The effect of monetary shocks

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Outline

- Monetary policy decisions
- Money market
- Goods market
- Equilibrium
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Changes in money supply

- Monetary policy decisions by the central bank encompass decisions on interest rates and money supply
- If money supply is increased, the price level should increase if the output is given
- From purchasing power parity, the exchange should adjust as well
- However, prices will generally not adjust quickly

Responses to changes in the money supply

- Changing the money supply changes price levels if there is full employment as output is given
- As prices only adjust slowly, the economy will not be in equilibrium immediately
- To ensure markets clear, other adjustments are needed
- The exchange rate is a variable that can adjust quickly

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Money demand

- Real money demand depends on the interest rate and output, with their respective elasticities
- $\frac{M}{P} = (1+r)^{\varepsilon_r} Y^{\varepsilon_Y}$
- Interest rate parity holds and the exchange rate change is the difference between domestic and foreign interest rates: $\Delta e = r - r^*$

$\Rightarrow$ $\ln M - \ln P = \varepsilon_r r + \varepsilon_Y \ln Y$

$\Rightarrow$ $\ln P - \ln M = \varepsilon_r (\Delta e + r^*) - \varepsilon_Y \ln Y$

Exchange rate change

- The equilibrium requires that exchange rates are stable, $\Delta e = 0$, at some price level $\overline{P}$
- The output we assume to be fixed due to full employment
- Money demand: $\ln \overline{P} - \ln M = \varepsilon_r r^* - \varepsilon_Y \ln Y$

$\Rightarrow$ $\ln P - \ln \overline{P} = \varepsilon_r \Delta e$

$\Rightarrow$ $\Delta e = \frac{\ln P - \ln \overline{P}}{\varepsilon_r}$

- The exchange rate decreases if the current prices are below their equilibrium level

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Demand in goods markets

- Demand depends on the relative prices of goods, output, and interest rates, with their respective elasticities
- $D = \left(\frac{eP^*}{P}\right)^{\hat{\varepsilon}_P} Y^{\hat{\varepsilon}_Y} \left(1+r\right)^{\hat{\varepsilon}_r}$

$\Rightarrow \ln D = \hat{\varepsilon}_P \left(\ln e - \ln P + \ln P^*\right) + \hat{\varepsilon}_Y \ln Y + \hat{\varepsilon}_r r$

- Prices adjust slowly to excess demand: $\Delta P = \lambda \left(\ln D - \ln Y\right)$
- For simplicity we normalise the foreign price level such that $\ln P^* = 0$

Inflation

- From the money demand we have $r = \frac{\ln P - \ln M + \varepsilon_Y \ln Y}{\varepsilon_r}$

$$\Rightarrow \Delta P = \lambda \left(\hat{\varepsilon}_P \left(\ln e - \ln P \right) - \frac{\hat{\varepsilon}_r}{\varepsilon_r} \left(\ln M - \ln P \right) + \left(\frac{\hat{\varepsilon}_r \varepsilon_Y}{\varepsilon_r} + \hat{\varepsilon}_Y - 1 \right) \ln Y \right)$$

- The equilibrium requires that prices are stable, $\Delta P = 0$, at some price level $\overline{P}$ and exchange rate $\overline{e}$

$$\Rightarrow 0 = \lambda \left(\hat{\varepsilon}_P \left(\ln \overline{e} - \ln \overline{P} \right) - \frac{\hat{\varepsilon}_r}{\varepsilon_r} \left(\ln M - \ln \overline{P} \right) + \left(\frac{\hat{\varepsilon}_r \varepsilon_Y}{\varepsilon_r} + \hat{\varepsilon}_Y - 1 \right) \ln Y \right)$$

$$\Rightarrow \Delta P = \lambda \hat{\varepsilon}_P \left(\ln e - \ln \overline{e} \right) + \lambda \left(\frac{\hat{\varepsilon}_r}{\varepsilon_r} - \hat{\varepsilon}_P \right) \left(\ln P - \ln \overline{P} \right)$$

- The price level increases if the current exchange rate is above the equilibrium and the price level is below its equilibrium

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Relationship between price level and exchange rate

