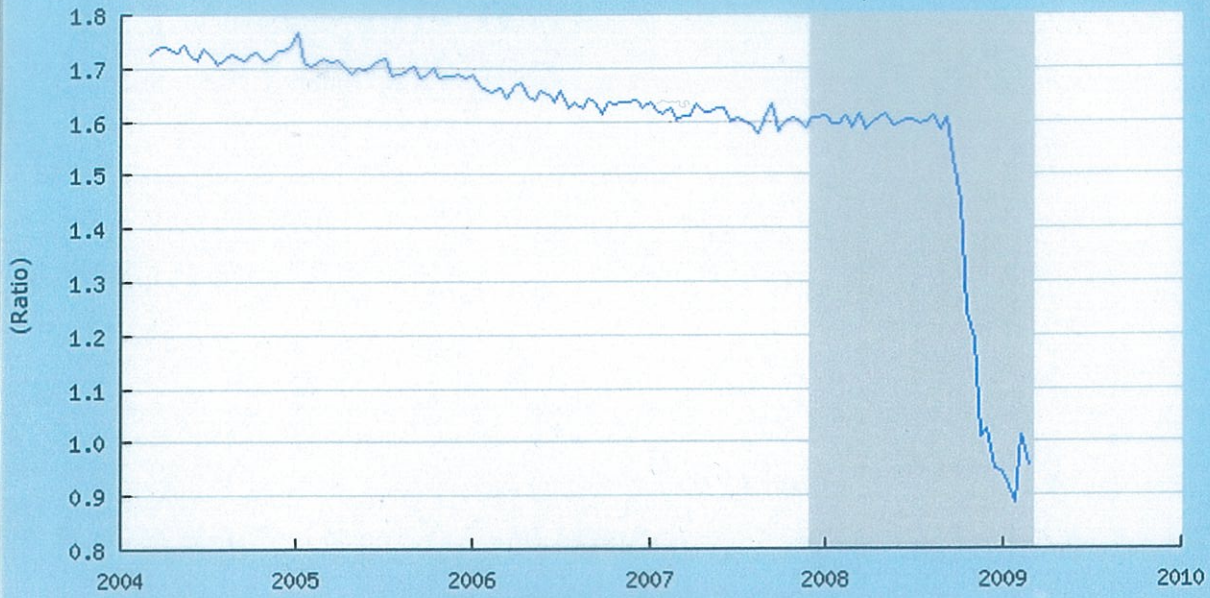


Topics for Today

- 1.) Trade in Goods + Assets
 - Nominal vs. Real Exchange Rates
 - Uncovered Interest Parity

- 2.) IS-LM in a Small Open Economy (The "Mundell-Fleming Model")
 - Real Exchange Rates + Net Exports
 - Monetary + Fiscal Policies with Flexible Exchange Rates
 - Monetary + Fiscal Policies with Fixed Exchange Rates

M1 Money Multiplier (MULT)
Source: Federal Reserve Bank of St. Louis



Shaded areas indicate US recessions.
2009 research.stlouisfed.org

- We are now going to extend the IS-LM model to an open economy, i.e., one that trades goods + assets with other countries.
- There are 2 key new variables:
 - 1.) The nominal exchange rate = The value of one currency in terms of another.

We will define the nominal exchange rate as the value of domestic currency

~~Domestic currency~~

$$e = \frac{\text{foreign currency}}{\text{domestic currency}}$$

Thus, $e \uparrow \Rightarrow$ domestic currency appreciates

$e \downarrow \Rightarrow$ domestic currency depreciates

2.) What matters for people's spending decisions is the real exchange rate, i.e., how many foreign goods can be acquired per unit of domestic goods?

$$\begin{aligned}\varepsilon = \text{Real Ex. Rate} &= \frac{eP}{P^*} \\ &= \frac{\text{for. curr.}}{\$} \times \frac{\$}{\text{dom. goods}} \\ &= \frac{\text{for. curr.}}{\text{for. goods}} \\ &= \frac{\text{foreign goods}}{\text{domestic goods}}\end{aligned}$$

$\varepsilon \uparrow \Rightarrow$ Real Ex. Rate Appreciation

$\varepsilon \downarrow \Rightarrow$ Real Ex. Rate Depreciation

The Foreign Exchange Market

The FX market is by far the world's largest financial market

On a typical day, roughly \$1.5-2.0 trillion changes hands

⇒ in less than a week FX transactions exceed the annual value of world trade.

The FX market is a decentralized multiple-dealer market. It never closes!

Most trading is between dealers (about 60-70%)

About $\frac{1}{2}$ of inter-dealer trades go through FX brokers.

Major Participants

- 1.) Commercial Banks
- 2.) Other financial institutions
- 3.) Corporations
- 4.) Central Banks

Leading Trading Centers

- 1.) London
- 2.) New York
- 3.) Tokyo
- 4.) Frankfurt, Hong Kong, Singapore

Major Instruments

- 1.) Spot (2 day settlement lag)
 - 2.) Forwards
 - 3.) Swaps
- } "over-the-counter" markets

Futures + options also exist, but they are less important

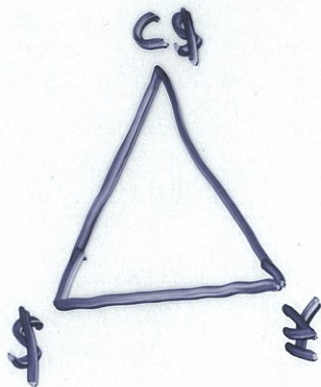
Most volume is in forwards + swaps (~60%)
with swaps being more important than forwards

Most fx trading takes place in and through the U.S. dollar.

Cross rates are determined by "triangular arbitrage"

$$\frac{C\$}{\text{¥}} = \frac{C\$}{\$} \cdot \frac{\$}{\text{¥}}$$

i.e.



The Demand for FX Assets

Like all assets, the demand for foreign currency-denominated assets depends on 3^o factors:

- 1.) Expected (real) returns
- 2.) Risk
- 3.) Liquidity

In turn, the expected dollar return on foreign currency assets depends itself on 2 factors:

- 1.) Their interest rate (or cash flows).
- 2.) Expected exchange rate changes

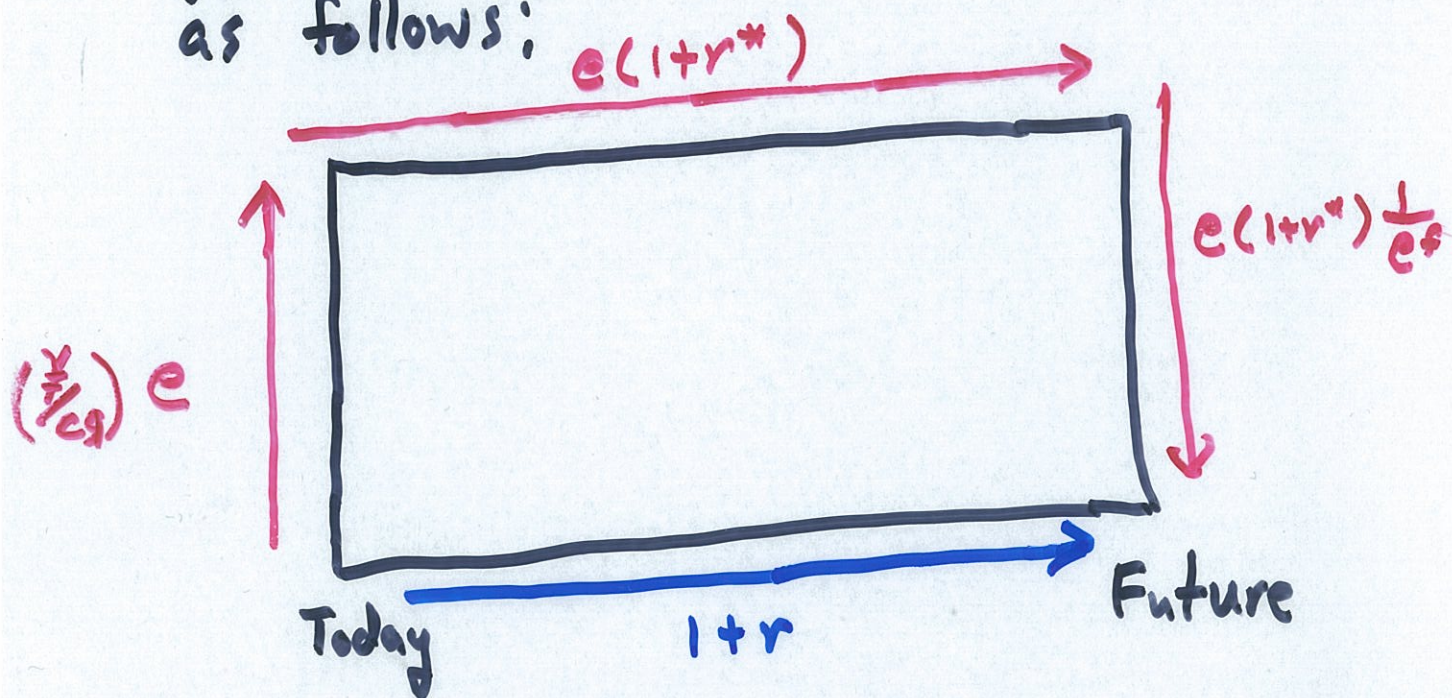
Note: When comparing real \$ returns on domestic and foreign assets, we can ignore inflation, since it is the same for both.

