Fixed Exchange Rates

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[1]I wish to acknowledge Battista Severgnini for providing last year's slides to me. His generosity saved me much time, and these slides are partially based on his. Any errors are of course my own.

Last time

Chapter 17:

- Determinants of aggregate demand in the short run
- Short run equilibrium for aggregate demand and output (DD curve)
- Short run equilibrium in the asset markets (AA curve)
- Short run equilibrium (AA & DD)
- Temporary changes in monetary and fiscal policy
- Permanent changes in monetary and fiscal policy
- Odds and ends

Plan for Today

Chapter 18:

- Balance sheets of central banks
- Fixed exchange rate
- Monetary and fiscal policies under fixed exchange rates
- Financial crises and capital flight
- Interest rate differentials
- Types of fixed exchange rate systems

Chapter 19:

- Goals of macroeconomic policies

But first a review

Determinants of Aggregate Demand in the Short Run

- Runs:
  1. Long run: flexible prices
  2. **Short run**: prices are sticky (reasons: menu costs, long-term contracts)
- Last classes: Money supply, exchange rate in the short and long-run
- Last class: Output and exchange rate in the long-run
- In this class: relationship between E and Y ($E = f(Y)$) in the short run

Determinants of Aggregate Demand in the Short Run

- *Aggregate demand* is the amount of a country's goods and services demanded by households, firms, and governments throught the world.
- Aggregate demand D can be expressed by:

$$D = C + I + G + CA$$

  where
  - C: consumption expenditure
  - CA: current account
  - I: investment expenditure
  - G: government purchase
- Only products again, no assets!
- Let's take these components one at a time

Determinants of Aggregate Demand in the Short Run: C

- Consumption expenditure is a function of disposable income

$$C = C\left(Y^d\right)$$

- Disposable income is total income less taxes $Y^d = Y - T$
- Consumption is increasing in disposable income
- However, the elasticity of consumption with respect to disposable income is less than one. Why?

Determinants of Aggregate Demand in the Short Run: CA

$$CA = CA\left(\frac{EP^*}{P}, Y - T\right)$$

Current account is a function of

- $\frac{EP^*}{P}$: if $\frac{EP^*}{P} \Uparrow$ (real depreciation)
  - Rise in exports (in terms of domestic product)
  - Two effects on imports:
    1. Increase in the value of each import (foreign baskets each become more expensive)
    2. Decrease in the volume of imports
  - Assumption: Volume effect dominates
  - Necessary condition on demand: *Marshall-Lerner condition*
  - Real depreciation leads to increase in current account

Determinants of Aggregate Demand in the Short Run: CA

$$CA = CA\left(\frac{EP^*}{P}, Y - T\right)$$

Current account is a function of

- $Y - T$: if $Y - T \Uparrow$ (increase in disposable income)
- Rise in imports (in terms of domestic product)
- No effect on exports (qualified a bit)
- Increase in disposable income leads to lower current account

Components of aggregate demand

1. Consumption is a function of national product, elasticity less than one
2. Current account is a increasing function of real exchange rate, and decreasing function of disposable income
3. Investment spending is fixed
4. Government spending is fixed

Determinants of Aggregate Demand in the Short Run

Aggregate demand:

$$D = C + I + G + CA$$

Plug in components as functions

$$D = C\left(Y - T\right) + I + G + CA\left(\frac{EP^*}{P}, Y - T\right)$$

or

$$D = D\left(\frac{EP^*}{P}, Y - T, I, G\right)$$

I and G are set outside our model
D is increasing in real exchange rate
What happens to D after a rise in disposable income?

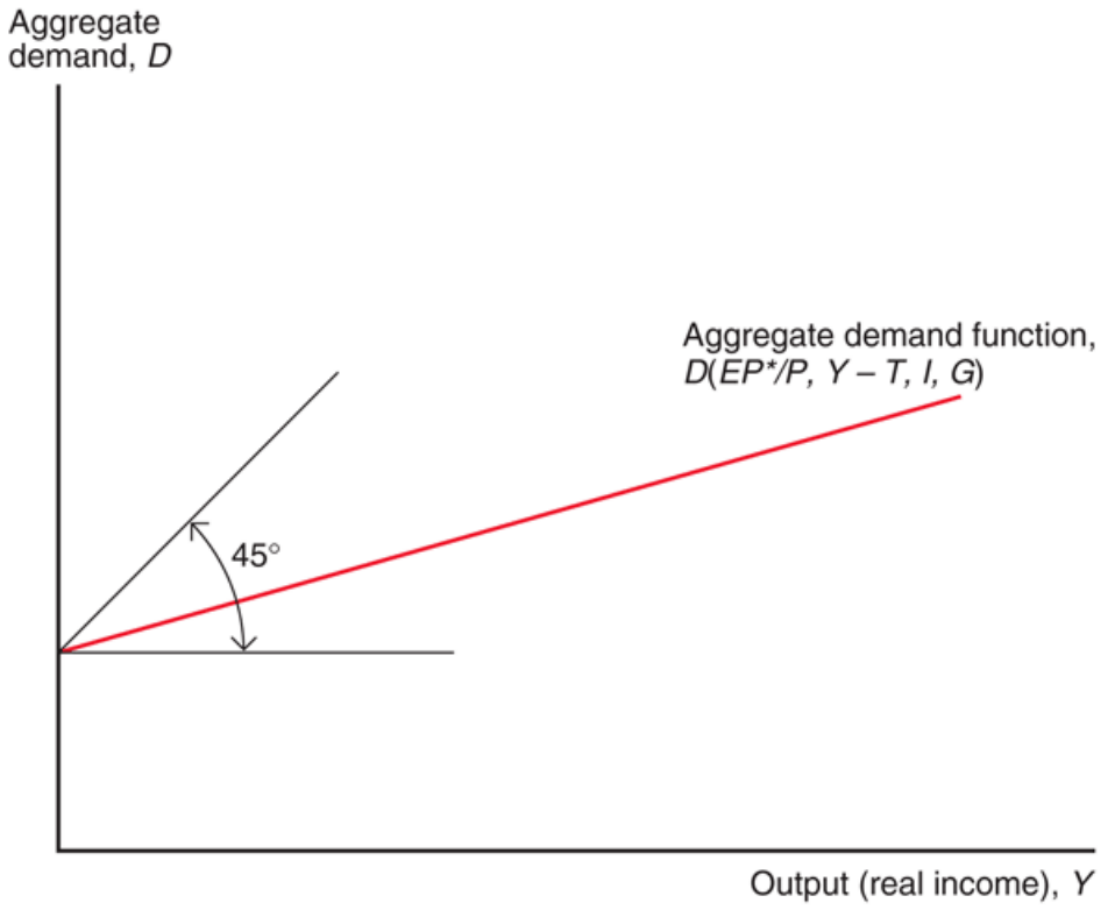
Determinants of Aggregate Demand in the Short Run

Two effects:

1. **Real exchange rate:** $\frac{EP^*}{P} \Uparrow \Rightarrow CA \Uparrow \Rightarrow D \Uparrow$
2. **Disposable income:** $(Y - T) \Uparrow \Rightarrow C \Uparrow, CA \Downarrow$

- Assume that if consumers get one more dollar, spend most of it on domestic production rather than foreign $\Rightarrow D \Uparrow$

Aggregate demand



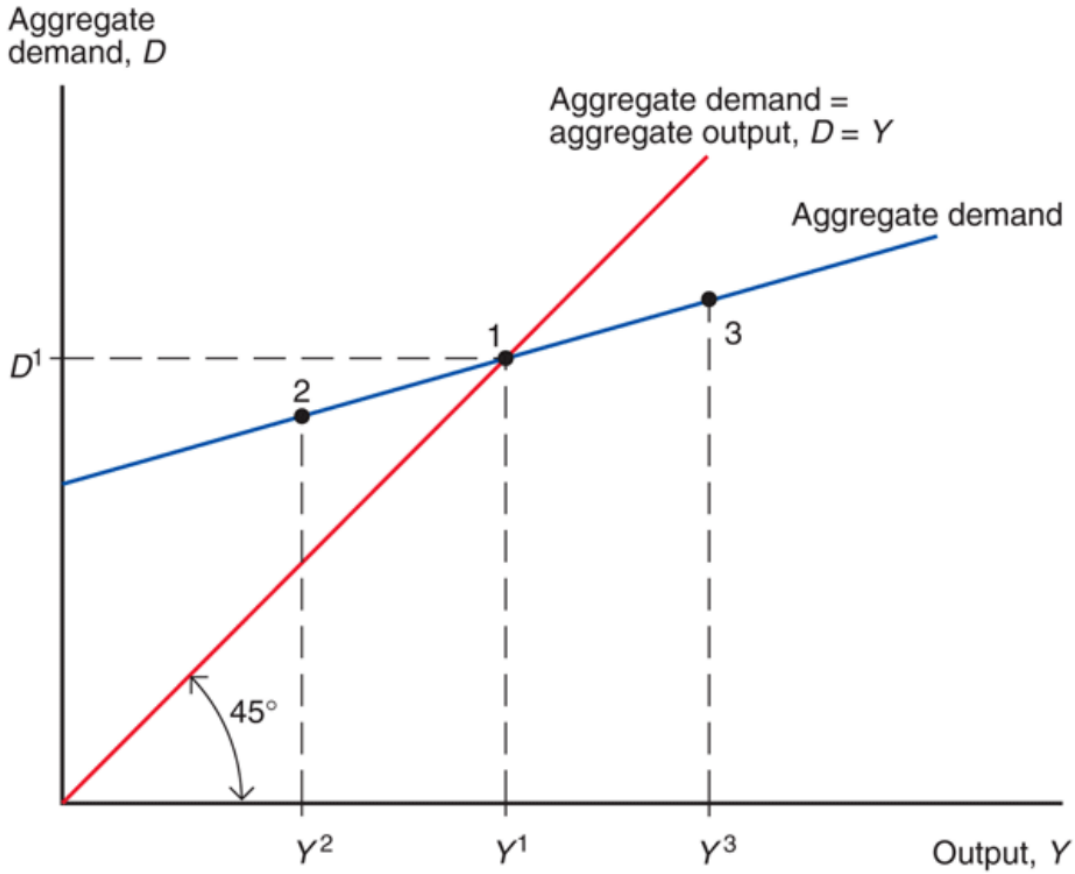
Short Run Equilibrium for Aggregate Demand and Output

- Equilibrium is achieved when the value of income from production (output) Y equals the value of aggregate demand D.

$$Y = D\left(\frac{EP^*}{P}, Y - T, I, G\right)$$

- Short run, because we don't allow money prices of goods to adjust
- Later in chapter, we will show how demand moves towards long run equilibrium

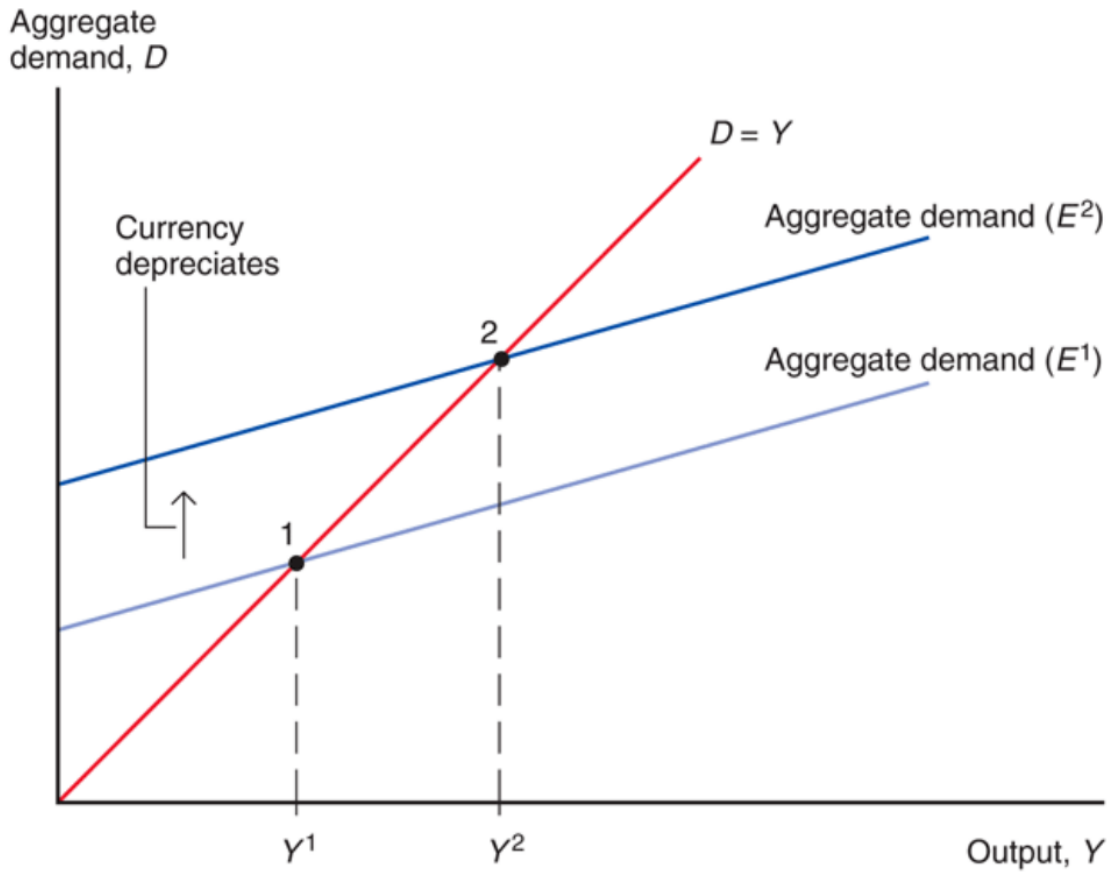
The Determination of Output in the Short Run



