Monetarist/Neoclassical Long-Run

\[ W = P_0 \cdot g(N) \]
\[ W = P_1 \cdot f(N) \]
\[ Y = f(K,N) \]

\[ W = P_0 \cdot f(N) \]
\[ W = P_1 \cdot g(N) \]
\[ Y = f(K,N) \]
Extreme Keynesian Short-Run

\[ W = P_0 \cdot g(N) = P_1 \cdot g(N) \]

\[ W = P_1 \cdot f(N) \]

\[ W = P_0 \cdot f(N) \]

\[ y = f(K, N) \]

\[ Y = f(K, N) \]

\[ N \]

\[ N^0 \]

\[ N^1 \]

\[ W^0 \]

\[ W^1 \]
Short Run vs. Long Run
Monetary Model of Floating Rates

Assumptions:

1. Perfect foresight in labor markets, i.e. $P'(P) = 1$
Monetary Model of Floating Rates

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Definition

The equilibria in this economy is given by $(y, P)$ pairs such that $AS=AD$ and where $AD$ is given by $(y, P)$ pairs such that $M^s = kPy = kSP^*y$ or $S = \frac{M^s}{kP^*y}$
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Corollary

Assumptions 1 \( \rightarrow \) vertical AS, therefore \( \frac{\Delta M_s}{M_s} = \frac{\Delta P}{P} \)
Monetary Model of Floating Rates

\[ P = SP^* \]

under-competitive
\[ P > SP^* \]

over-competitive
\[ P < SP^* \]
Theorem

A given percentage increase in domestic \( M^s \) leads to a depreciation of the domestic currency at the same proportion.
Monetary Model of Floating Rates

Theorem

A given percentage increase in domestic $M^s$ leads to a depreciation of the domestic currency at the same proportion

Proof.

$M^s = kPy$, taking logs, $\ln M^s = \ln k + \ln P + \ln y$

taking derivatives: $\frac{dM^s}{M^s} = \frac{dP}{P} + \frac{dy}{y}$

but $\frac{dy}{y} = 0$ Since $Q = 1$, $P = SP^*$ and $\frac{dM^s}{M^s} = \frac{dS}{S} + \frac{dP^*}{P^*}$ and $\frac{dP^*}{P^*}$

= constant
An increase in $M^s$ creates excess demand but $y$ is fixed so $P \uparrow$. Since PPP holds $S \uparrow$. Inflation and Depreciation.
\( M^s = kPy \). Since \( M^s \) is constant \( P \downarrow \). If \( P \) were constant there will be an excess demand for money at \( b \). Since PPP holds, a decrease in domestic prices causes the currency to appreciate. Deflation, Appreciation.
Two Country Model

- $M^s = kPy$ (home)
Two Country Model

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- $\frac{M^s}{M^{s*}} = \frac{kPy}{k^*P^*y^*}$
Two Country Model

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- Under PPP \( \frac{P}{P^*} = S \) therefore
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Under PPP \( \frac{P}{P^*} = S \) therefore
- \( \frac{M^s}{M^{s*}} = S \frac{ky}{k^* y^*} \)
Two Country Model

- \( M^s = kPy \) (home)
- \( M^{s*} = k^*P^*y^* \) (foreign)
- \( \frac{M^s}{M^{s*}} = \frac{kPy}{k^*P^*y^*} \)
- Under PPP, \( \frac{P}{P^*} = S \) therefore

- \( \frac{M^s}{M^{s*}} = S \frac{ky}{k^*y^*} \)

- \( S = \left( \frac{k^*y^*}{ky} \right) \left( \frac{M^s}{M^{s*}} \right) \)

relative real money demand, relative money supply
Monetary Model of Fixed Rates

Assumptions:

1. \( y, P^* \) given
Assumptions:

1. $y, P^*$ given

2. Under fixed rates money supply is endogenous and since rates are fixed, given $\Delta M^s = \Delta FX + \Delta DC$, the only policy variable is $DC$. The adjustments are through changes in $FX$. 


Assumptions:

1. $y, P^*$ given

2. Under fixed rates money supply is endogenous and since rates are fixed, given $\Delta M^s = \Delta FX + \Delta DC$, the only policy variable is $DC$. The adjustments are through changes in $FX$.