Uncovered Interest Parity

- In addition to trading goods, countries also exchange assets (borrow + lend).
- With open, integrated capital markets, assets denominated in different currencies must offer the same expected rate of return, when expressed in common currency units
- This equality is called "Uncovered Interest Parity". If r is the domestic interest rate and r^* is the foreign interest rate it says
$$r = r^* + (\text{expected rate of depreciation of the domestic currency})$$
- For example, if the domestic currency is expected to depreciate, then the only way you can get people to hold domestic assets is if they offer a higher interest rate
- Following the original Mundell-Fleming model, we will usually assume no expected change in the exchange rate, so $r = r^*$.

Uncovered Interest Parity

- Suppose you have some money to invest. You can either invest in Canada or Japan. Suppose all you care about is the expected rate of return.
- We can visualize the 2 investment strategies as follows:



- 1.) Invest in Canada and get $1+r$ per \$ invested
(r = Canadian interest rate)
- 2.) Convert C\$1.00 to e ¥ at spot exchange rate
 - Invest the ¥ and get $e(1+r^*)$ per ¥
 - Convert future ¥ back to C\$ at the expected spot exchange rate, e^f .

- Uncovered Interest Parity (UIP) just states that these 2 alternative investment strategies offer the same expected return.

$$1+r = e(1+r^*) \frac{1}{e^f}$$

Re-Arranging,

$$\frac{e^f - e}{e} = \frac{r^* - r}{1+r} \approx r^* - r$$

Or,

$$r = r^* - \frac{e^f - e}{e}$$

In words,

+ Expected Depreciation of C\$

Domestic Interest Rate

=

Foreign Interest Rate

-

Expected Appreciation of Domestic Currency

- If domestic currency expected to appreciate, then investors are willing to invest domestically even when interest rate is lower!

2 Key Ingredients of Mundell-Fleming Model

1.) Small Country + Capital Mobility

$$\Rightarrow r = r_w$$

If $r > r_w \Rightarrow$ Massive Capital Inflows

If $r < r_w \Rightarrow$ Massive Capital Outflows

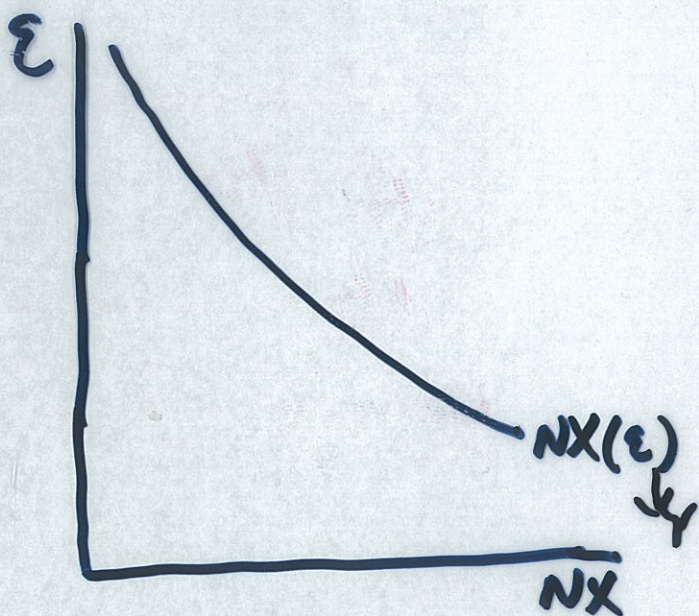
2.) Capital Inflows \Rightarrow Currency Appreciation
(with flexible exchange rates)

\Rightarrow Increase in Money Supply
(with fixed exchange rates)

Capital Outflows \Rightarrow Currency Depreciation
(with flexible exchange rates)

\Rightarrow Decrease in Money Supply
(with fixed exchange rates)

Open-Economy IS-LM (The Mundell-Fleming Model)



e = Nominal Exchange Rate
(Value of domestic Currency)

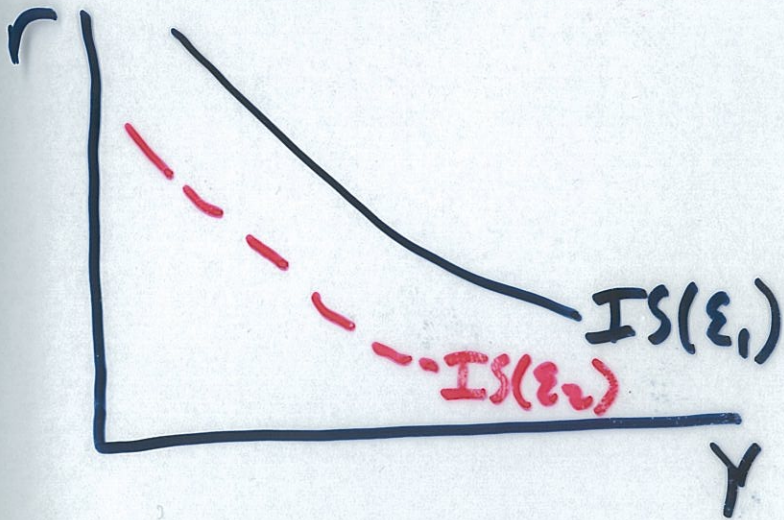
ε = Real Exchange Rate
= Foreign Goods per
domestic goods
= $\frac{eP}{P^*}$

In the short-run, with prices sticky,
 ε is proportional to e .

$$Y = C(Y-T) + I(r) + G + NX(\varepsilon)$$

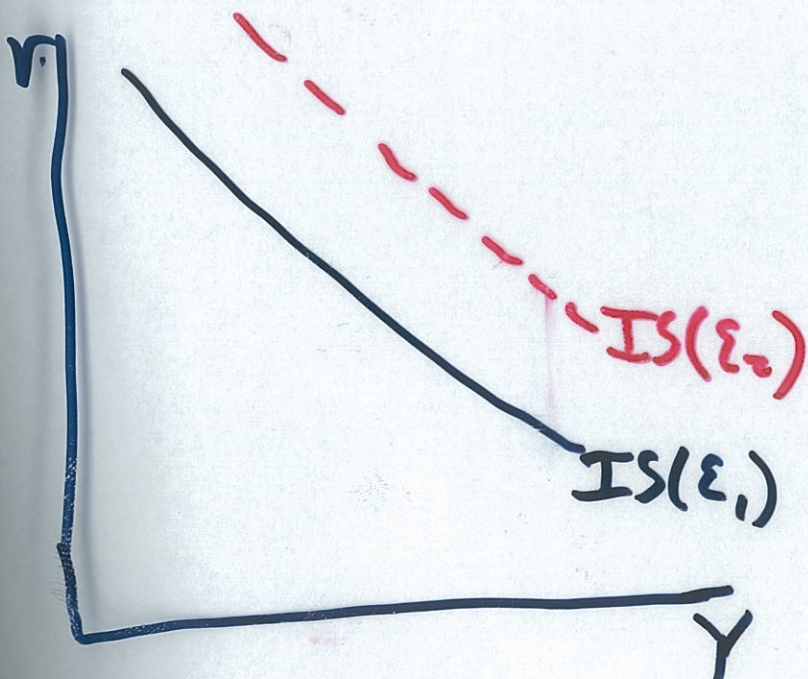
} Goods
Mkt.
Equil.