DD Schedule

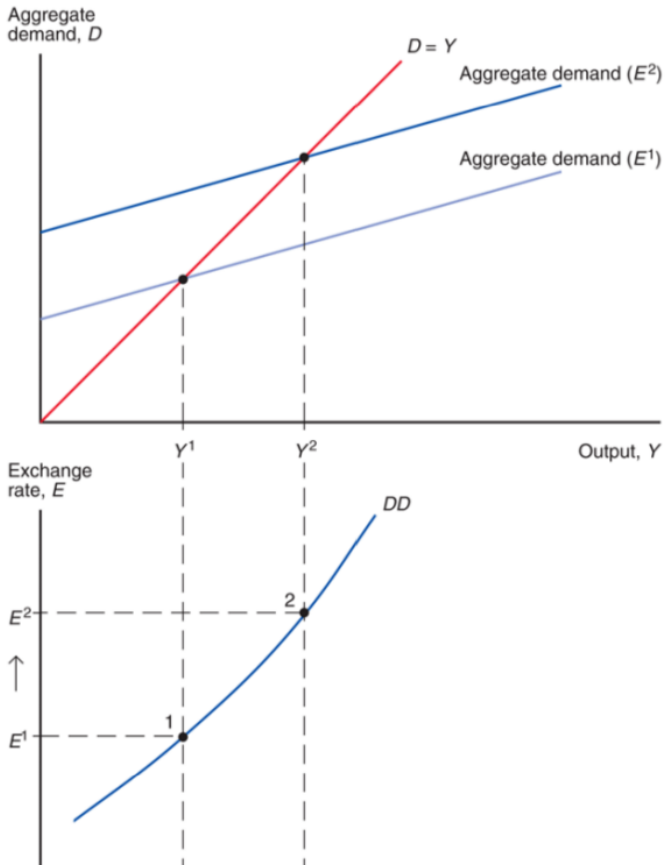
- The DD Schedule is the relationship between exchange rates and output
- Real depreciation of domestic currency increases demand for domestic goods
- Production has to increase to meet demand

Output Effect of a Currency Depreciation with Fixed Output Prices

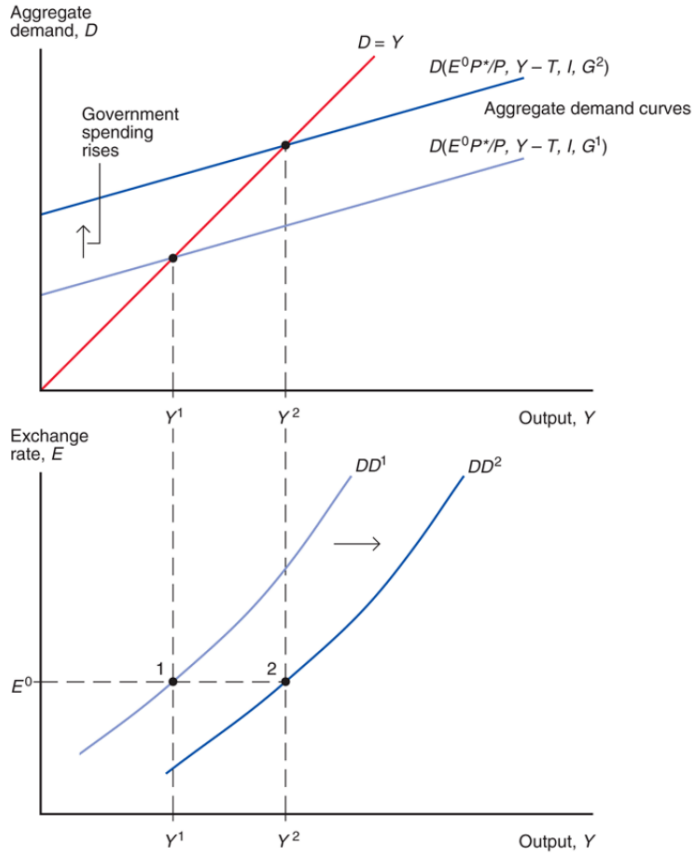


DD Schedule

- Fix everything in aggregate demand except output Y and nominal exchange rate E
- DD: Set of all Y and E at which the output market is in short run equilibrium



Government Demand and the Position of the DD Schedule



DD Schedule

- Moral of the story:
  - Whatever causes an increase in aggregate demand causes a rightward shift of *DD* curve

Short Run Equilibrium in Asset Markets

Two sets of assets markets:

1. Foreign exchange markets

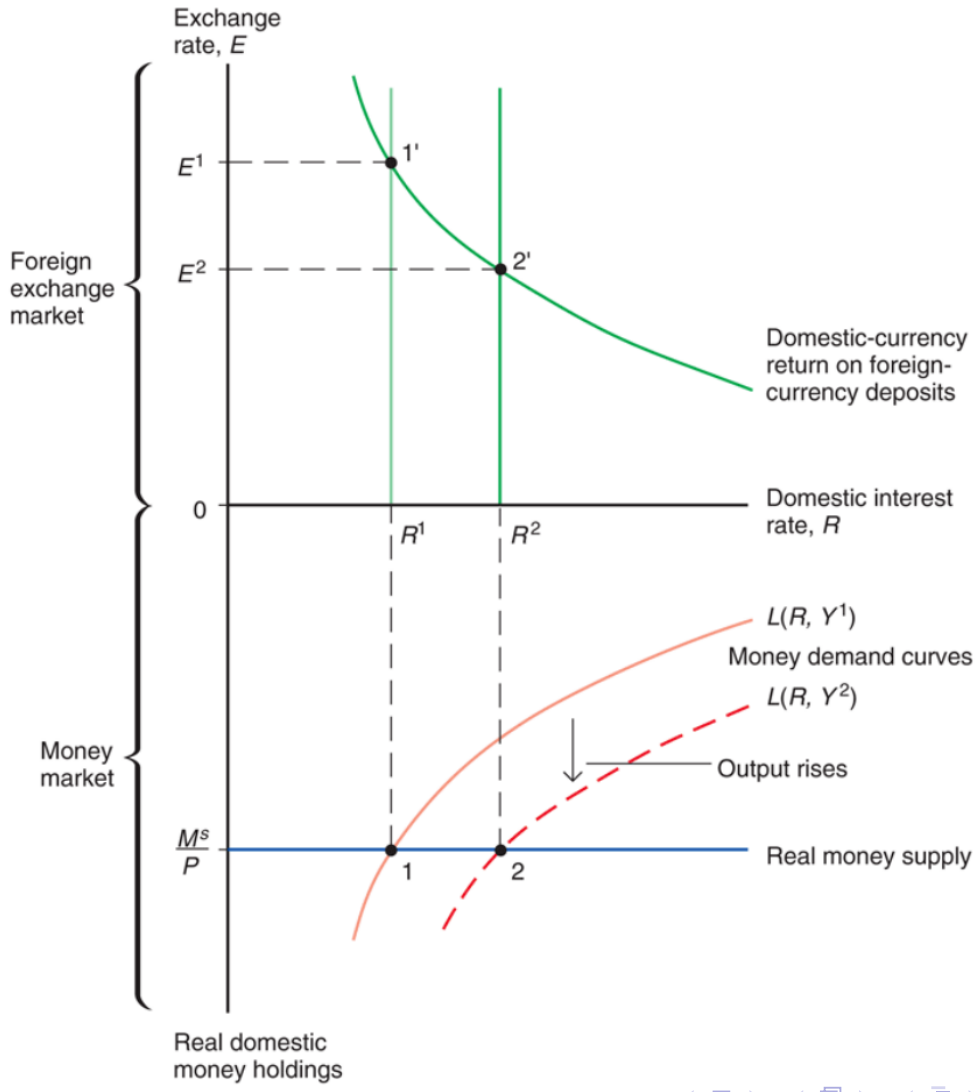
$$R = R^* + \frac{(E^e - E)}{E}$$

2. Money market

$$\frac{M^s}{P} = L(R, Y)$$

Something we are used to!
BUT: Now we are going to fix everything but Y and E

Output and the Exchange Rate in Asset Market Equilibrium



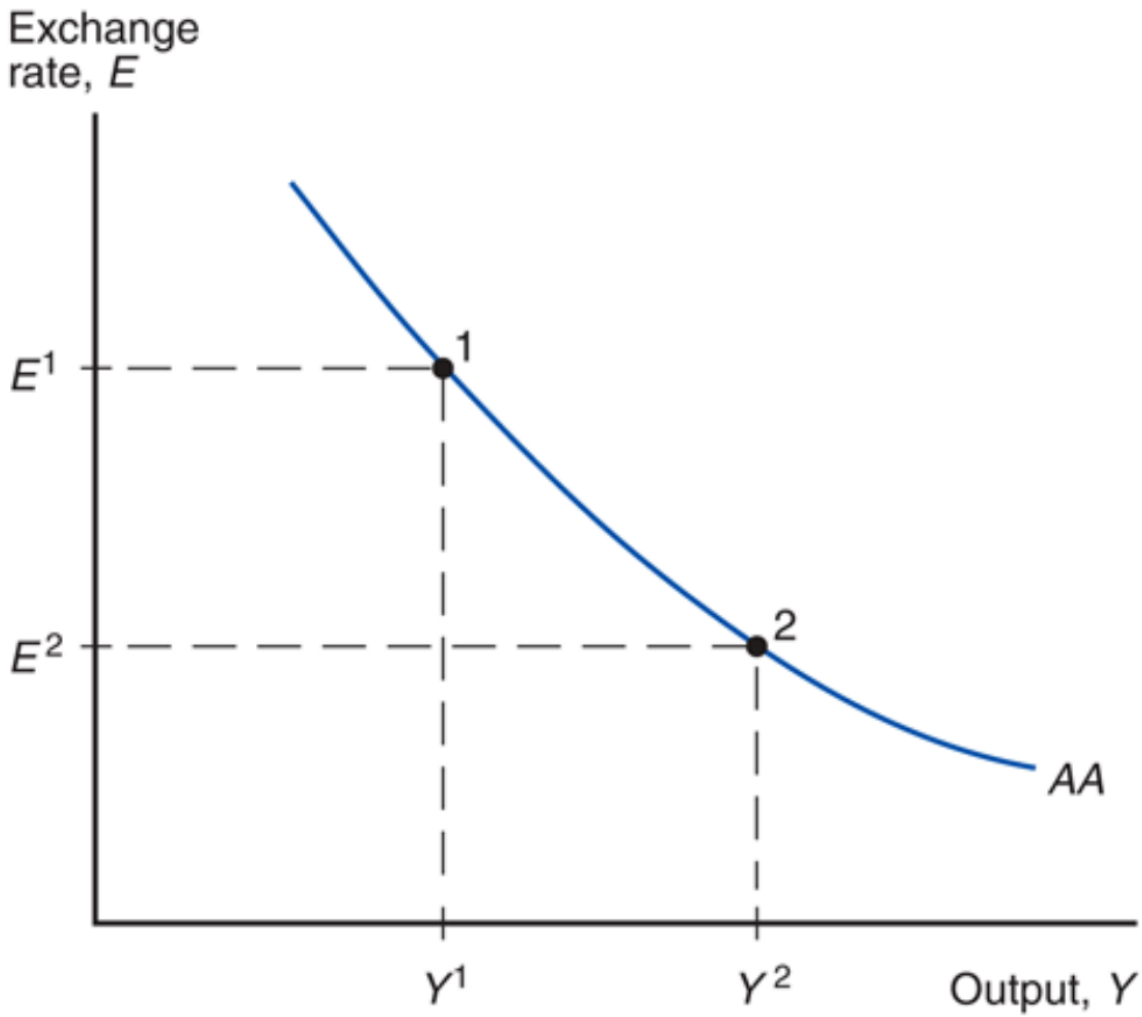
Short Run Equilibrium in Asset Markets: AA Curve

If $Y \Uparrow$:

1. $L(R, Y) \Uparrow$
2. $R \Uparrow$
3. $E \Downarrow$

Output up, exchange rate down (appreciation)
How convenient, going to give us a downward sloping AA curve!