3. $\bar{S}$ is fixed by authorities.
An increase in DC will increase $M^s$ (and $P$ as a result of excess money supply), rendering domestic economy uncompetitive. There is a BOP deficit at A and reserves fall. As a result $M^s$ will decrease to its original level and so is $P$. 

\[ P_0 < 0 \]
Increase in Money Supply

- Demand: $M^d = kPy = k \bar{S} \bar{P}^* \bar{y}$
Increase in Money Supply

- **Demand:** \( M^d = kPy = k \bar{S} \bar{P}^* \bar{y} \)
- **Supply:** \( M^s = FX + DC \)
Increase in Money Supply

- Demand: \( M^d = kPy = k \bar{S} \bar{P}^* \bar{y} \)
- Supply: \( M^s = FX + DC \)
- Equilibrium: \( k \bar{S} \bar{P}^* \bar{y} = FX + DC \)
Increase in Money Supply

- Demand: \( M^d = kP_y = k \bar{S} \bar{P}^*y \)
- Supply: \( M^s = FX + DC \)
- Equilibrium: \( k \bar{S} \bar{P}^*y = FX + DC \)
- \( FX = k \bar{S} \bar{P}^*y - DC \)
Increase in Money Supply

- Demand: $M^d = kP_y = k \overline{S} \overline{P^*y}$
- Supply: $M^s = FX + DC$
- Equilibrium: $k \overline{S} \overline{P^*y} = FX + DC$
- $FX = k \overline{S} \overline{P^*y} - DC$

**Theorem**

*Under fixed exchange rates changes in domestic credit are neutralized by changes in reserves. Any change in domestic credit will change the composition of money supply.*
The above mechanism is an auto-stabilization, because reserves act as a buffer to equilibrium distortions.
Increase in Money Supply

- The above mechanism is an auto-stabilization, because reserves act as a buffer to equilibrium distortions.
- Suppose the authorities insist on increasing in $M^s$. They can do so by further increasing $DC$, to offset the effect of the decline in reserves:
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Suppose the authorities insist on increasing in $M^s$. They can do so by further increasing $DC$, to offset the effect of the decline in reserves:

**Definition**

**Sterilization** is neutralizing the effects of BOP deficit(surplus) by creating (cancelling) extra domestic credit to offset the decrease(increase) in foreign reserves.
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**Definition**

**Sterilization** is neutralizing the effects of BOP deficit(surplus) by creating (cancelling) extra domestic credit to offset the decrease(increase) in foreign reserves.

Q: Can sterilization work under fixed rate systems?
Domestic Income and Foreign Price Increase

Theorem

*Under fixed rates, an increase in real income will increase reserves. Prices will return to PPP levels.*
Domestic Income and Foreign Price Increase

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Theorem

Under fixed rates, an increase in foreign prices will increase reserves. Prices will increase. A small open economy will import foreign inflation under this scenario.
Mundell-Fleming Model Assumptions

- AS is flat. Prices are fixed:
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  - Only $y$ adjusts. Since prices are fixed $Q \sim S$
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Capital mobility is less than perfect:

- $r \neq r^*$ in SR
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- $m(y, r) = ky - lr$ ($\neq kPy$)
- Exchange Rate expectations are static
- Capital mobility is less than perfect:
  - $r \neq r^*$ in SR
  - Non-zero Capital Account Balance: $K(r) = k(r - r^*)$ with $K' \geq 0$, $r^*$ exogenously given.
Define the BOP eq as: \( F(S, y, r) = B(S, y) + K(r) = 0 \)
Mundell-Fleming Model with Floating Rates

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Where

\[
\frac{\partial F(S,y,r)}{\partial S} > 0
\]
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- $\frac{\partial F(S, y, r)}{\partial S} > 0$
- $\frac{\partial F(S, y, r)}{\partial y} < 0$
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- $\frac{\partial F(S, y, r)}{\partial r} > 0$

Can express BOP equilibrium in: 