$\epsilon \uparrow \Rightarrow NX \downarrow \Rightarrow IS$ shifts left



$$\epsilon_2 > \epsilon_1$$

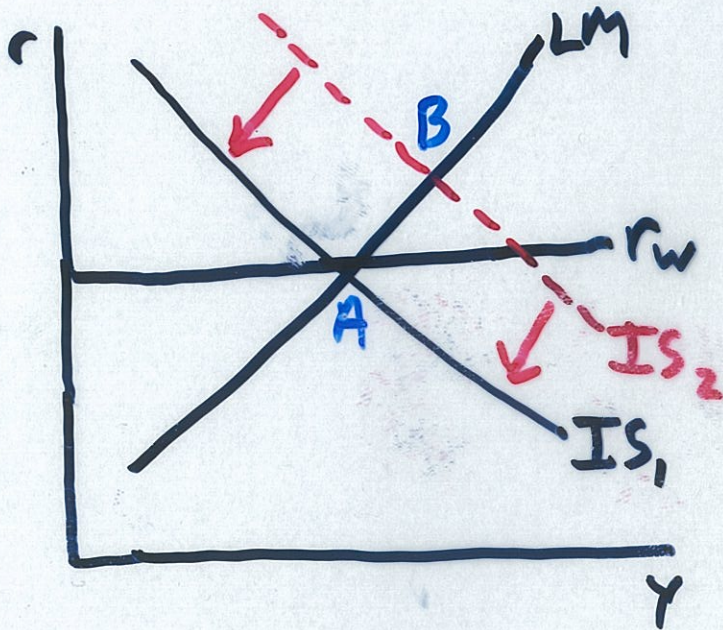
$\epsilon \downarrow \Rightarrow NX \uparrow \Rightarrow IS$ shifts right



$$\epsilon_2 < \epsilon_1$$

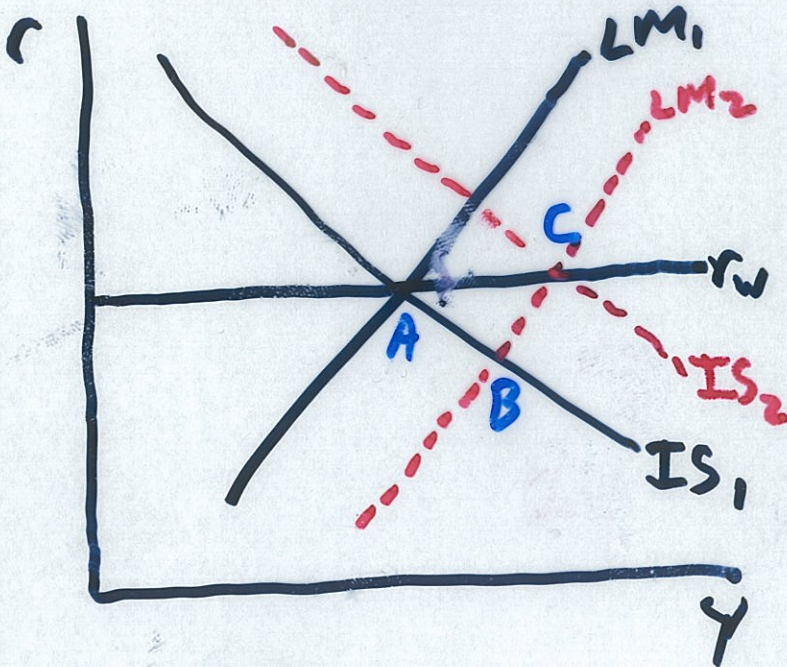
Flexible Exchange Rates

Fiscal Policy



- At B $r > r_w$
- \Rightarrow capital inflow
- \Rightarrow Currency Appreciation
- \Rightarrow $NX \downarrow$
- \Rightarrow IS shifts left
- \Rightarrow Return to A

Monetary Policy



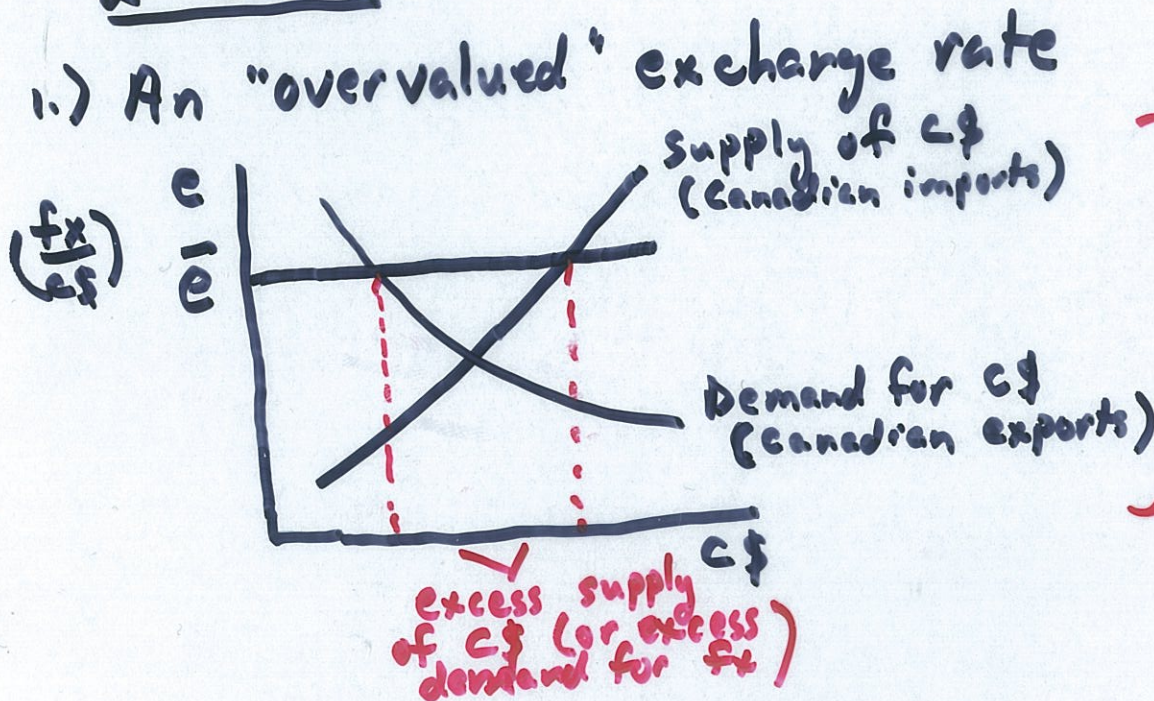
- At B $r < r_w$
- \Rightarrow capital outflow
- \Rightarrow Currency Depreciation
- \Rightarrow $NX \uparrow$
- \Rightarrow IS shifts right
- \Rightarrow Go to C

Fixing the Exchange Rate

- Fixing the exchange rate is essentially no different from fixing the price of milk or wheat. In general, the govt. must intervene in the fx market, since there is no guarantee the fixed rate clears the market.

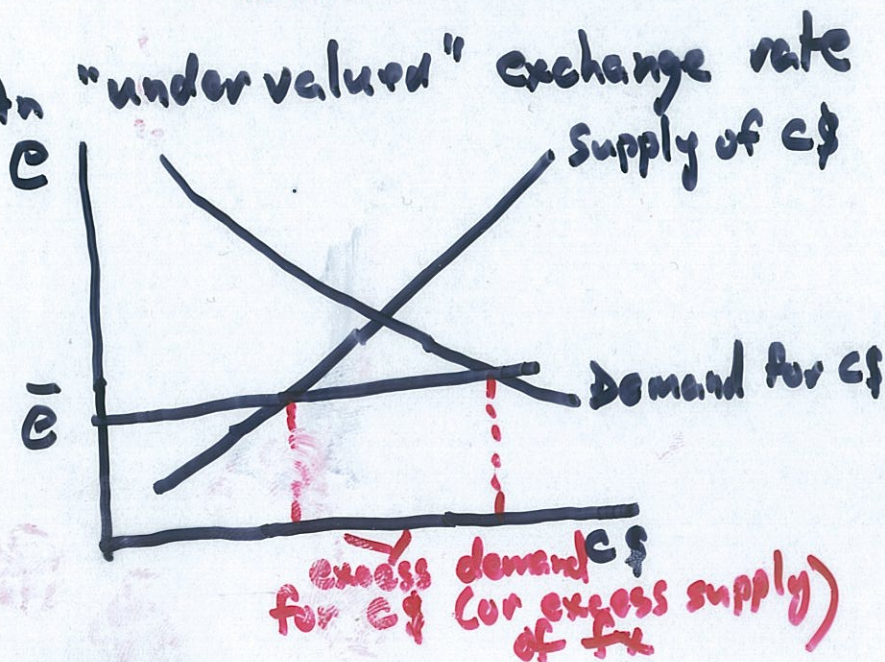
2 Cases

1.) An "overvalued" exchange rate



Govt. must buy €\$ using its fx reserves.