The AA Schedule

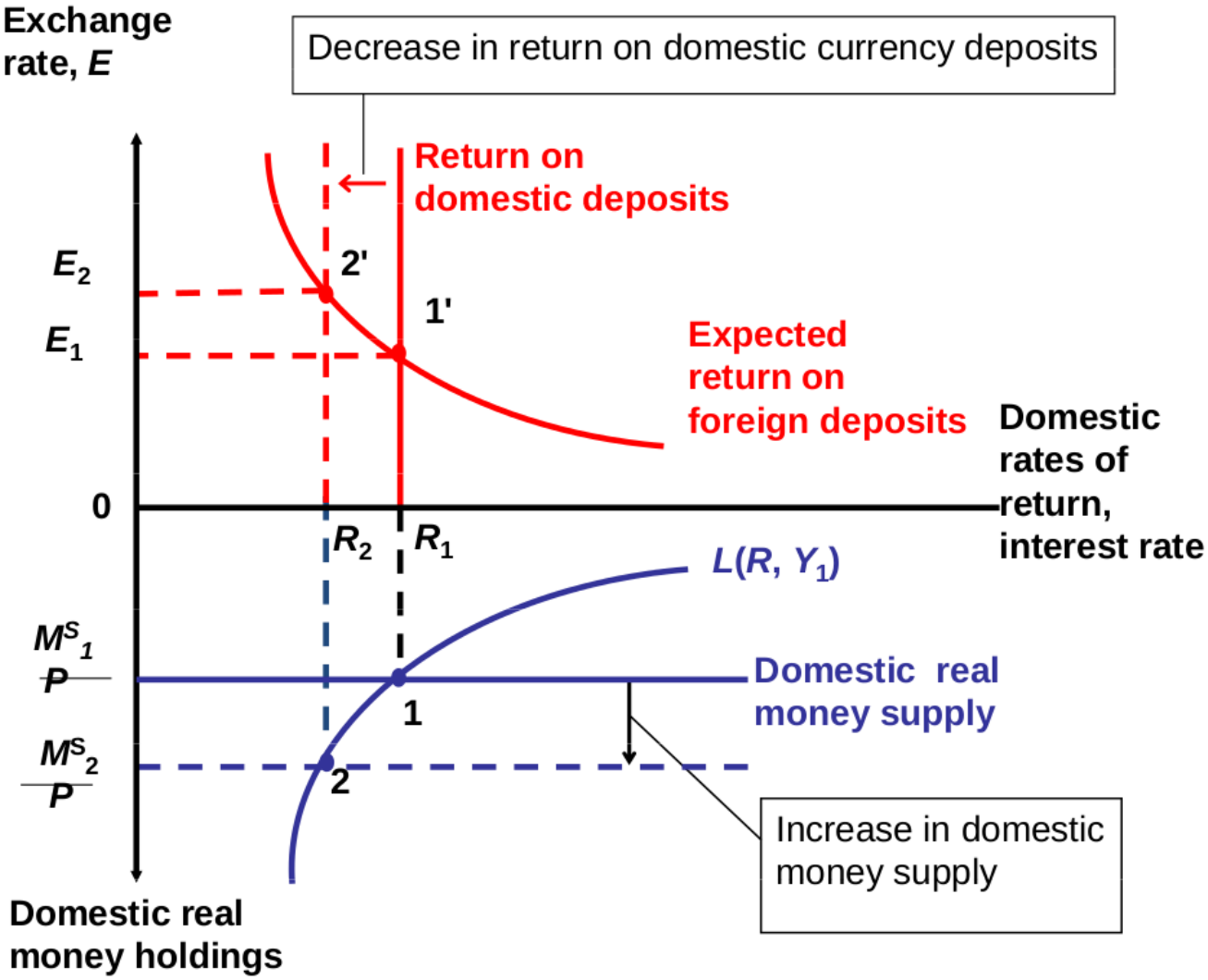


AA Schedule

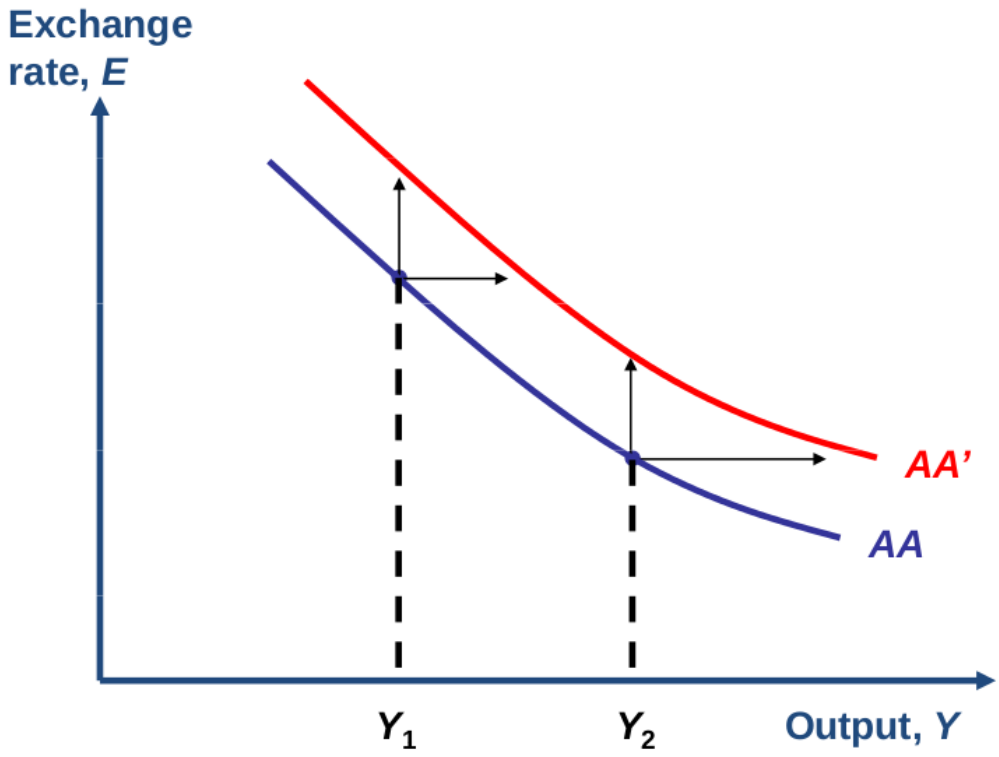
Money supply shift causes AA to shift:

- M^s: if $M^s \Uparrow \Rightarrow R \Downarrow \Rightarrow E \Uparrow$: AA shifts up.

The AA Schedule: Increase in money



The AA Schedule: Increase in money



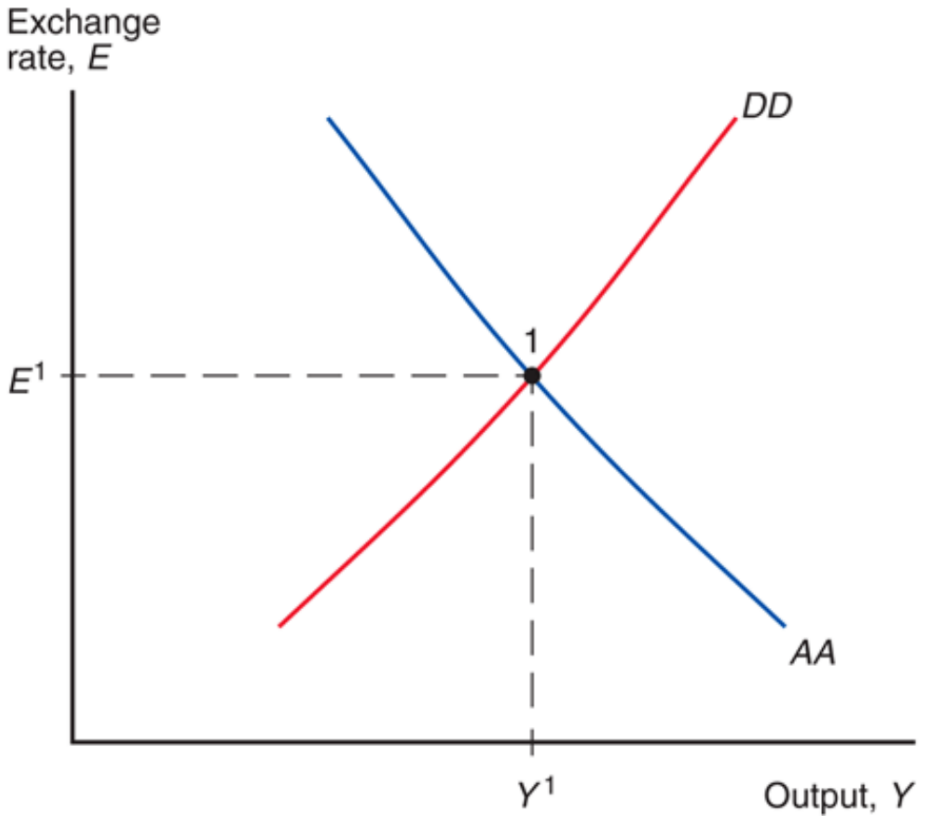
Short Run Equilibrium

A short run equilibrium means E and Y such that:

1. equilibrium in the output markets holds (DD): $D = Y$
2. equilibrium in the foreign exchange markets holds (AA):
$$R = R^* + \frac{(E^e - E)}{E}$$
3. equilibrium in the money market holds: $M^s = M^d$

Short-Run Equilibrium: The Intersection of DD and AA

- Begining to think everything in undergrad econ is the same picture
- Just change the labels



Temporary Changes in Monetary and Fiscal Policy

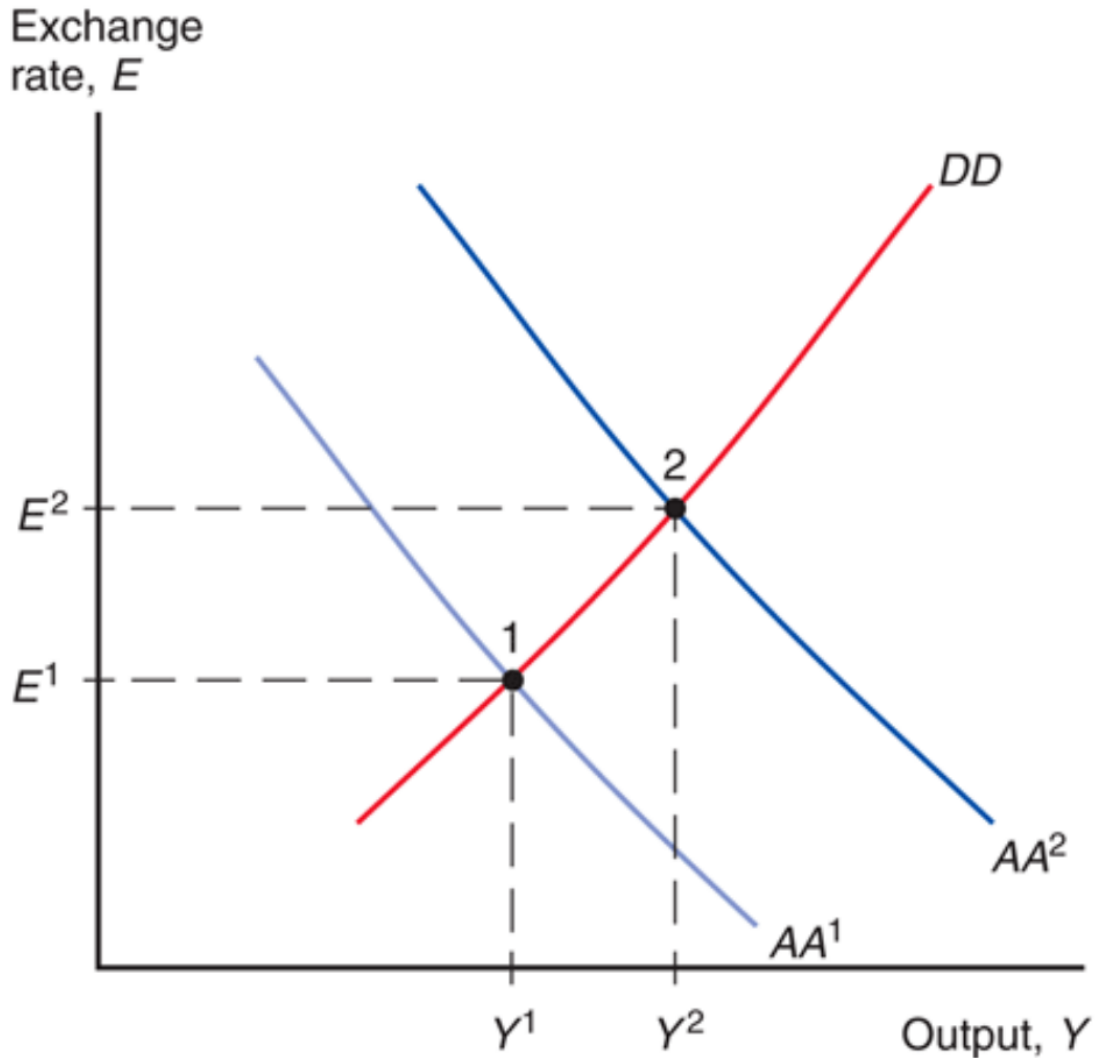
- **Monetary policy:** the central bank influences the supply of monetary assets (AA)
- **Fiscal policy:** governments influence the amount of government purchases and taxes (DD)