- $(S, r)$ or $(y, r)$ plane
BOP eq. in Mundell-Fleming Model

\[ r < S < S_{FF(y_0)} \]

\[ r < S < S_{FF(y_1 > y_0)} \]

\[ r < S < S_{BP(S_0)} \]

\[ r < S < S_{BP(S_1 > S_0)} \]

\[ y_0 < y < y_{BP(S_0)} \]

\[ y_0 < y < y_{BP(S_1 > S_0)} \]

OR
Summary of Mundell-Fleming Assumptions

- An increase in $S$
Summary of Mundell-Fleming Assumptions

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  - IS shifts right, BP shifts right, FF does not shift,
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If capital is perfectly mobile, BP and FF curves are flat.
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Summary of Mundell-Fleming Assumptions

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Mundell-Fleming Model

\[ \text{IS}(S_0) \]
\[ \text{LM}(M_0) \]
\[ \text{BP}(S_0) \]

CA Eq: \( B(y, s) = 0 \)

45° line

Ozan Hatipoglu (Bogazici Economics)
Open Economy Macroeconomics
Spring 2015 20 / 72
Increase in Money Supply (with floating rates)
Increase in Money Supply (with floating rates)

\[ r \rightarrow S \]

- Increase in Money Supply (with floating rates)

- IS(S₀)
- IS(S₁)
- LM(M₀)
- LM(M₁)
- BP(S₀)
- BP(S₁)

- CA Eq: B(y, s) = 0

- 45° line
An increase in $M_s$
An increase in $M_s$

- LM shifts right, since AS is flat, real income $y \uparrow$. To have money market eq. $r$ has to come down.
An increase in $M_s$

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- As a result: $y \uparrow, r \downarrow \Rightarrow F(S, y, r) < 0$ because $K(r)\downarrow$ (capital account deficit) and $B(S, y)\downarrow$. (current account deficit).
Summary of Monetary Policy Intermediate Effects

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  - To retain BOP eq. $S \uparrow$
  - If $S \uparrow$ then $S(y, r) - I(r) < (G - T) + B(S, y)$ So IS shifts right such that $r \uparrow$ to bring the capital account deficit down.
An increase in $M_s$

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- To retain BOP eq. $S \uparrow$
- If $S \uparrow$ then $S(y, r) - I(r) < (G - T) + B(S, y)$ So IS shifts right such that $r \uparrow$ to bring the capital account deficit down.
- The adjustment through the goods market prevents a steep decrease in $r$ (i.e. $r \rightarrow r_2$ and $r_2 > r_1$)
Summary of Monetary Policy Final Effects

- An increase in $M_s$
Summary of Monetary Policy Final Effects

- An increase in $M_s$
  - a depreciation of the currency
Summary of Monetary Policy Final Effects

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  - increase in real income
Summary of Monetary Policy Final Effects

- An increase in $M_s$
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  - increase in real income
  - decrease in domestic interest rates assuming capital is not perfectly mobile

How about the effects of monetary policy if there is perfect capital mobility?
An increase in $M_s$

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- increase in real income
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- improvement in current account and a deterioration in capital account, no effect on BOP eq.
Summary of Monetary Policy Final Effects

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- How about the effects of monetary policy if there is perfect capital mobility?
Fiscal Expansion with floating rates

\[ r = S_F(y_0) \]

\[ S = IS(S_0) \]

\[ L = LM(M_0) \]

\[ r \]

\[ y \]

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\[ \text{CA Eq: } B(y,s) = 0 \]

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Fiscal Expansion with floating rates

\[ S(y_0) \]

\[ IS(G_0, S_0) \]

\[ LM(M_0) \]

\[ B(y, s) = 0 \]

\[ 45^0 \text{ line} \]

\[ 45^0 \text{ line} \]

\[ IS(G_1, S_0) \]

\[ LM(M_0) \]

\[ IS(G_0, S_0) \]

\[ BP(S_0) \]

\[ IS(G_0, S_0) \]

\[ IS(G_1, S_0) \]

\[ LM(M_0) \]

\[ IS(G_0, S_0) \]

\[ BP(S_0) \]
Fiscal Expansion with floating rates

\[ r_0 \cdot A \cdot y_0 \cdot IS(G_0, S_0) \]