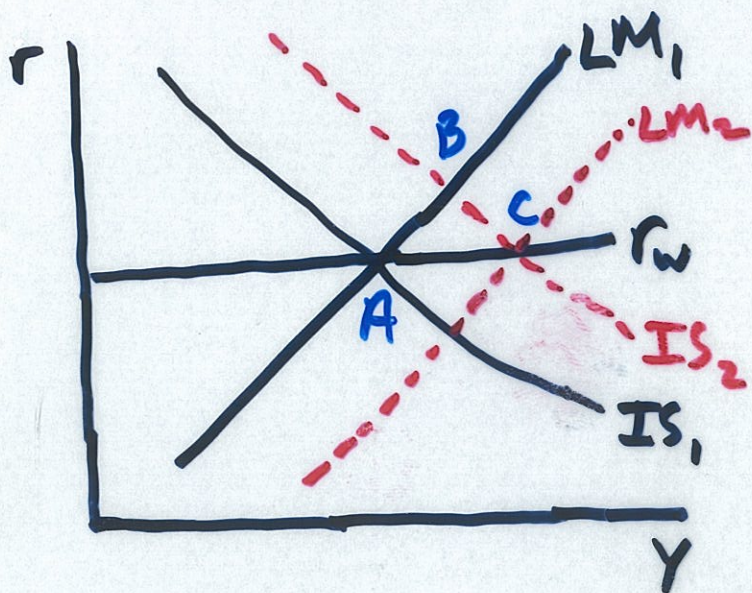
2.) An "undervalued" exchange rate



Govt. must buy fx using its own currency.

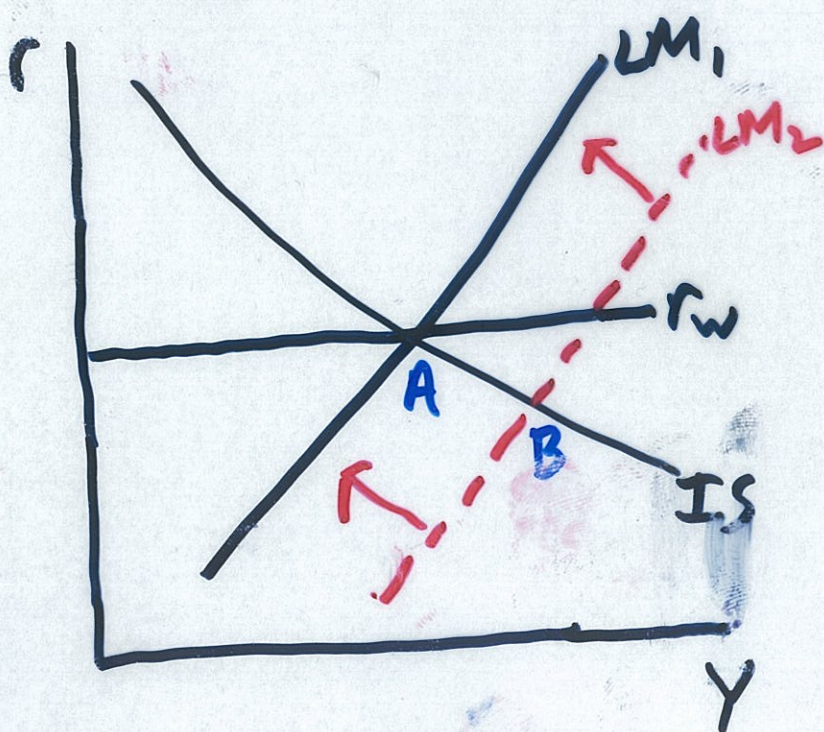
Fixed Exchange Rates

Fiscal Policy



- At B $r > r_w$
- \Rightarrow capital inflow
- \Rightarrow pressure for currency to appreciate
- \Rightarrow Central Bank increases the money supply (buys Foreign Exchange)
- \Rightarrow LM shifts right
- \Rightarrow Go to C

Monetary Policy



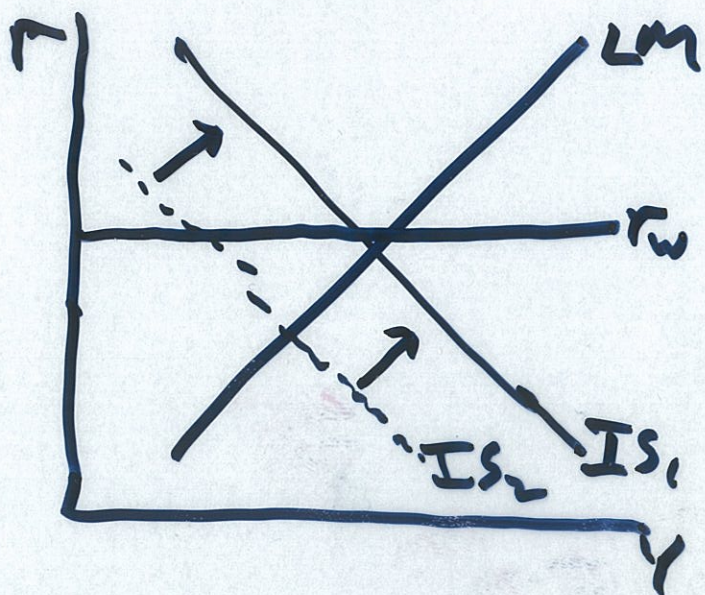
- At B $r < r_w$
- \Rightarrow Capital Outflow
- \Rightarrow Pressure for currency to depreciate
- \Rightarrow Central Bank Must decrease the Money Supply (Sell FX).
- \Rightarrow LM shifts left
- \Rightarrow Return to A

Summary

	Monetary	Fiscal
Flexible	Effective	Ineffective (crowds out NX)
Fixed	Ineffective (Monetary Policy must be used to fix the ex. rate)	Effective

