchange rate:

\[ E^e_kr/\epsilon = E_kr/\epsilon \]

so VIP implies:

\[ i_{KR} = i_e + 0 \]

So if Denmark pegs its currency to the euro, its interest rate should be the same as the euro interest rate (if VIP holds).

This means Denmark cannot lower its interest rate with monetary policy expansion.
suppose a case where Denmark tried to expand its money supply and lower its interest rate... → Lower interest rate (\( \text{yr} \)) → pressure for value of krone to fall in value in the foreign exchange market (F) gives lower expected return than euro asset → traders see a profit opportunity; buy krone cheap in the private market and sell back to the central bank at the higher official rate.

This process will continue until all the excess supply of kroner is removed from the market.

This means all the kroner the central bank issued to raise the money supply will be taken back to the central bank by traders and removed from circulation.
A way to avoid this problem:

Capital controls

Some countries legally prevent traders from taking advantage of the arbitrage opportunities involving cross-border trade in assets (restricting "capital mobility").

We conclude that among the following three objectives:

1) Exchange rate stability
2) Monetary policy autonomy
3) Capital mobility

Only two are possible at one time, called the "trilemma problem."