\[ LM(M_0) \]

\[ S_0 \cdot S \cdot FF(y_0) \]

\[ B(y_0, s) = 0 \]

\[ IS(G_1, S_0) \]

\[ IS(G_1, S_1) \]

\[ IS(G_0, S_0) \]

\[ BP(S_0) \]

\[ BP(S_1) \]

\[ 45^\circ \text{ line} \]
An increase in $G$
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- IS shifts right, since AS is flat, real income $y \uparrow$. To have money market eq. $r$ has to increase since money supply is fixed. $r$ has to increase due to higher equilibrium borrowing requirement of the government.
Summary of Fiscal Policy Intermediate Effects

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  - As a result: $y \uparrow, r \uparrow \Rightarrow$ A capital account surplus ($K(r) \uparrow$) and a current account deficit ($B(S, y) \downarrow$). Since funds flows much faster than goods and services it must be the case that $K(r)$ dominates $B(S, y), K(r_1) > B(S, y_1)$ such that $F(S, y, r) > 0$
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- The adjustment through the goods market prevents a steep increase in $r$ (i.e. $r \rightarrow r_2$ and $r_2 < r_1$)
Summary of Fiscal Policy Final Effects

- An increase in $G$
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- An increase in $G$
  - an appreciation of the currency
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- How about the effects of fiscal policy if there is perfect capital mobility?
Mundell-Fleming: Increase in Money Supply (with fixed rates)
$M_s \uparrow$: In SR a fall in $r$ and an increase in real income, $y$. Since $F(r) < 0$ and $B(S, y) < 0$ there is a BOP deficit.
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Since $S$ is fixed the CB has to sell $FX$ to counter the flight from domestic currency. And LM shifts back. Decrease in $FX$, no change in $r, y$ or $S$. 
Fiscal Expansion with fixed rates

\[ r = SFF(y_0) \]

\[ IS(S_0) \]

\[ LM(M_0) \]

\[ BP(S_0) \]

CA Eq: \[ B(y, s) = 0 \]

45° line

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Fiscal Expansion with fixed rates

\[ S \]

\[ IS(G_0) \]

\[ LM(DC_0, FX_0) \]

\[ CA \ Eq: \ B(y,s) = 0 \]

\[ r \rightarrow \]

\[ r_0 \rightarrow \]

\[ r_1 \rightarrow \]

\[ y \rightarrow \]

\[ y_0 \rightarrow \]

\[ y_1 \rightarrow \]

\[ 45^\circ \ line \]

\[ 45^\circ \ line \]

\[ IS(G_1) \]

\[ IS(G_0) \]

\[ BP(S_0) \]

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Fiscal Expansion with fixed rates

\[ S = 0 \]

\[ IS(G_0) \]

\[ LM(DC_0, FX_0) \]

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Summary of Fiscal Policy Effects

- $G \uparrow$: an increase in $r$ and an increase in real income, $y$. $F(r) > 0$ and $B(S, y) < 0$. In SR capital account dominates current account and there is a BOP surplus.
Summary of Fiscal Policy Effects

- $G \uparrow$: an increase in $r$ and an increase in real income, $y$. $F(r) > 0$ and $B(S, y) < 0$. In SR capital account dominates current account and there is a BOP surplus.

- Since $S$ is fixed the CB has to buy $FX$ to counter the effects of hot money inflows. (i.e. to prevent appreciation) And LM shifts right (Increase in $FX$) $r$ decreases and $y$ increases even further deteriorating CA deficit even more.
Summary of Fiscal Policy Effects

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- Higher $r$, higher $y$, BOP eq, significant $CA$ deficit.
Impulse Response Functions (M-F model: Mont. Policy with floating Rates)
Dornbusch Model

- Some weaknesses of preceding models:
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- Monetary Model: exchange rates are far more volatile than monetary variables (and prices) than implied by data.
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- Short run properties of Keynesian models
Dornbusch Model

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- Dornbusch (1976) hybrid:
  - Short run properties of Keynesian models
  - Long run properties of Monetary Model
Empirical observation: financial markets adjust to shocks far more rapidly than goods markets
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Consequence for the model: in the short run, financial markets have to overadjust in order to compensate for sluggish goods markets (OVERSHOOTING).
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With prices fixed in the short run, any change in the nominal money supply changes real balances, requiring the interest rate to adjust to clear the money market (Liquidity Effect).
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With prices fixed in the short run, any change in the nominal money supply changes real balances, requiring the interest rate to adjust to clear the money market (Liquidity Effect).