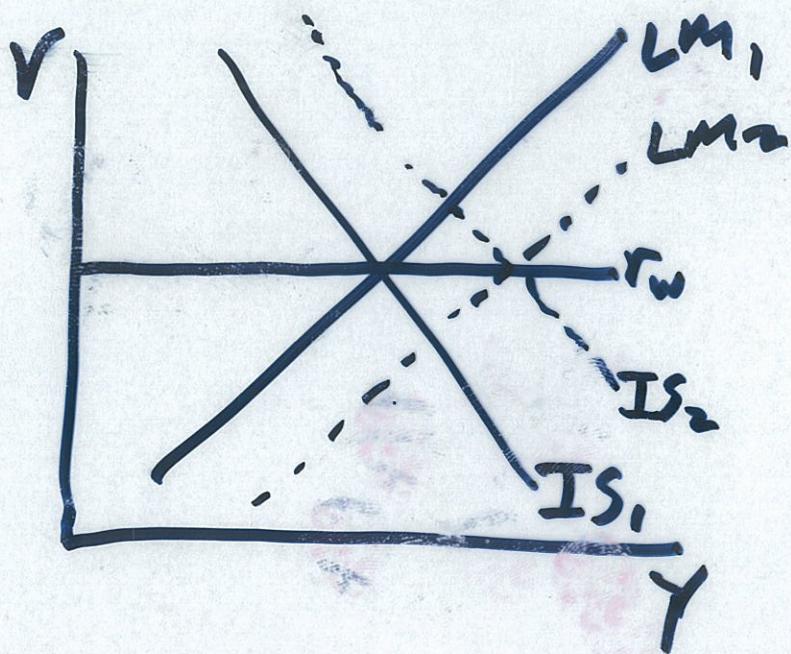
Flexible Ex. Rates

IS shocks



Flex. rates
insulates
economy from
IS shocks

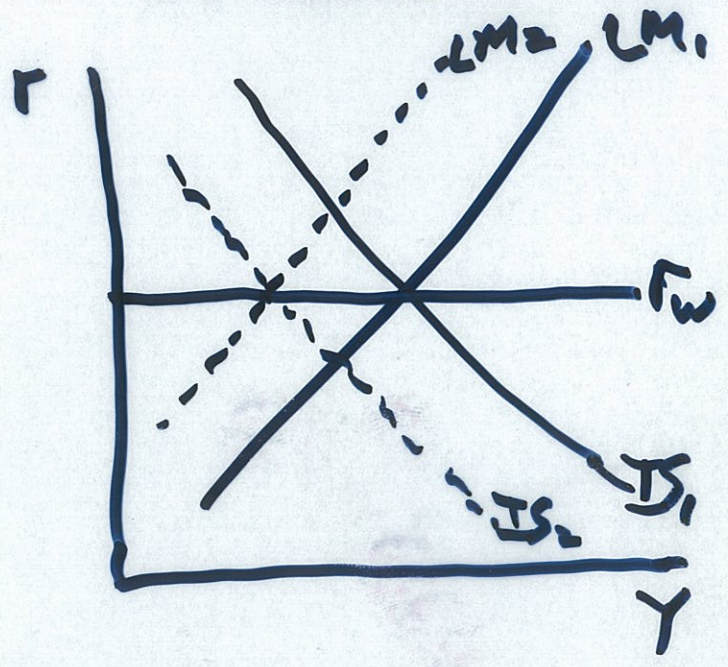
LM shocks



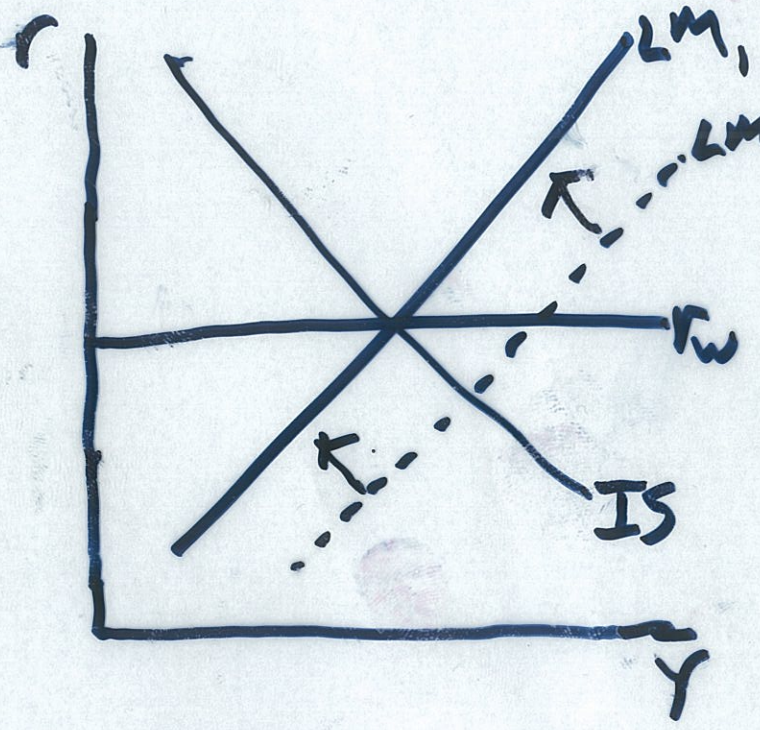
Flex. rates
accentuate
the economy's
response to
LM shocks

Fixed Ex. Rates

IS Shocks



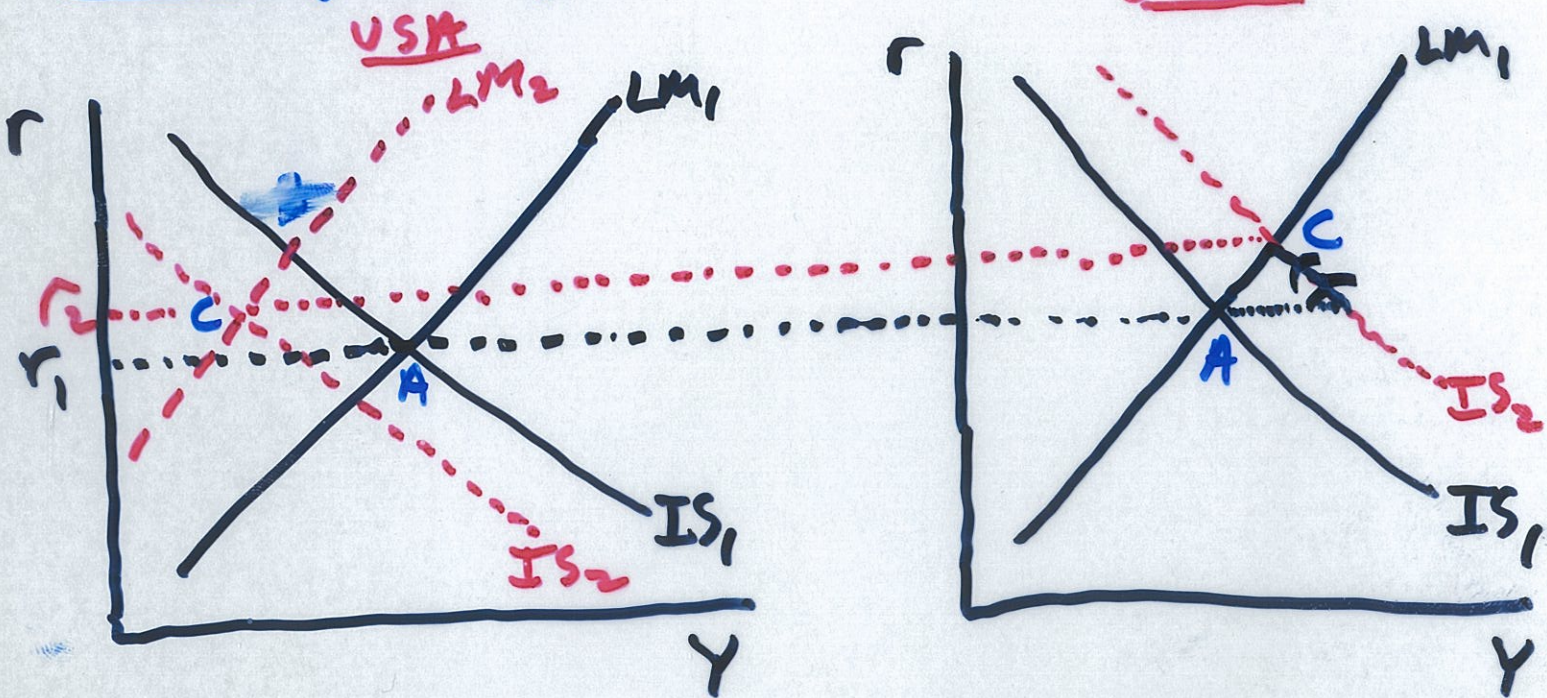
Fixed rates accentuate the economy's response to IS shocks



Fixed rates insulate the economy from LM shocks.