Suppose that the policies are going to be undone after a short period

Temporary Monetary Policy

- if $M^s \Uparrow \Rightarrow R \Downarrow E \Uparrow$
- AA shifts up

Temporary Changes in Monetary and Fiscal Policy

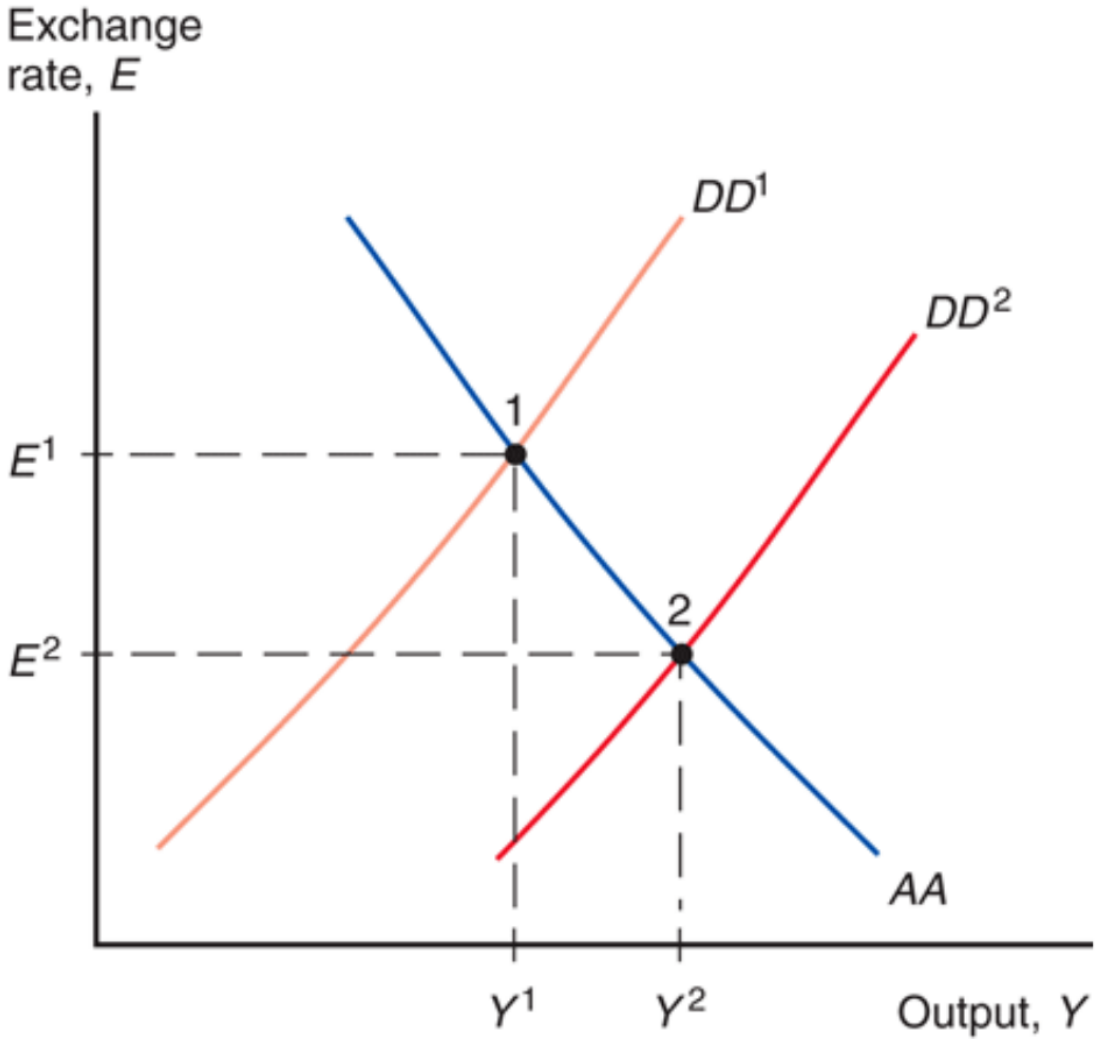


Temporary Fiscal Policy

Government decides to build a space shuttle

- if $G \Uparrow$ (or $T \Downarrow$) $\Rightarrow D \& Y \Uparrow$
- DD shifts down
- $Y \Uparrow \Rightarrow L(Y, R) \Uparrow \Rightarrow R \Uparrow$
- $E \Downarrow$

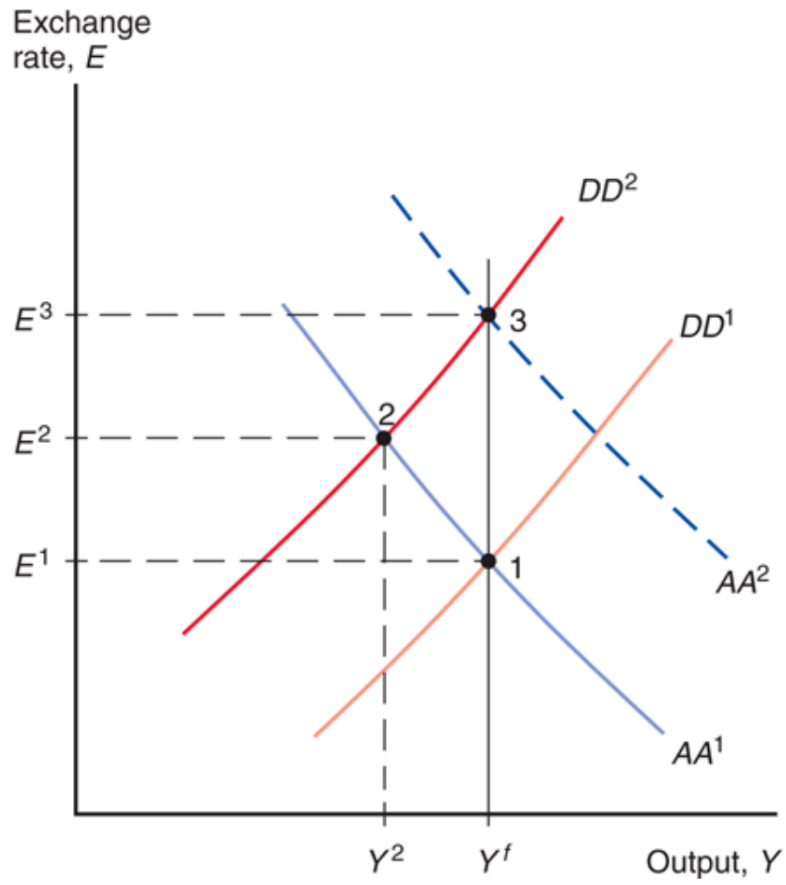
Effects of a Temporary Fiscal Expansion



Policies to Maintain Full Employment

- How might governments use these policy tools?
- Suppose there is a temporary shift of consumer taste away from domestic product
- This will shift DD up, resulting in unemployment (factors same, drop in Y)
- Central bank can increase money supply

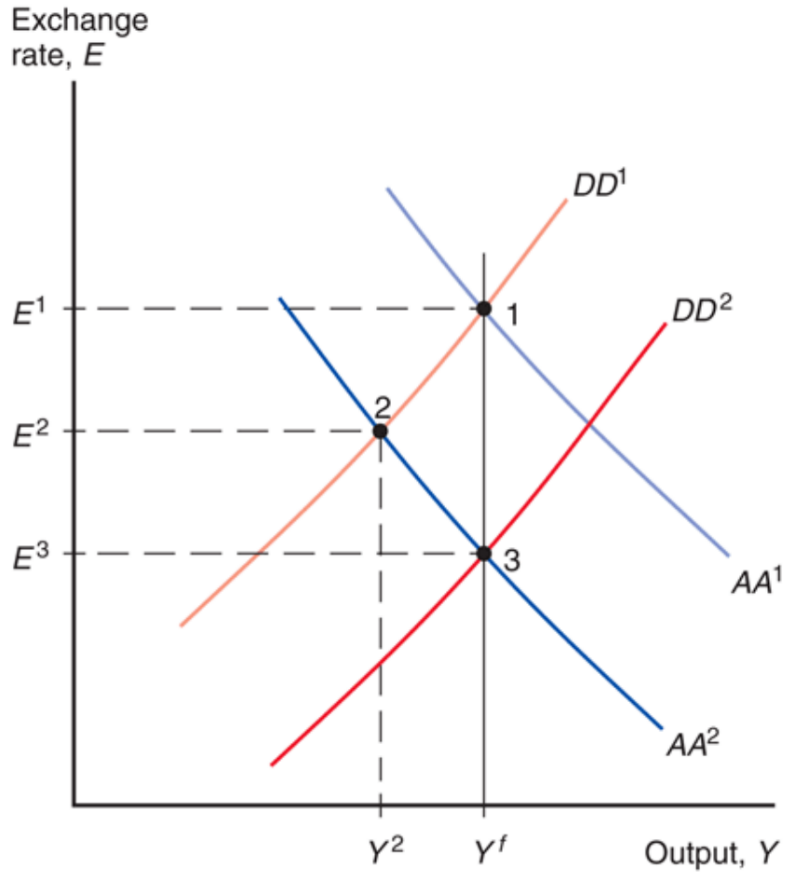
Maintaining Full Employment After a Temporary Fall in World Demand for Domestic Products



Policies to Maintain Full Employment

- How might governments use these policy tools?
- Suppose people suddenly demand more money
- This will shift AA down, resulting in unemployment
- Government can demand more stuff, raising DD

Policies to Maintain Full Employment After a Money Demand Increase

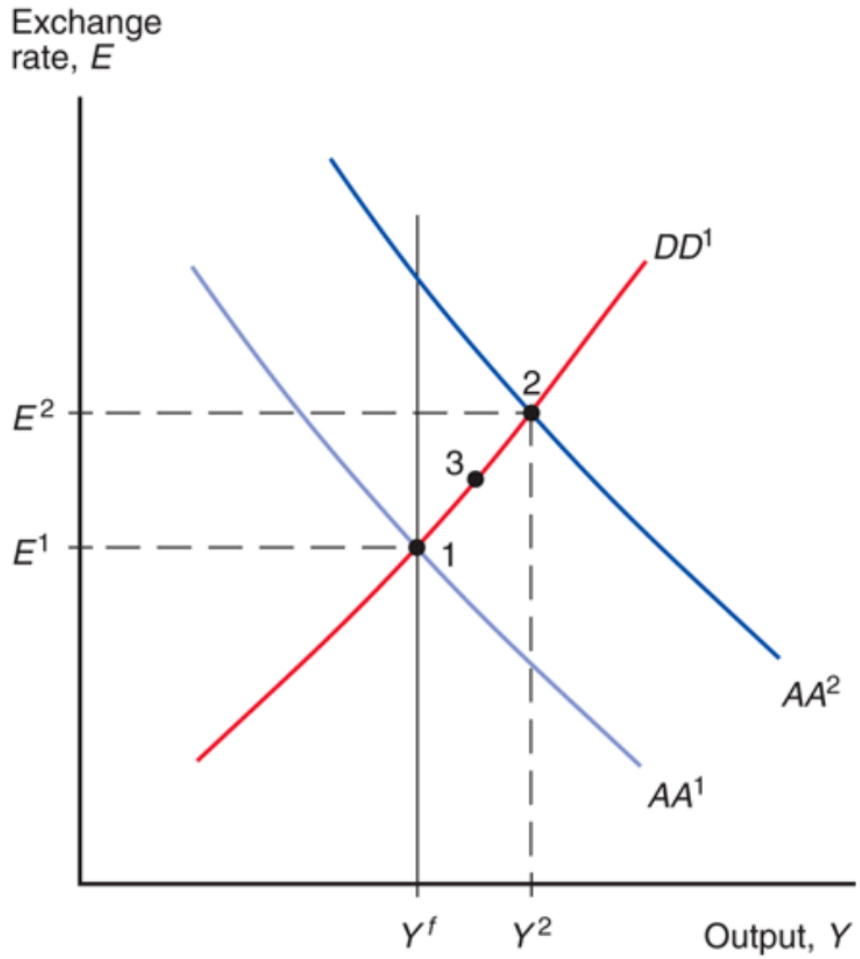


Policies to Maintain Full Employment

Policies to maintain full employment are difficult to implement:

- inflation bias
  - Government is expected print money to expand output and win an election
  - Workers anticipate inflation, ask for higher wages
  - Costs rise leading to less output and unemployment
  - Government needs monetary policy just to return to baseline output
- Difficult to tell if problem is in the asset or output market
  - Which tool?
- Policy lag
- Monetary policy much faster
  - Government may use it even when fiscal policy is more appropriate
- Ricardian equivalence