- The equilibrium requires that prices are stable, $\Delta P = 0$, at some price level $\overline{P}$ and exchange rate $\overline{e}$
- In equilibrium, exchange rates are also stable, $\Delta e = 0$, and from interest rate parity we then have $r = r^*$

$\Rightarrow$ $\ln \overline{e} - \ln \overline{P} = \frac{-\hat{\varepsilon}_r r^* + (1 - \hat{\varepsilon}_Y) \ln Y}{\hat{\varepsilon}_P}$

- In equilibrium, there is a positive relationship between the price level and exchange rate

Out-of equilibrium dynamics

- The evolution of the exchange rate and price level is given by

  $\Delta e = \frac{\ln P - \ln \overline{P}}{\varepsilon_r}$

  $$\Delta P = \lambda \hat{\varepsilon}_P \left(\ln e - \ln \overline{e}\right) + \lambda \left(\frac{\hat{\varepsilon}_r}{\varepsilon_r} - \hat{\varepsilon}_P\right) \left(\ln P - \ln \overline{P}\right)$$

- These equations characterise the relationship between price levels and exchange rates outside of the equilibrium
- The solution shows that the equilibrium is only reached if

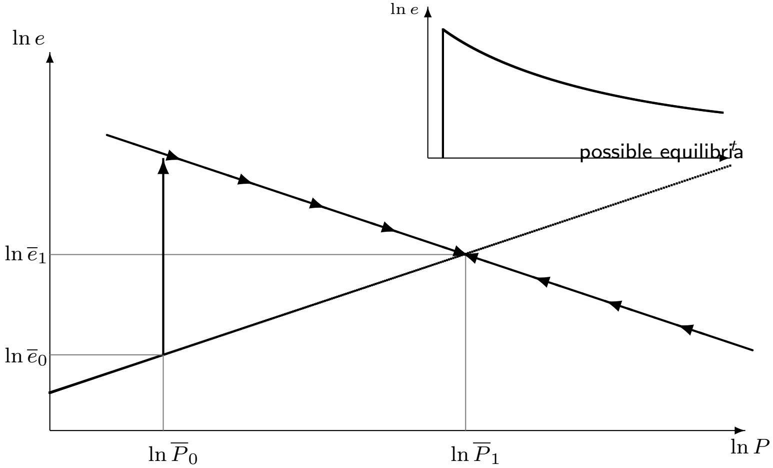
  $$\ln e - \ln \overline{e} = \frac{\xi + \lambda\left(\hat{\varepsilon}_P - \frac{\hat{\varepsilon}_r}{\varepsilon_r}\right)}{\hat{\varepsilon}_P} \left(\ln P - \ln \overline{P}\right) \ln e - \ln \overline{e} = \underbrace{\frac{\xi + \lambda\left(\hat{\varepsilon}_P - \frac{\hat{\varepsilon}_r}{\varepsilon_r}\right)}{\hat{\varepsilon}_P}}_{<0} \left(\ln P - \ln \overline{P}\right)$$

- The adjustment towards the equilibrium has a negative slope

Impact of monetary policy

- From the money demand we had $\ln \overline{P} - \ln M = \varepsilon_r r^* - \varepsilon_Y \ln Y$
- An increase in the money supply will increase the price level due to the output being given
- From the relationship of exchange rates and price levels in equilibrium, this implies a higher exchange rate

Reaction to an increase in money supply



Overshooting exchange rates

- The exchange rate will adjust quickly to its new equilibrium path
- As price levels adjust slowly, the exchange rate then adjusts slowly towards its equilibrium
- The exchange rate initially overshoots the equilibrium exchange rate and then slowly falls back
- We have this large change in the exchange rate to compensate for the lack of price adjustment
- Only once the prices adjust does the exchange rate fall back to its equilibrium value

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Sticky prices

- Price levels only adjust slowly to changes in the money supply
- Exchange rates will adjust instantaneously and put the economy on an equilibrium path
- The adjustment of the exchange rate is more than the new equilibrium requires
- As prices adjust slowly, the exchange rate also slowly adjusts towards its equilibrium

Exchange rates over-adjust

- In response to monetary policy exchange rates initially bear the full adjustments
- As the remainder of the economy adjusts, exchange rates slowly fall back
- This leads to a reversal of the initially excessive exchange rate movement

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