Policy Transmission with Flexible Exchange Rates

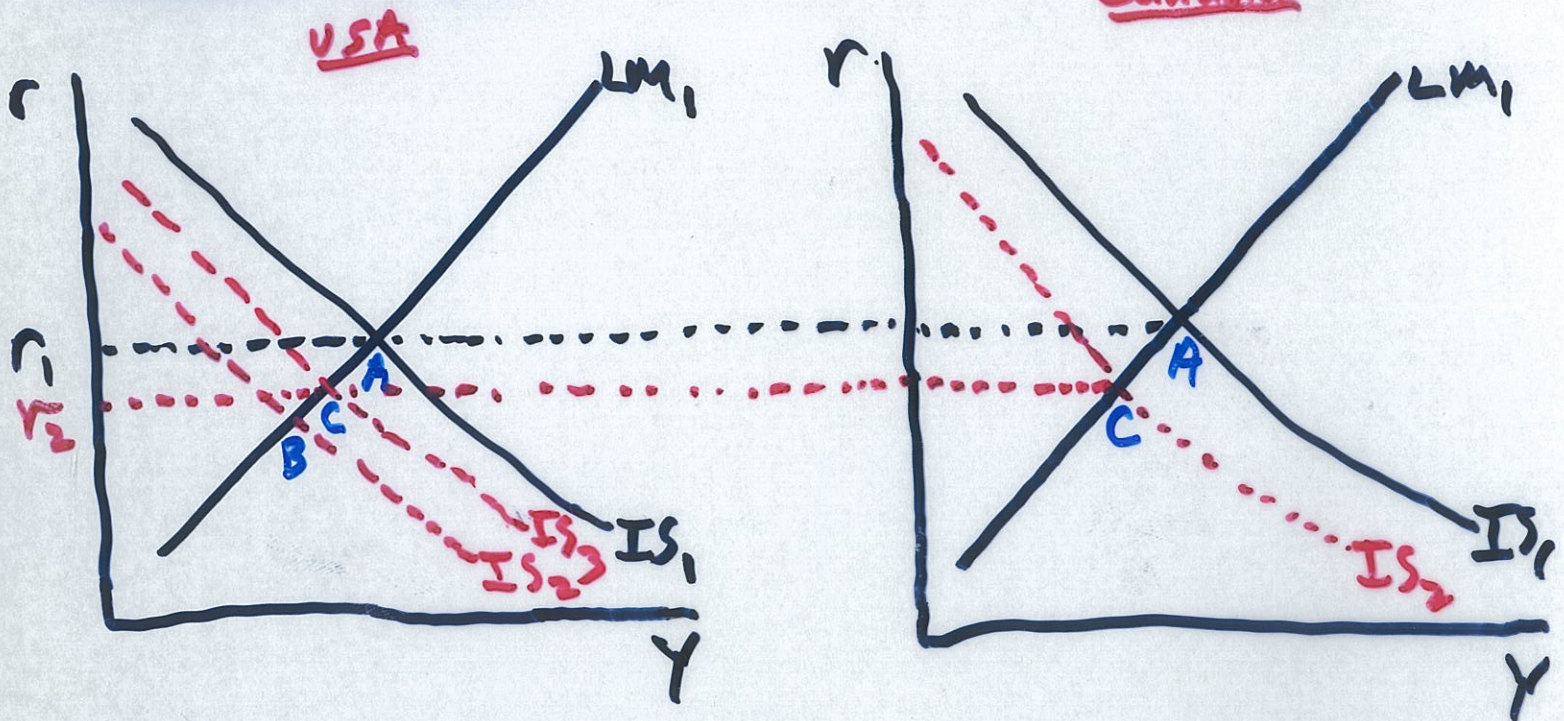
Monetary Policy



- USA Monetary Contraction \Rightarrow USA LM shifts left
- \Rightarrow $r_{USA} > r_{CAN}$
- \Rightarrow Capital Inflow into USA
Capital Outflow from Canada
- \Rightarrow US \$ Appreciates relative to Canadian \$
- \Rightarrow USA NX \downarrow
Canadian NX \uparrow
- \Rightarrow USA IS Shifts left
Canadian IS Shifts right
- \Rightarrow New Equil. at C

Policy Transmission with Flexible Exchange Rates

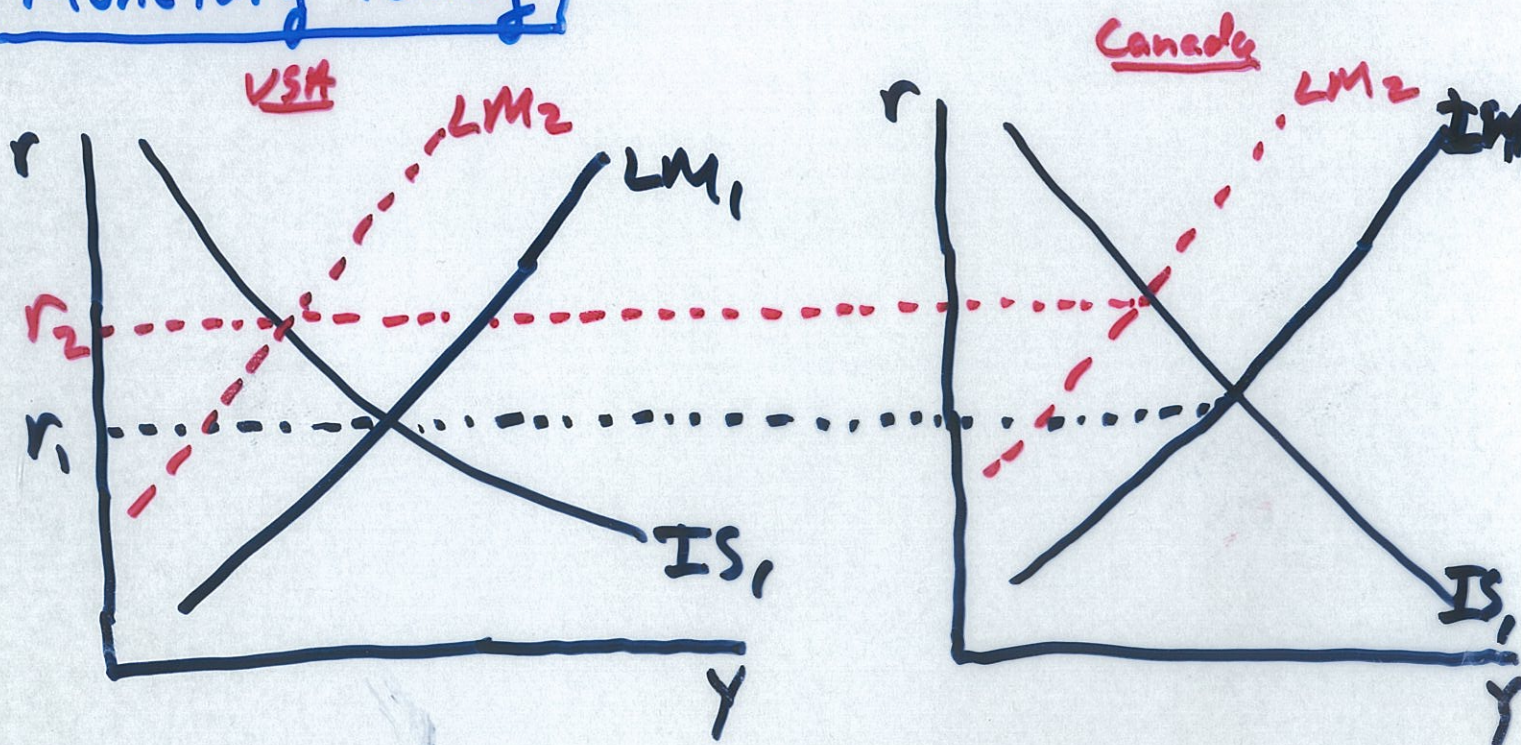
Fiscal Policy



- USA Fiscal Contraction \implies USA IS shifts left
- \implies $r_{usa} < r_{can}$
- \implies Capital Outflow from USA
Capital Inflow into Canada
- \implies US \$ Depreciates relative to Canadian \$
- \implies USA NX \uparrow
Canadian NX \downarrow
- \implies USA IS shifts right
Canadian IS shifts left
- \implies New Equil. at C

Policy Transmission with Fixed Exchange Rates

Monetary Policy



From Canada's perspective, A U.S. Monetary contraction raises the "world" interest rate.