Short-Run Effects of a Permanent Increase in the Money Supply



Permanent Changes in Monetary Policy

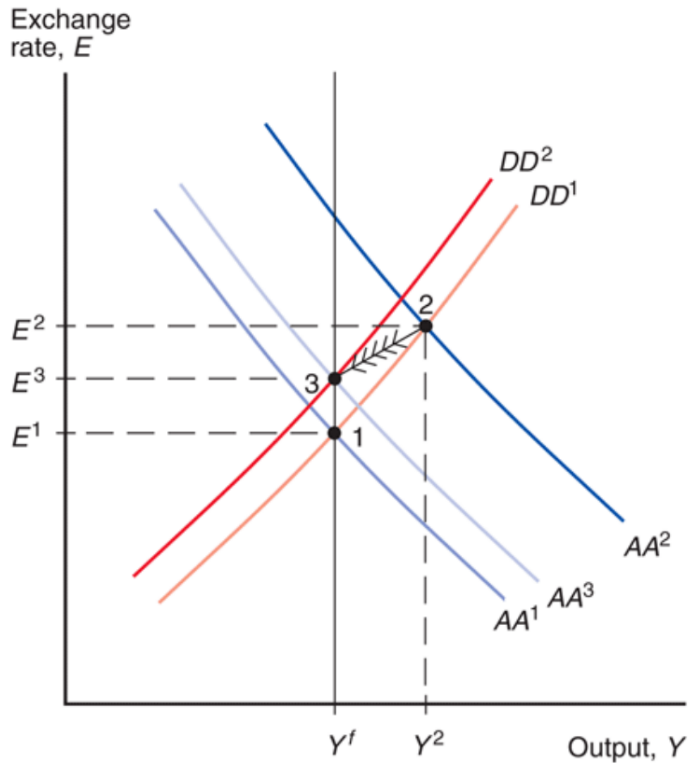
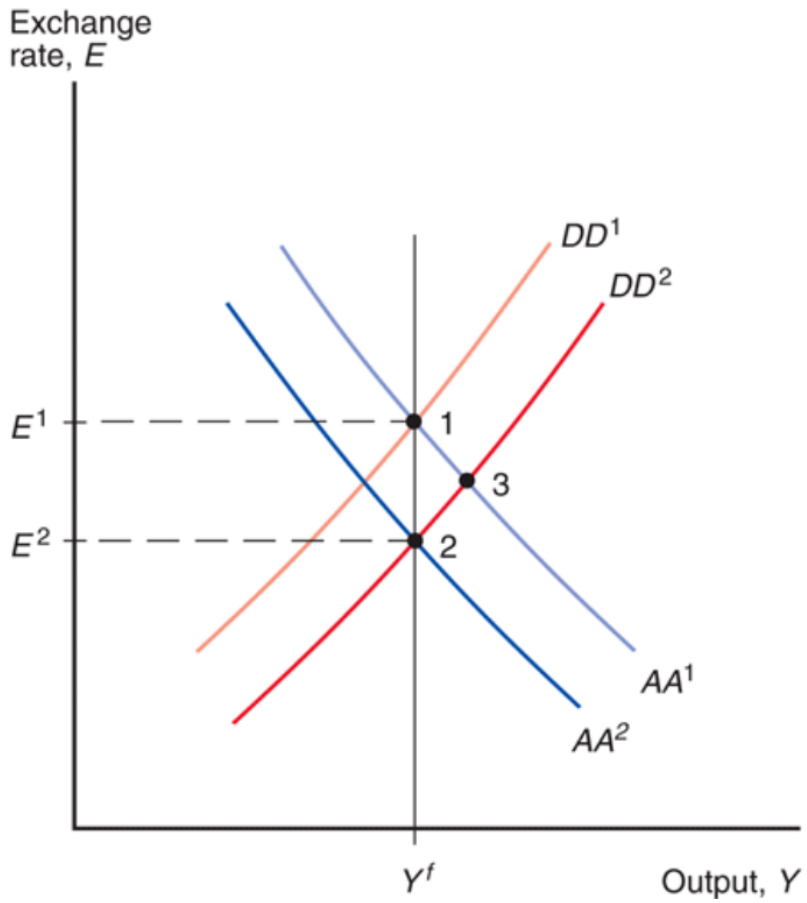


Fig. 17-16: Effects of a Permanent Fiscal Expansion



Review

- End review

Chapter 18. Fixed Exchange Rates and Foreign Exchange Intervention

Exchange Rates

1. **Fixed or Pegged**
2. **Flexible**

Why Study Fixed Exchange Rates?

1. Rich, industrialized countries: The dirty float
2. Regional currency arrangements (Denmark in the textbook!)
3. Developing countries fix to baskets or currencies
4. Lessons from the history of exchange rates intervention

Bottom line: Still a lot of intervention today

Central Bank's Simplified Balance Sheet

Assets

- Foreign government bonds (official international reserves)
- Gold (official international reserves)
- Domestic government bonds
- Loans to domestic banks (called discount loans in US)

Liabilities

- Deposits of domestic banks
- Currency in circulation (previously central banks had to give up gold when citizens brought currency to exchange)

Asset=Liabilities+ Net worth

Net Worth is assumed to be zero:

$$\Delta Asset = \Delta Liabilities$$

Central Bank's Simplified Balance Sheet

Changes in the central bank's balance sheet lead to changes in currency in circulation or changes in deposits of banks, which lead to changes in the money supply.
If bank deposit $\Uparrow \Rightarrow$ additional fund for customers $\Rightarrow M^s \Uparrow$

Purchase & Sale

1. **Purchase:** central bank buys domestic bonds or foreign bonds $\Rightarrow +\Delta Asset = +\Delta Liabilities \Rightarrow M^s \Uparrow$
2. **Sale:** central bank sells domestic bonds or foreign bonds $\Rightarrow -\Delta Asset = -\Delta Liabilities \Rightarrow M^s \Downarrow$

- Foreign currency deposits and foreign government bonds are substitutes (liquidity)
- Purchase and sale influence money supply
- Money supply affects the exchange rate both in the short and long-run

Sterilization

- Suppose the central bank sells foreign currency in the foreign exchange market
  - Assets decrease, liabilities decrease (why?)
  - Money supply decreases
- Suppose the central bank wants to leave money supply unchanged
  - Buy domestic bonds (T-Bills, for example)
  - Assets increase, liabilities increase
  - Money supply returns to original level
- *Sterilization*: offsetting foreign asset transactions with domestic asset transactions

Central bank transactions

Domestic Central Bank's Action	Effect on Domestic Money Supply	Effect on Central Bank's Domestic Assets	Effect on Central Bank's Foreign Assets
Nonsterilized foreign exchange purchase	+$100	0	+$100
Sterilized foreign exchange purchase	0	−$100	+$100
Nonsterilized foreign exchange sale	−$100	0	−$100
Sterilized foreign exchange sale	0	+$100	−$100

Fixed Exchange Rate

To fix the exchange rate, a central bank influences the quantities supplied and demanded of currency by trading domestic and foreign assets, so that the exchange rate (the price of foreign currency in terms of domestic currency) stays constant. So the UIRP

$$R = R^* + \frac{(E^e - E)}{E}$$

can be rewritten as

$$R = R^*$$

Why?

Fixed Exchange Rate

To fix the exchange rate, the central bank must trade foreign and domestic assets in the foreign exchange market until

$$R = R^*$$

or

$$\frac{M^s}{P} = L(R^*, Y)$$

Why?

Example

- Level of output rises
- How does Central bank respond to maintain fixed exchange rate in the short run?

Fixed Exchange Rate

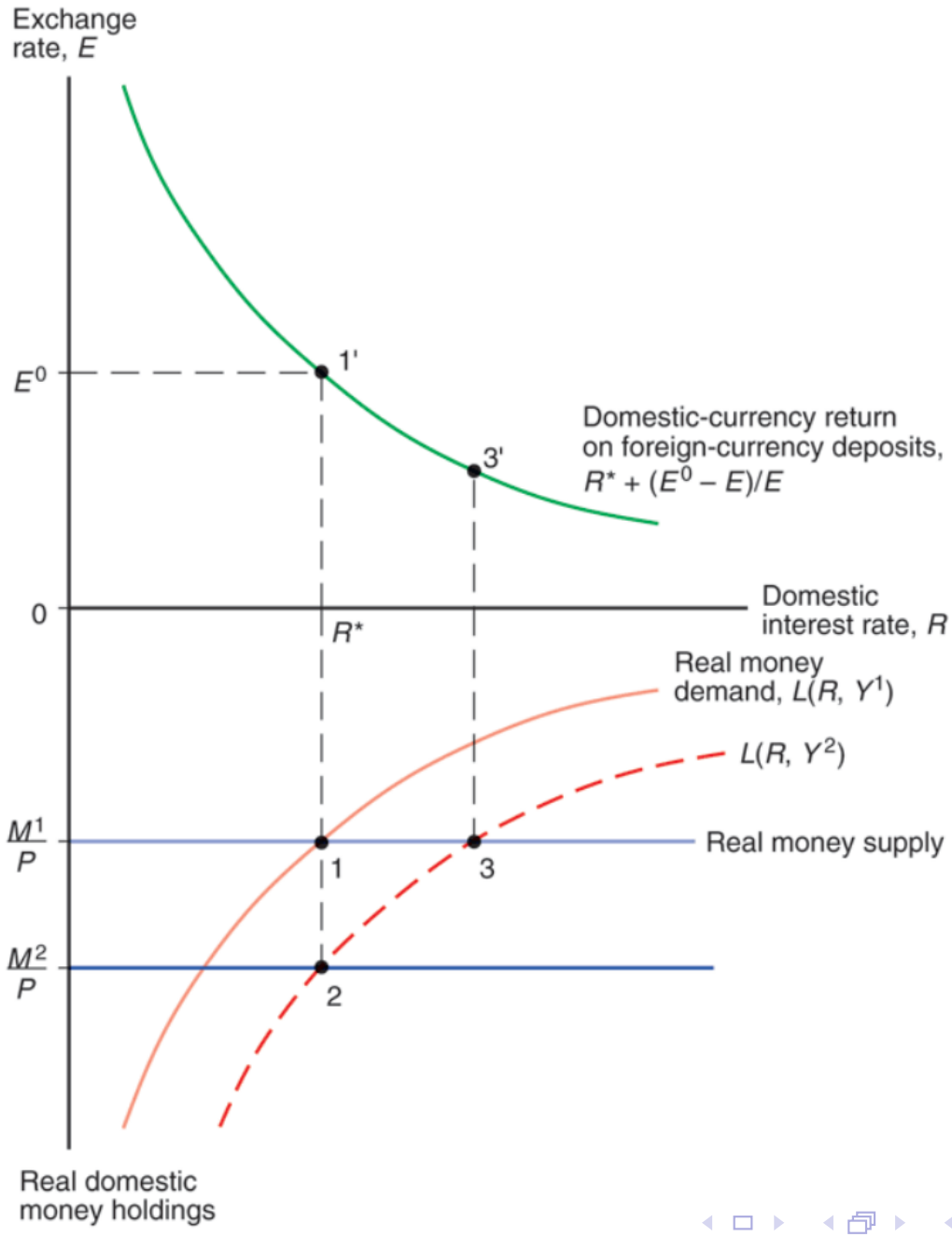
Assumptions:

- fixed exchange rate $E_t = E_0$
- if $Y \Uparrow \Rightarrow L(R, Y) \Uparrow$

In order to maintain fixed exchange rate:

- Central bank buys assets denominated in foreign currency and sells domestic currency
  - the price/value of foreign currency increases
  - the price/value of domestic currency decreases
- This means monetary policy cannot be used for other purposes
- That is, the central bank no longer able to control short-run employment and output
- As long as peg, Danes might as well adopt Euro!

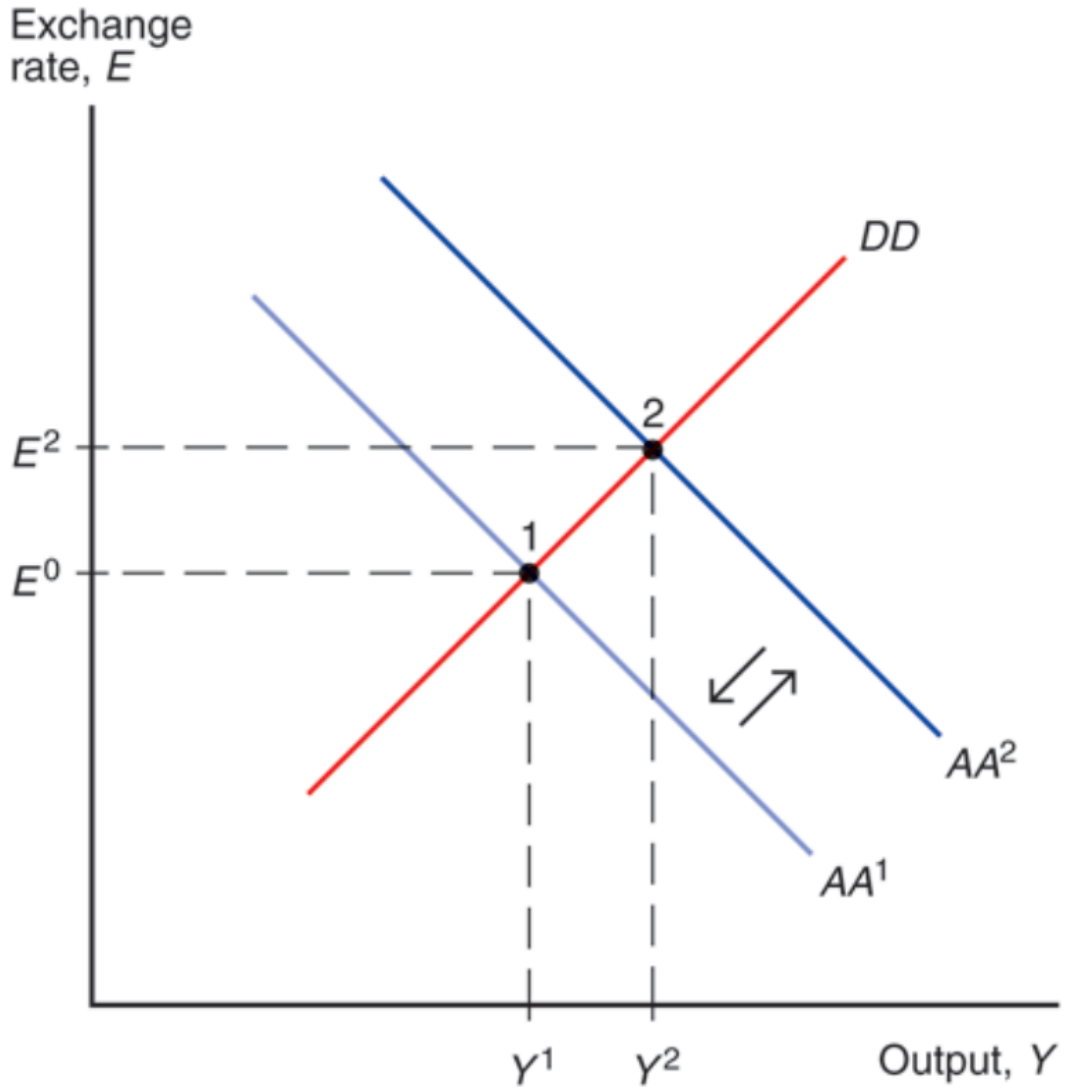
Asset Market Equilibrium with a Fixed Exchange Rate, E_0