In the long run, prices adjust fully, returning all real variables to their pre-shock levels, but leaving the nominal exchange rate at the new equilibrium level predicted by the simple Monetary Model
Small open economy (so $P^*$, $r^*$ exogenous)
Dornbusch Model Assumptions

1. Small open economy (so $P^*$, $r^*$ exogenous)

2. Initially, equilibrium inflation and exchange rate depreciation zero and aggregate demand is determined by the standard open economy IS-LM mechanism.
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Theorem

Investors’ exchange rate expectations formed adaptively i.e. by $\Delta S^e_t = \theta(\bar{S} - S_t)$ where $\theta > 0$ is the sensitivity of market expectations to over- or undervaluation of currency from equilibrium level, $\bar{S}$, therefore UIRP can be written as $r = r^* + \theta(\bar{S} - S_t)$
If $S_t > \bar{S}$ then $\Delta S_t^e < 0$ and if $S_t < \bar{S}$ then $\Delta S_t^e > 0$
Dornbusch Model

\[ IS(G_0, Q_0) \]

\[ AS(LR) \]

\[ AS(SR) \]

\[ LM(M^0 / P^0) \]
Dornbusch Model: Monetary Expansion

\[
\bar{Q}_0 = \frac{SP_0^*}{P}
\]

\[
RP(\bar{S}^0)
\]

\[
RP(\bar{S}^1)
\]

\[
LM \left( \frac{M_0}{P_0} \right)
\]

\[
LM \left( \frac{M_1}{P_0} \right)
\]

\[
IS(G_0, Q_0)
\]

\[
IS(G_0, Q_0)
\]

\[
AS(LR)
\]

\[
45^\circ \text{ line}
\]

\[
AS(SR)
\]

\[
AD(G_0, M_0, S_1 P_0^*)
\]

\[
AD(G_0, M_0, S_{\text{bar}, 0} P_0^*)
\]

\[
AD(G_0, M_0, S_{\text{bar}, 1} P_0^*)
\]
Long Run effects:

- In LR, the AS curve is vertical, meaning there is no change in real income $y_0$ and prices $P$, such that to accommodate the increase in the money supply, an increase in money demand is required to match the increase in money supply. In the goods market, an increase in interest rates $r$ starting from the initial lower rates that result from an increase in $M_s$.

- In LR, PPP holds, i.e., $Q = S/P$, since prices are higher in the long run. The RP curve shifts right.

- We have current account equilibrium due to instantaneous adjustment of CPA and PPP.

- IS and LM are in their original positions.
Long Run effects:

- AS is vertical which means that in LR there is no change in eq. real income $y_0$ and $P \uparrow$ such that to accommodate the increase in money supply such that we have eq in both money (an increase in money demand to match the increase in money supply) and goods markets (an increase in interest rates $r$ starting from the initial lower rates that result from an increase in $M_s$).

In LR PPP holds, i.e. $Q = S/P^*$, since prices are higher therefore $S \uparrow$ in the long run.
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- In LR PPP holds, i.e. $Q = \overline{S}P^*/P$, since prices are higher therefore $\overline{S}$ ↑ in the long run. $RP$ curve shifts right.
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- We have current account equilibrium due to instantaneous adjustment of $CPA$ and $PPP$.
- $IS$ and $LM$ are in original positions.
Impact Effects:

Starting from \( r = r^* + \theta (S_0 - S_t) \), \( r \) ↓, \( r_0 \to r_1 \) where \( r_1 < r^* + \theta (S_1 - S_t) \).

And due to LR effects on prices we have \( S \) ↑, \( S_0 \to S_1 \) where \( S_1 > S_0 \).