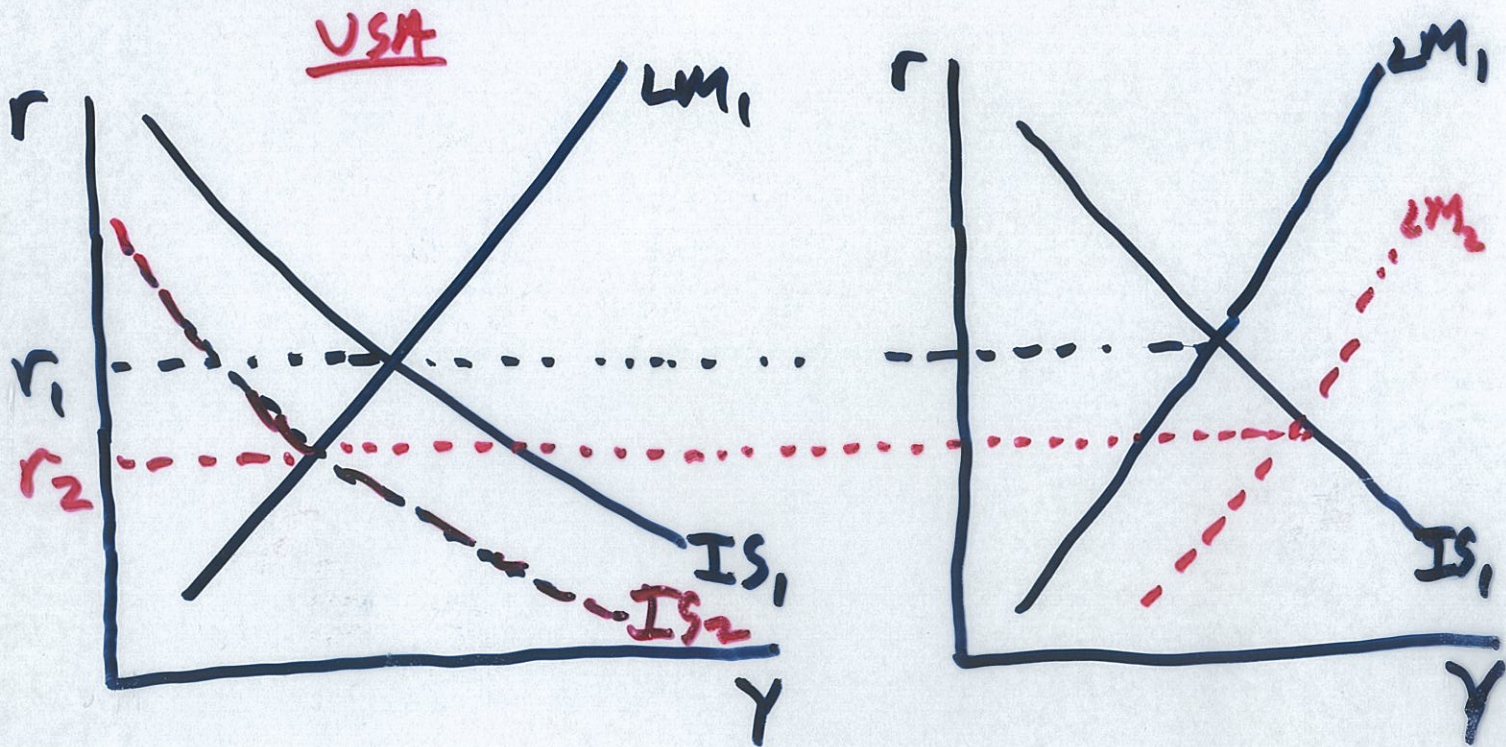
To prevent its currency from depreciating, Canada must also raise its interest rate (by cutting its money supply).

Conclusion

With fixed exchange rates, monetary policy is transmitted "positively" i.e., in the same direction.

Policy Transmission with Fixed Exchange Rates

Fiscal Policy



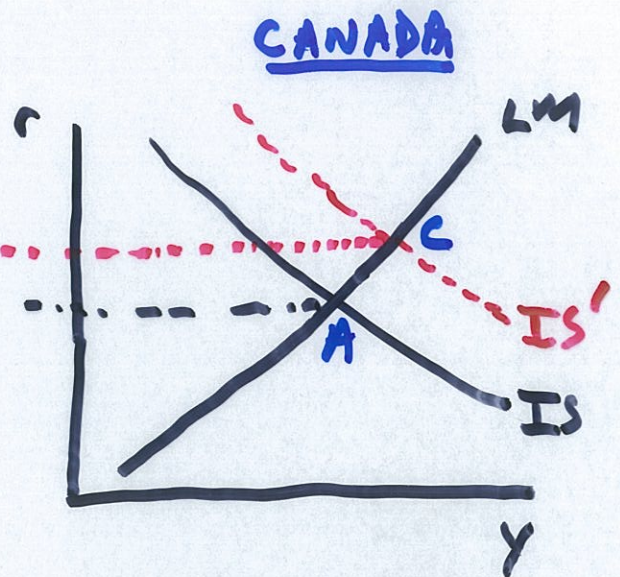
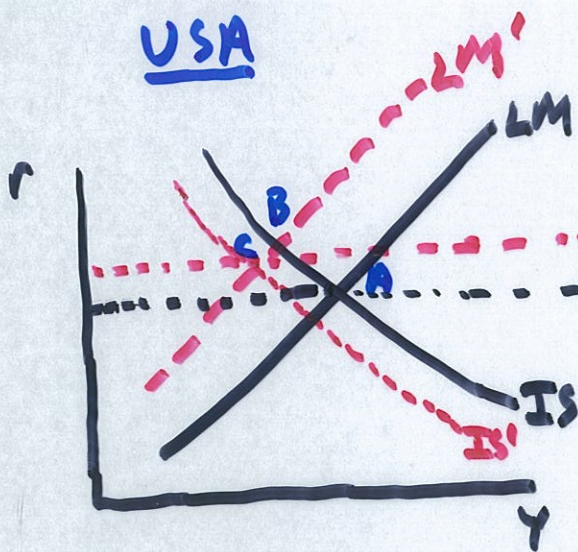
From Canada's perspective, a U.S. fiscal contraction lowers the "world" interest rate.

To prevent its currency from appreciating, Canada must also lower its interest rate (by expanding the money supply).

Conclusion

With fixed exchange rates, fiscal policy is transmitted "negatively".

Foreign Financial Crisis

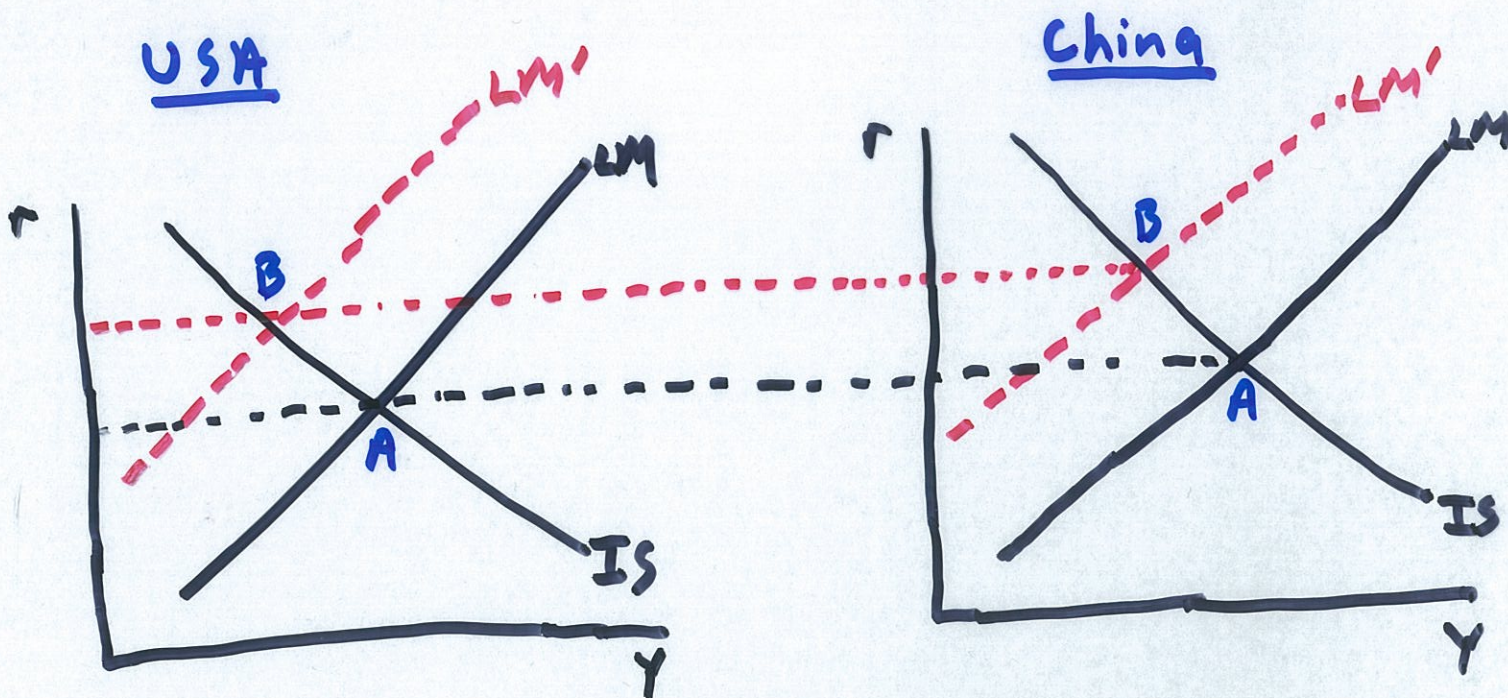


- 1.) $M^d \uparrow \Rightarrow LM$ shifts Up
- 2.) $r \uparrow, Y \downarrow$, currency appreciates
- 3.) $NX \downarrow \Rightarrow IS$ shifts down