Currency peg and monetary policy

- Suppose as in last chapter a temporary decrease in aggregate demand
- Shift DD curve in
- Last chapter: Temporary increase in money supply
- Shift AA curve out, maintain full employment
  - BUT: also depreciate currency!
  - Not possible with a peg

Monetary Expansion Is Ineffective Under a Fixed Exchange Rate



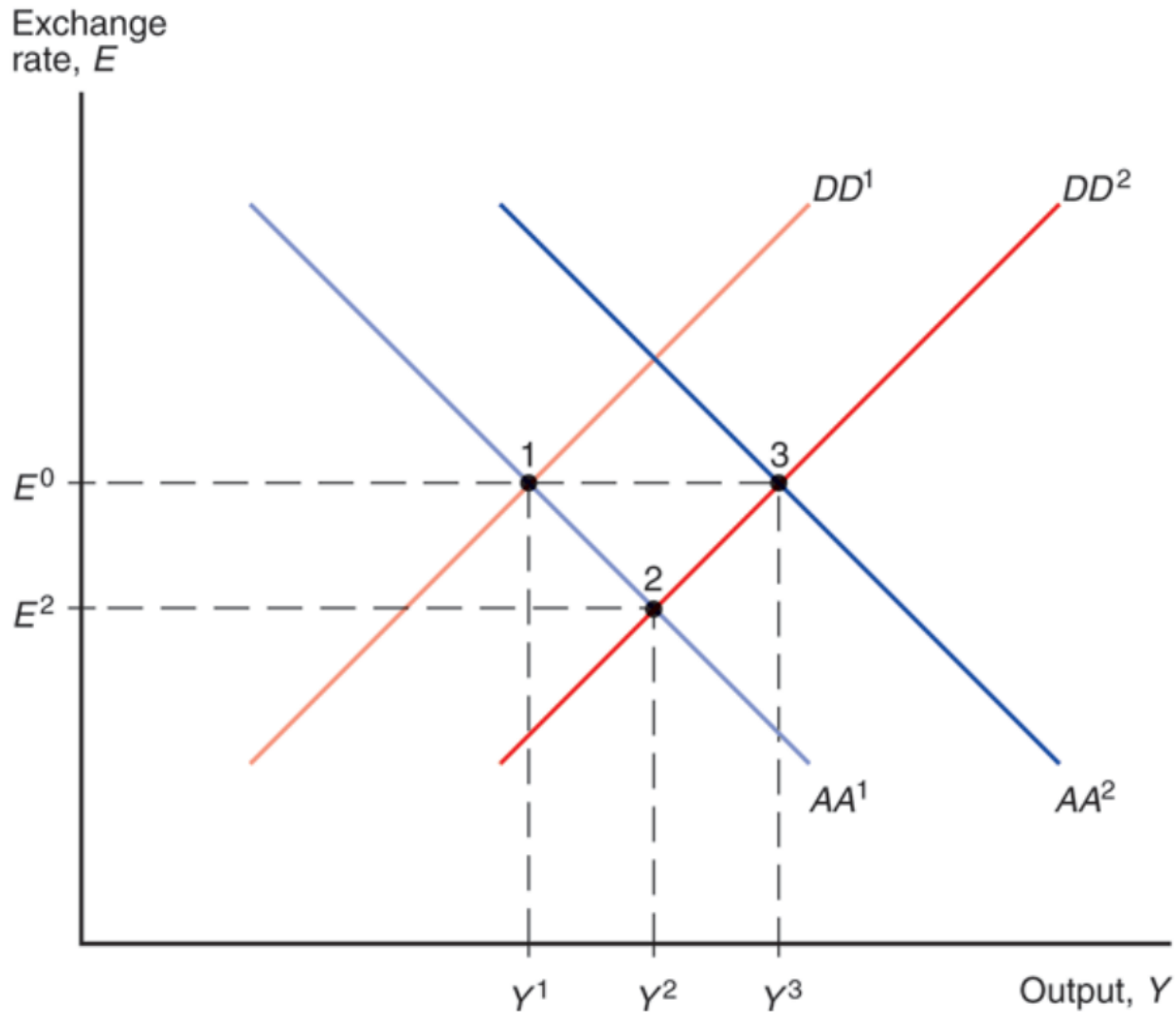
Fiscal Policy and Fixed Exchange Rates in the Short Run

On the other hand, temporary changes in fiscal policy are more effective in influencing output and employment in the short run:

$$\text{if } G \Uparrow (\text{or } T \Downarrow) \Rightarrow D \Uparrow, Y \Uparrow \Rightarrow L(R, Y) \Uparrow \Rightarrow R \Uparrow \Rightarrow E \Downarrow$$

In order to have $E_t = E_0$, central bank must buy foreign assets, thereby increasing the money supply and decreasing interest rates.

Fiscal Expansion Under a Fixed Exchange Rate



Fiscal Policy and Fixed Exchange Rates in the Long Run

- if $\frac{P^*}{P} \Downarrow \Rightarrow q \Downarrow \Rightarrow AD \Rightarrow$ DD curve shifts in
- Why does a rise in the real exchange rate cause an inward shift of aggregate demand?
- P tends to rise until output falls to their normal (potential or natural) level.

Central bank intervenes in the foreign exchange markets:

- AA curve shifts in as prices rise
- Nominal exchange rate is fixed
- Real exchange rate falls

$$Y^f = D(E\frac{P^*}{P}, Y^f - T, I, G)$$

Pause

- How does central bank control the exchange rate?
- A currency peg ties the central bank's hands
  - Monetary policy no longer effective
  - Fiscal policy becomes more effective
- After an intervention, prices rise to return output to long-run level
- Next: Balance of payments crisis

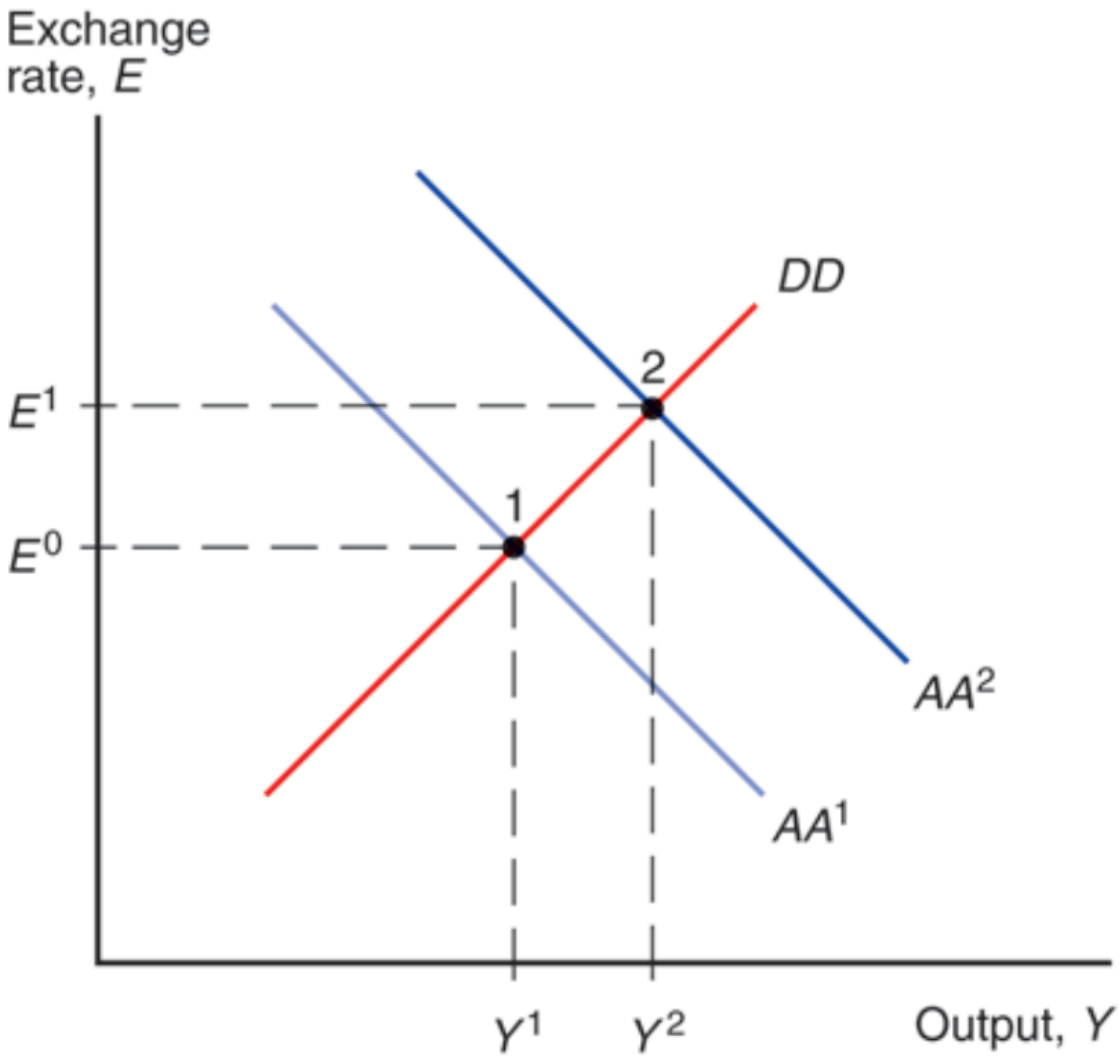
Devaluation & Revaluation

- **devaluation:** a unit of domestic currency is made less valuable, so that more units must be exchanged for 1 unit of foreign currency.
- **revaluation:** a unit of domestic currency is made more valuable, so that fewer units need to be exchanged for 1 unit of foreign currency.
- What do we call a change in currency value under for floating exchange rates?

Devaluation 101

- Devaluation is pretty easy
- Central bank just announces new price of domestic currency
- Moment after announcement:
  - Foreign currency buys more domestic currency from central bank than market
  - People sell central bank a ton of foreign currency
  - Market floods with domestic currency until market adjusts
  - Central bank ends up with large foreign currency reserves

Effect of a Currency Devaluation



Financial Crises and Capital Flight

Balance of payments crisis: central bank does not have enough official foreign reserves to maintain a fixed exchange rate.

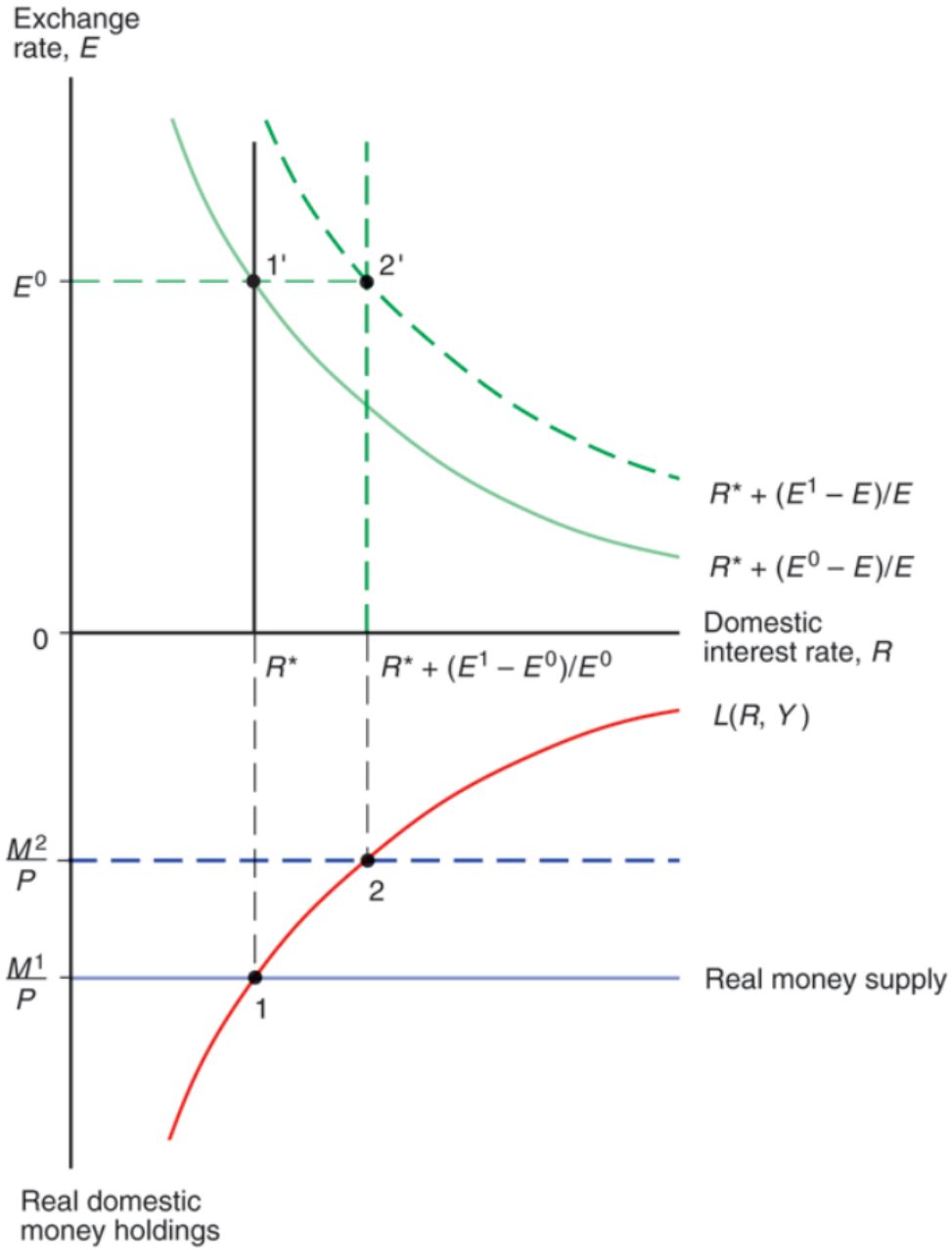
- Basic recipe for BOP crises
  1. Increased pressure on currency to depreciate
  2. Peg maintained by central bank selling foreign reserves
  3. People expect central bank to run out of reserves
  4. Implies future depreciation of domestic currency
  5. Makes people want foreign assets, decreases domestic currency value
  6. Repeat
- Eventually central bank runs out of foreign reserves