As a result \( r_1 < r^* + \theta (S_1 - S_t) \).

It must be the case that current exchange rate \( S_t > S_1 \), to have interest rate parity equilibrium immediately. e. even higher than the long-run depreciated rate. This is called overshooting. It results in over-competitiveness at least in SR.

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- $r \downarrow$ (liquidity effect)
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- LM and IS shifts right.
Adjustment Effects:

- Prices start to increase as workers adjust their expectations. Inflation starts to shift LM back. At the same time, because of inflation, the real exchange falls, which starts to shift the IS curve back.
- As real money stock falls, interest rates rise, reducing the money demand, which leads to an appreciation of the domestic currency up to the new eq $S_1$.
- As $S_\downarrow$, IS shifts further back, AD shifts back but still to the right of the original.
- Real income back to its original level, $y_0$, but prices remain higher.
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\[ \bar{Q}_0 = SP^*_0 / P \]
How do people diversify their portfolios?
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Risk aversion: How do people choose between two assets with different returns and risks.
Portfolio Balance Model: Assumptions

- How do people diversify their portfolios?
- Risk aversion: How do people choose between two assets with different returns and risks.
- With utility maximization investors diversify their holdings of risk assets.
Demand for money generalised to demand for assets i.e. proportions of wealth allocated to three markets
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- Money market \( M/W \)

- Domestic currency bonds market \( B/W \)

- Foreign currency bonds market \( SF/W \)
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  - Money market \( M/W \)
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- Risk aversion

- Investors diversify their holdings of risk assets. Portfolio share of a particular asset will increase as its return relative to competing assets increase.
Portfolio Balance Model: Assumptions

- Imperfect capital mobility (as in M-F), so risk aversion prevents UIRP

Current account surplus/deficit $\rightarrow$ capital in/outflow $+$ increasing/decreasing stock of FX assets $+$ changing equilibrium wealth allocation
- Imperfect capital mobility (as in M-F), so risk aversion prevents UIRP
- Sticky prices (as in Dornbusch), so balance of payments in temporary disequilibrium

Current account surplus/deficit → capital in/outflow + increasing/decreasing stock of FX assets + changing equilibrium wealth allocation
Portfolio Balance Model: Assumptions

- $M, B$ are exogenous (issued by domestic government)

- $r, S$ are endogenous (determined within the model in the SR)

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Domestic investors hold foreign assets, but not vice versa i.e. foreigners hold no domestic assets.
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Portfolio Balance Model: Assumptions

- Domestic investors hold foreign assets, but not vice versa i.e. foreigners hold no domestic assets.
- Other forms of wealth (e.g. equity, human capital) can be ignored: all wealth is allocated to money, domestic or foreign bonds.
- Bonds short term – so capital gains/losses resulting from interest rate changes are negligible.
Risk averse agents will take account of both risk and return, diversifying their asset portfolio to attain best (i.e utility-maximising) risk-return combination.
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Equilibrium in asset markets involves different (expected) rates of return to compensate for risk differences between assets.
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- Equilibrium in asset markets involves different (expected) rates of return to compensate for risk differences between assets.
- Given risks associated with each asset class, small increase in return on asset $j$ (relative to competing assets) increases demand for $j$. 
Risk averse agents will take account of both risk and return, diversifying their asset portfolio to attain best (i.e. utility-maximising) risk-return combination.

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Given wealth is fixed in short run, increase in demand for $j$ implies fall in demand for other assets ceteris paribus.
The nominal wealth, $W$, can be written as $W = \bar{M} + \bar{B} + SF$ where bars denote exogenous variables.
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- $\frac{\bar{M}}{W} = m(r, \bar{r}^* + \Delta s^e)$, $m_1 < 0$, $m_2 < 0$, $b_1 + b_2 > 0$, $f_1 + f_2 > 0$ (own return effects dominate cross return effects)

In SR, $W$ is constant $\rightarrow m_1 + b_1 + f_1 = 0$ and $m_2 + b_2 + f_2 = 0$
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- $\frac{\bar{B}}{W} = b(r, r^* + \Delta s^e)$, $b_1 > 0, b_2 < 0$, (own return effects dominate cross return effects)

In SR, $W$ is constant $\rightarrow m_1 + b_1 + f_1 = 0$ and $m_2 + b_2 + f_2 = 0$.
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- $\frac{SF}{W} = f(r, \bar{r}^* + \Delta s^e), \; f_1 < 0, f_2 > 0$. 