- 1.) Currency Depreciates
 $\Rightarrow NX \uparrow$
- 2.) IS shifts out
- 3.) $Y \uparrow$!

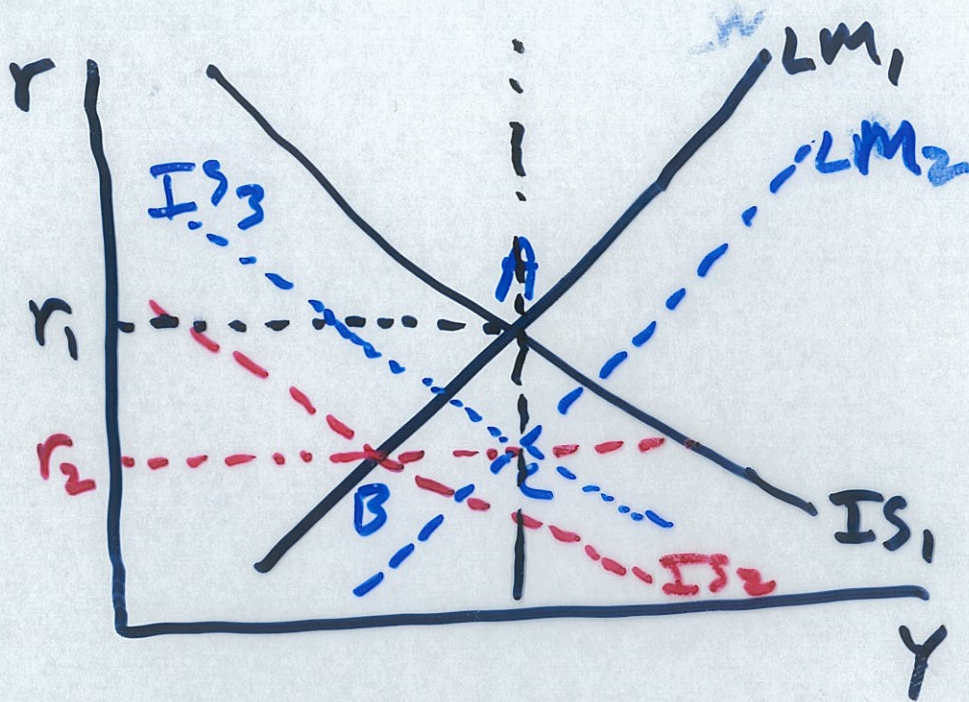
Qualification: Financial crisis in U.S. could spillover to the Canadian financial markets, and thus affect Canadian LM curve

Foreign Financial Crisis



To keep its exchange rate pegged to the U.S. \$, China must match the rise in U.S. interest rates. U.S. recession gets transmitted abroad.

How Should Canada Respond to the U.S. Recession?



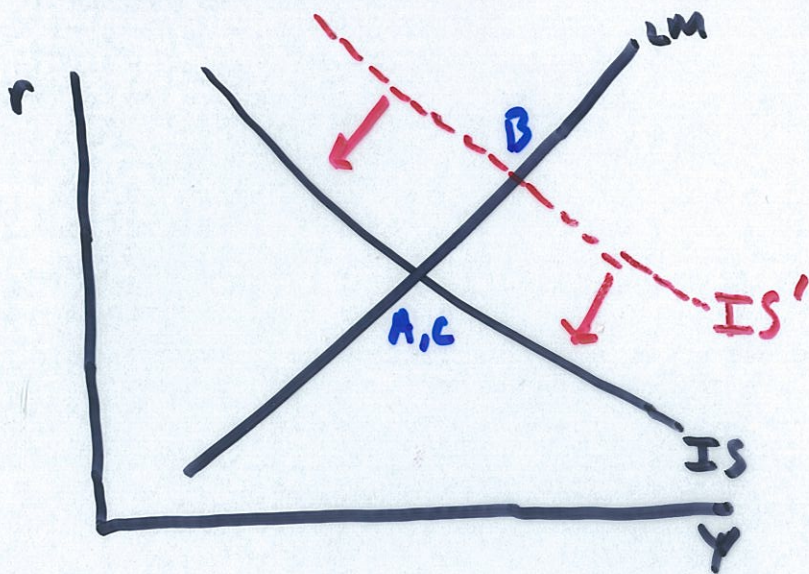
The U.S. recession pushes Canada from A to B.

To get back to original output level the Bank of Canada should shift the LM out to LM_2 , by cutting interest rates (or expanding the money supply)

Fiscal policy is likely to be relatively ineffective.

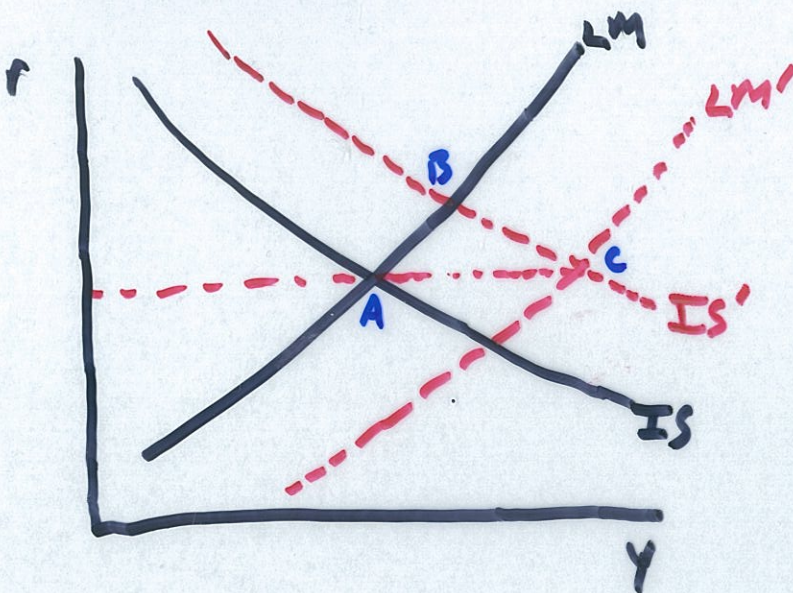
Import Tariff

Flexible Ex. Rate



- Tariff \Rightarrow Imports More Expensive
- $\Rightarrow NX \uparrow$
 - $\Rightarrow IS$ shifts out
 - $\Rightarrow r \uparrow$, Capital Inflow
 - \Rightarrow Currency Appreciates
 - $\Rightarrow NX \downarrow$
 - \Rightarrow No lasting effect on output!

Fixed Ex. Rate



- Tariff \Rightarrow Imports More Expensive
- $\Rightarrow NX \uparrow$
 - $\Rightarrow IS$ shifts out
 - $\Rightarrow r \uparrow$, Capital Inflow
 - \Rightarrow To prevent currency appreciation, govt. must expand money supply (purchase fx)
 - $\Rightarrow LM$ shifts out
 - $\Rightarrow Y \uparrow$ in short-run

What happens in Long-Run?

Policy Transmission

	Monetary	Fiscal
Flex.	Negatively (Opposite Direction)	Positively (Same Direction)
Fixed	Positively (Same Direction)	Negatively (Opposite Direction)