BOP Crisis

If investors believe that the domestic currency will be devalued:

- Rush to sell domestic currency
- Sell domestic assets, *capital flight*
  - But real domestic production is ok...
- central bank: $M^s \Downarrow \Rightarrow R \Uparrow$
- $D \Downarrow$, $Y \Downarrow$ employment $\Downarrow$

Capital Flight, the Money Supply, and the Interest Rate



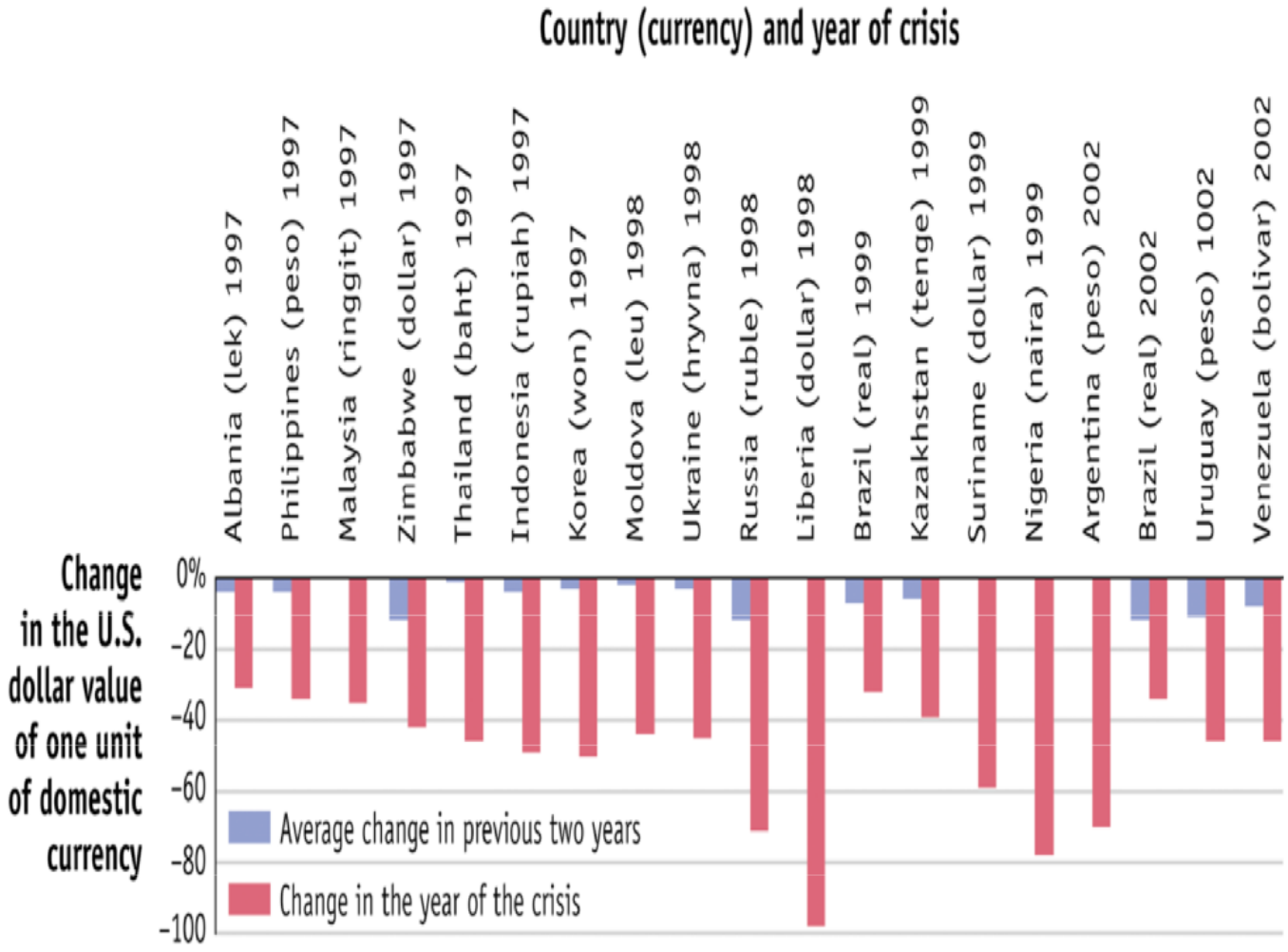
Beliefs

- Expectations of devaluation can cause a devaluation: **self-fulfilling crisis**.
- Modern macroeconomics is driven by belief and expectations
- A short history:
  1. Before 1970, ad-hoc
  2. 1970's: rational expectations revolution
  3. 1980's: sunspots and weird behavior
  4. 1990's: bubbles and noise-traders
  5. 2000's: Rational inattention
  6. Fringe: Agent-based modelling
- Recently lots of criticism, but macro chugs along

When Exchange Rates Misbehave

- **Exchange rate crises** occur when a currency experiences a sudden change in value against another world currencies.
  - Such crises are fairly common, 19 crises 1980-2002
- Crises can have severe economic consequences.
  - Government default
  - Severe changes in lending positions (bank collapse)
  - Contraction in output and decline in real wages
- Also politically embarrassing
  - Countries experiencing crises often seek loans from international development agencies, such as the International Monetary Fund (IMF).
  - Idea: use foreign currency to change money supply

When Exchange Rates Misbehave. Source: IMF, International Financial Statistics.

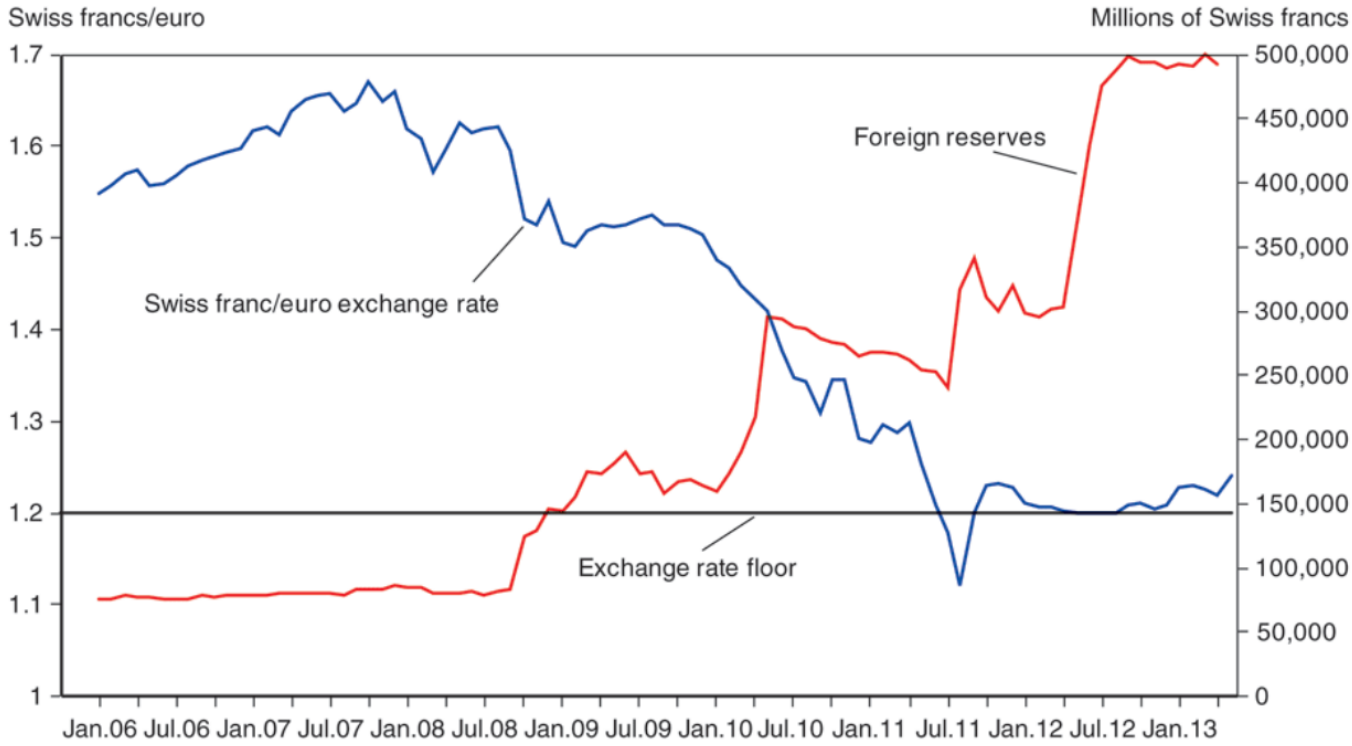


Case Study: Argentina (2001)

- Depreciated to 70% in six months!
- Effect on importers (good? bad?)
- Effect on exporters (good? bad?)

Currency too strong, no worries

- If depreciation pressure, crisis
- If appreciation pressure, no problem
- Just accumulate reserves!



Source: Swiss National Bank.

Pause

- How does central bank control the exchange rate?
- A currency peg ties the central bank's hands
- Balance of payments crisis
- Next: The puzzle of sterilization

Sterilization

- Most rich countries manage a float
- Central bank still makes interventions
- These are usually *sterilized*
- Leave money supply unchanged
- Our model: no change in money supply, no change in exchange rate
- To explain: add difference in foreign and domestic assets

Parity

- *perfect asset substitutability:* If investors are indifferent between holding two assets, the two assets are perfect substitutes
- We used to call this condition something else. . .
- If this condition holds, why buy and sell foreign currency reserves at all?
  - Central bank could just sell T-bills to reduce the money supply
  - Were we being tricky in the balance of payments crisis section?