In SR, $W$ is constant $\Rightarrow m_1 + b_1 + f_1 = 0$ and $m_2 + b_2 + f_2 = 0$. 

(Own return effects dominate cross return effects)
The nominal wealth, $W$, can be written as $W = \bar{M} + \bar{B} + SF$ where bars denote exogenous variables.

Equilibrium in each market is defined as follows:

- $\frac{\bar{M}}{W} = m(r, \bar{r}^* + \Delta s^e)$, $m_1 < 0, m_2 < 0$,
- $\frac{\bar{B}}{W} = b(r, \bar{r}^* + \Delta s^e)$, $b_1 > 0, b_2 < 0$,
- $\frac{SF}{W} = f(r, \bar{r}^* + \Delta s^e)$, $f_1 < 0, f_2 > 0$,
- $b_1 + b_2 > 0, f_1 + f_2 > 0$, (own return effects dominate cross return effects)
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In SR, $W$ is constant $\rightarrow m_1 + b_1 + f_1 = 0$ and $m_2 + b_2 + f_2 = 0$
Buy domestic bonds → excess supply of money and excess demand for bonds. Price of bonds ↑ and rates ↓. Foreign assets become more attractive: $S \uparrow$. How about open market purchase of foreign bonds? How about an increase in the stock of FX assets?
Portfolio Balance Model: Long Run Effects

- Similar to monetary model

i.e. rate of inflation = percentage change in money supply but rate of depreciation < percentage change in money supply. Why?

Impact effect: $S \uparrow$ but prices are constant in SR. Therefore there is real depreciation and current account surplus. A rising foreign currency stock implies appreciation. And in the adjustment phase prices increase reducing competitiveness, but CA surplus remains until long run.
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Portfolio Balance Model: Microfoundations

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Determinants of Risk Premium

- Risk premium exist if
Determinants of Risk Premium

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Determinants of Risk Premium

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- Investors are risk averse

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**Definition**

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- Money is a low risk asset in the short run. The associated risks are:
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  - Price Risks (Market Risks)
A simple model

- Assume investor can invest in two assets: Money or bonds. Assume money is riskless and bonds are risky. Bonds pay a return of $i$ on the capital invested at the maturity. Let $\gamma$ be the share of the individual’s portfolio invested in bonds. Let $\pi$ be the capital gain (or loss), i.e. gain obtained by changes in the price of the bond. The rate of return, $r$ on the portfolio is given by

$$r = \gamma (i + \pi)$$

Assume $E(\pi) = 0$ then $E(r) = E(\gamma(i + \pi)) = \gamma E(i) = \gamma i$ because $i$ is fixed at the maturity.

The variance of the rate of return on bonds

$$\sigma_r^2 = \gamma^2 \sigma_\pi^2$$

because $r - E(r) = \gamma \pi$ and $(r - E(r))^2 = \gamma^2 \pi^2$.
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E(\gamma^2 \pi^2) = \gamma^2 E(\pi^2) = \gamma^2 \sigma_\pi^2
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or \( \sigma_r = \gamma \sigma_\pi \) Given the capital riskiness the higher you invest in bonds (higher \( \gamma \)) the higher the risk you are taking.
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- How do the individual determines $\gamma$ optimally? Assume the individual tries to maximize
- $U(r) = E(r) - 1/2\rho \text{var}(r)$ where $\rho$ is the relative risk aversion given the relative return-riskiness of asset, i.e. $E(r)/\sigma_r = \gamma i / \gamma \sigma_\pi = i / \sigma_\pi$
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- FOC: \( i - \rho \gamma \sigma_\pi^2 = 0 \quad \gamma = \frac{i}{\rho \sigma_\pi^2} \)
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- FOC: \( i - \rho \gamma \sigma^2_\pi = 0 \) \( \gamma = \frac{i}{\rho \sigma^2_\pi} \)