Goodbye Parity

- Until now: assets differ only in expected returns
- Add another dimension: risk
- Now an investor may be indifferent between:
  - risky asset with high return
  - safe asset with low return
- We no longer have interest rate parity in expected returns!
- *imperfect asset substitutability*

Interest Rate Differentials

We can consider two different types of risk:

1. **Default risk**
2. **Exchange rate risk**

Interest rate parity

$$R = R^* + \frac{(E^e - E)}{E}$$

can be rewritten as

$$R = R^* + \frac{(E^e - E)}{E} + \rho$$

$\Rightarrow$ foreign and domestic deposit become imperfect substitutes

The parameter ρ:

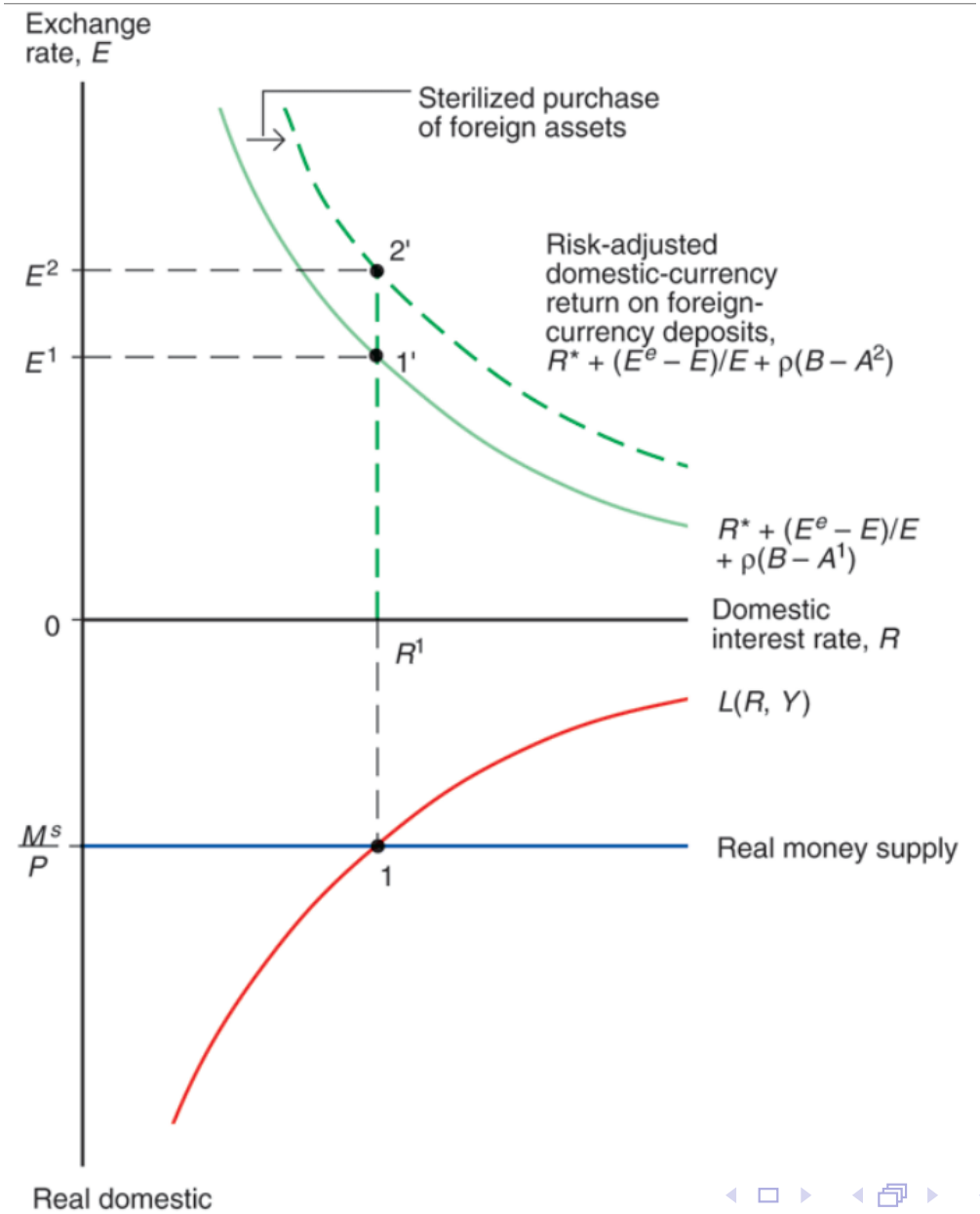
- is the risk premium
- can be default or exchange risk

Risk premium

$$R = R^* + \frac{(E^e - E)}{E} + \rho$$

- Assume that risk premium increasing function of domestic government bonds held by private sector
- Fixing R^* and exchange rates, why does R need to increase if domestic government bonds increase?
- Let B be the total amount of government bonds available
- Let A be the Central banks holdings of government bonds
- We assume that ρ is increasing function of $B - A$

Effect of a Sterilized Central Bank Purchase of Foreign Assets Under Imperfect Asset Substitutability



Empirical evidence on sterilized exchange rate interventions

- No strong evidence that sterilized interventions actually affect exchange rates
- However, interest rate parity is violated
- May be a signaling effect of government interventions
  - Steralized intervention tells market what government is trying to do
  - Chandler Lutz researches the effect of government announcements on bond prices

Types of Fixed Exchange Rate Systems

1. **Reserve currency system:** one currency acts as official international reserves (Bretton Woods, 1944-1973)
2. **Gold standard:** gold acts as official international reserves that all countries use to make official international payments (1870-1914, 1918-1939)
3. **Gold exchange standard:** a system of official international reserves in both a group of currencies (with fixed prices of gold) and gold itself.
4. **Bimetallic standard:** the value of currency is based on both silver and gold.

- Talk a little about 1. and 2.

Reserve currency system

- All countries fix exchange rates to one currency
- Implies that all exchange rates are fixed
- The country that has the currency is priveleged
  - Prices are normalized, so one currency is free to change real value
  - This reserve currency can then be used for monetary policy
- The unfairness of a dollar reserve currency lead to the end of Bretton Woods

Gold

- If all currencies fixed to gold, no privelege
- Natural limit on monetary policy
  - Popular among American fiscal conservatives after 2008
- But there are some problems:
  1. Gold is commodity money, wasteful
  2. Monetary policy determined by gold market
  3. Growing world requires growing gold
  4. Gives power to countries with natural gold resources

Chapter 19. A Short History of the International Monetary System

Goals of Macroeconomic Policy

Internal balance:

- Full employment of factors
- Price level stability

External balance

- Don't borrow too much
- Don't lend too much

Goals of Macroeconomic Policies: Full employment

- Suppose some shock causes temporarily low demand
  - Harm from unemployment is clear
- Suppose some shock causes temporarily high demand
  - Quick depreciation of capital
  - Contractual agreements cause too little leisure

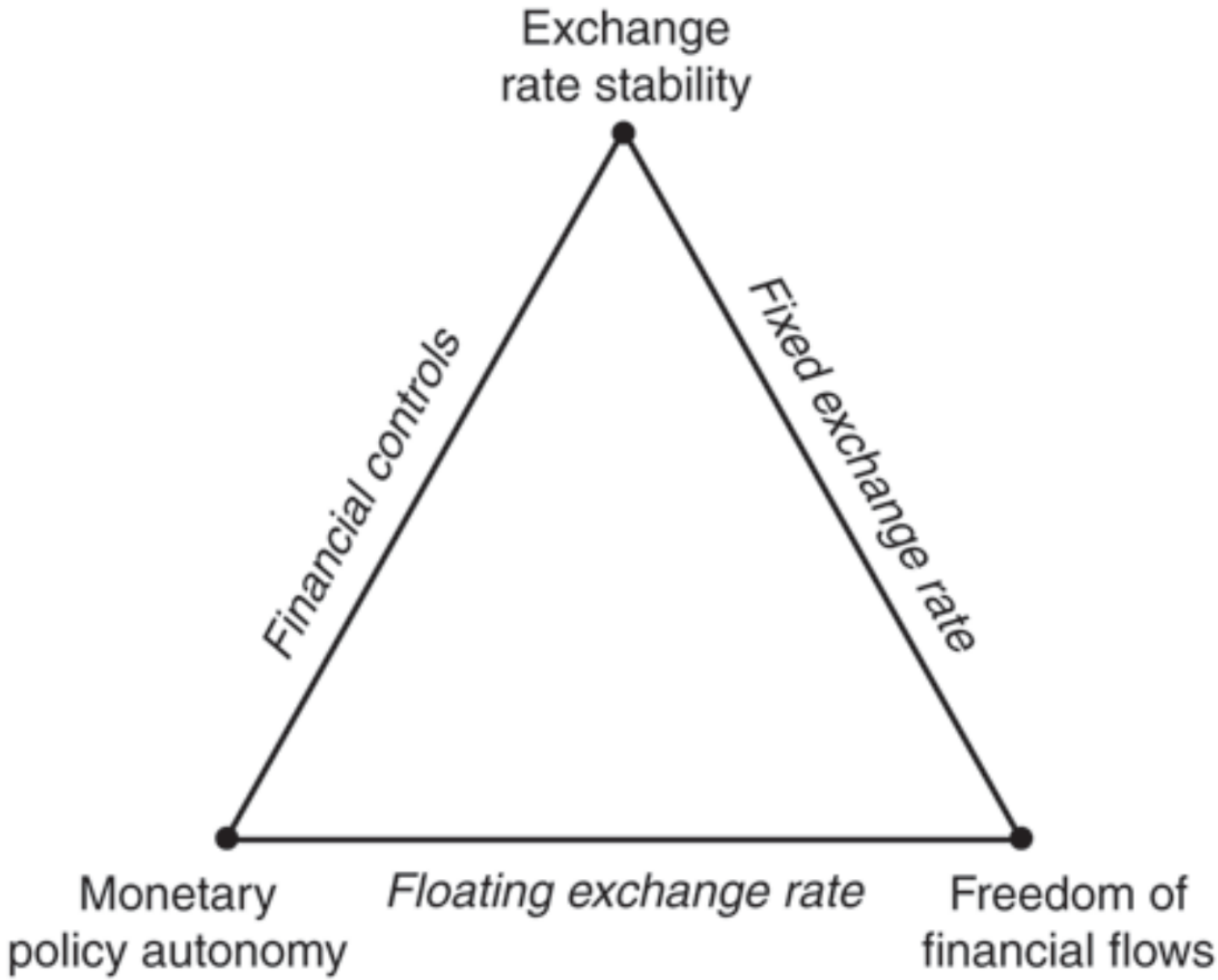
Goals of Macroeconomic Policies: Price stability

- Unexpected inflation
  - Transfer to borrowers
- Unexpected deflation
  - Transfer to lenders
- Both bad

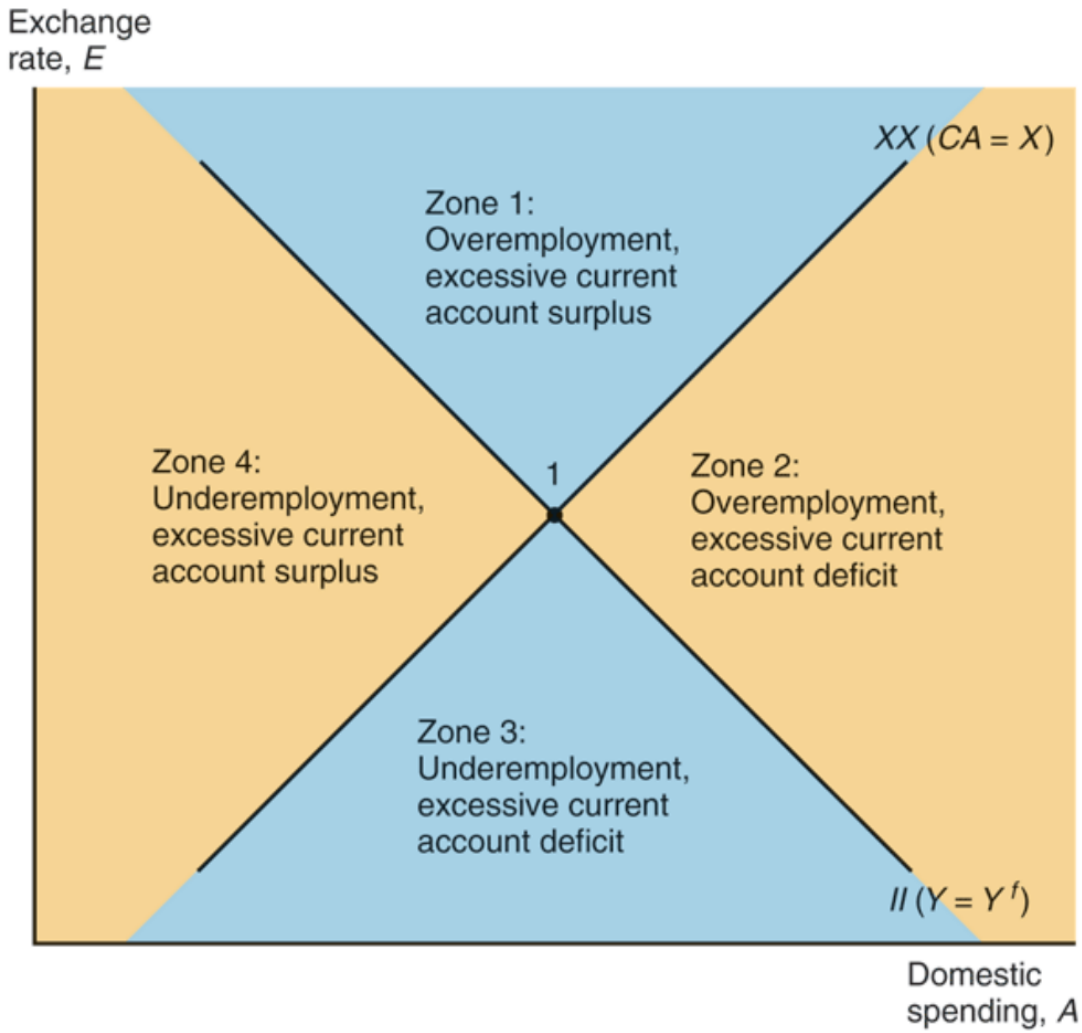
Goals of Macroeconomic Policies: Reasonable Current Account Deficit

- We do want countries to borrow and lend: smooth consumption
- Too much borrowing:
  - Countries find it hard to meet debt obligations
  - Countries find further funding hard to come by
- Too much lending:
  - Vulnerable to default
  - Capital leaving the country, spillovers

The Policy Trilemma for Open Economies



Internal Balance (II), External Balance (XX), and the "Four Zones of Economic Discomfort"



Summary

Chapter 18:

- Balance sheets of central banks
- Fixed exchange rate
- Monetary and fiscal policies under fixed exchange rates
- Financial crises and capital flight
- Interest rate differentials
- Types of fixed exchange rate systems

Chapter 19:

- Goals of macroeconomic policies

- Now for some problems