- \( E(r) = E(\gamma i) = \frac{i^2}{\rho \sigma^2_\pi} \)
A simple model: Domestic vs. foreign bonds.

\[ r = (1 - \gamma)(\pi + i) + \gamma(\pi^* + i^*) \]
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- \( r = (1 - \gamma)(\pi + i) + \gamma(\pi^* + i^*) \)
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- \( \text{var}(r) = \sigma_r^2 = E(r - E(r))^2 = (1 - \gamma)^2 \sigma_\pi^2 + \gamma^2 \sigma_{\pi^*}^2 + 2\gamma(1 - \gamma)\sigma_{\pi,\pi^*} \)

where \( \sigma_{\pi,\pi^*} = \text{covariance} \) between capital losses (gains) in domestic and foreign bonds.
A simple model: Domestic vs. foreign bonds.

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- \( E(r) = (1 - \gamma)i + \gamma i^* \)
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  where \( \sigma_{\pi,\pi^*} = covariance \) between capital losses (gains) in domestic and foreign bonds
- If \( \sigma_{\pi,\pi^*} < 0 \) Capital loss in one asset is offset by the other reducing overall risk.
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  where $\sigma_{\pi,\pi^*} = \text{covariance}$ between capital losses (gains) in domestic and foreign bonds
- If $\sigma_{\pi,\pi^*} < 0$ Capital loss in one asset is offset by the other reducing overall risk.
- If $\sigma_{\pi,\pi^*} > 0$ Capital loss in one asset is reinforced by the other
Empirical evidence $\sigma_{\pi,\pi^*}$ is lower than the covariance between domestic assets which implies that international diversification reduces the riskiness of portfolios.
Empirical evidence $\sigma_{\pi, \pi^*}$ is lower than the covariance between domestic assets which implies that international diversification reduces the riskiness of portfolios.

If $\sigma_{\pi}^2 = \sigma_{\pi^*}^2$, then $\sigma_r^2 = 2\gamma(1 - \gamma)\sigma_{\pi, \pi^*}$
Consider the following standard present value model with risk neutral agents:

\[
P_t = \frac{1}{1 + r_t} E_t(P_{t+1} + d_t)
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- \(P_t\): the real stock price at time \(t\)
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\[ P_t = \left( \frac{1}{1 + r_t} \right)^2 E_t(P_{t+2} + D_{t+1}) + \frac{1}{1 + r_t} D_t = \ldots = \sum_{i=0}^{\infty} \left( \frac{1}{1 + r_t} \right)^i E_t D_{t+i} + \lim_{i \to \infty} \left( \frac{1}{1 + r_t} \right)^i E_t(P_{t+i}) \]  

(1)

\[ \text{Fundamentals} \quad \uparrow \quad \text{Bubble} \]
Intrinsic Rational Bubbles

- If the transversality conditions hold, i.e. \( \lim_{i \to \infty} \left( \frac{1}{1+r_t} \right)^i E_t(P_{t+i}) = 0 \) or

  if \( E_t(P_{t+i})/P_t \leq 1 + r_t \) then \( P_t = \sum_{i=0}^{\infty} \left( \frac{1}{1+r_t} \right)^i E_tD_{t+i} \).
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- Uncertainty about fundamentals: \( \sum_{i=0}^{\infty} \left( \frac{1}{1+r_t} \right)^i E_tD_{t+i} \). Froot and Obstfeld (1991) assumption of a constant random walk with drift is shown to be invalid by Driffill and Sola (1998).
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Uncertainty about bubbles: Is \( \lim_{i \to \infty} \left( \frac{1}{1+r_t} \right)^i E_t(P_{t+i}) \) exogenous or intrinsic?
Intrinsic Rational Bubbles

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- For each time the hypothesis of bubbles is not rejected, there might be other fundamental processes that explain the price volatility.
Figure: Prices and bubble percentages: USA.
Figure: Prices and bubble percentages: Turkey.
Figure: Prices and bubble percentages: World.
Intrinsic Rational Bubbles

Figure: Crises in US.
Intrinsic Rational Bubbles

Figure: Crises in Turkey.