Econ 352 - Money in the Open Economy

(See Williamson Ch. 17)

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Introduction

- We now have international trade
- In some sense, just our same model from Chapter 11, with international demand bolted on
- Rather than r determined by Y^d and Y^s, total Y^d is set by world r, and domestic Y^d determines current account surplus/deficit
- But no money yet (no exchange rates!)
- We want to add in a little international finance & money

Exchange Rates and Purchasing Power Parity

- Now, there are two currencies (dollar and Euro, for instance)
- Foreign goods sell at P^* (foreign currency), while domestic goods sell at P (domestic currency)
- We can exchange one unit of foreign currency for e units of domestic
- For instance, 1 British pound is 0.87 USD.
- If you use dollars to buy foreign goods, then the cost to you in dollars is eP^*.
- Dimensions:

$$e = \frac{\text{Domestic Currency}}{\text{Foreign Currency}} \qquad P^* = \frac{\text{Foreign Currency}}{\text{Good}}$$

$$P = \frac{\text{Domestic Currency}}{\text{Good}}$$

Dimensional Analysis

- Dimensions:

$$e = \frac{\text{Domestic Currency}}{\text{Foreign Currency}} \qquad P^* = \frac{\text{Foreign Currency}}{\text{Foreign Good}}$$

$$P = \frac{\text{Domestic Currency}}{\text{Domestic Good}}$$

- So, the nominal exchange rate:

$$eP^* = \frac{\text{Domestic Currency}}{\text{Foreign Currency}} \frac{\text{Foreign Currency}}{\text{Foreign Good}} = \frac{\text{Domestic Currency}}{\text{Foreign Good}}$$

- And we can calculate the real exchange rate:

$$\text{Real Exchange Rate} = \frac{eP^*}{P} = \frac{\frac{\text{Domestic Currency}}{\text{Foreign Currency}} \frac{\text{Foreign Currency}}{\text{Foreign Good}}}{\frac{\text{Domestic Currency}}{\text{Domestic Good}}}$$

$$= \frac{\text{Domestic Good}}{\text{Foreign Good}}$$

Exchange Rates

- So the nominal exchange rate, eP^* is how many dollars you have to give up to get one foreign good
- The real exchange rate, $\frac{eP^*}{P}$, is how many domestic goods you have to give up to get one foreign good
- Assuming we are comparing like goods, you should be indifferent between foreign & domestic!
- If $eP^* > P$, then buy only domestic
- If $eP^* < P$, then buy only foreign
- Thus it must be that $P = eP^*$

The Law of One Price

- If $P = eP^*$, we say that "purchasing power parity" holds (the power of your dollars is same in domestic and foreign markets)
- Sometimes called the "law of one price" (good shouldn't be more expensive in one country than another!)
- Some "violations" of PPP make sense: some goods are expensive to ship, or are non-tradable, or are domestically subsidized/taxed/regulated
- So should be true for highly liquid/tradable goods (like oil), but not for things like haircuts
- **To be clear**: PPP **does not** hold in reality, but it is a good predictor of where things are going over a longer time horizon

Flexible and Fixed Exchange Rate Regimes

- There are, broadly, two types of exchange rate regimes
- "Fixed" exchange rates, in which a country tries to keep e constant (
- And "flexible" exchange rates, in which e is allowed to be determined by the market
- Fixed exchange rate regimes take on several flavors:
  - "Hard pegs," in which a country sets the exchange rate for the longer term
  - "Soft pegs," in which no long term commitment is set, so periodic changes in e are allowed
- Let's talk about implementation of pegs: how do you fix the exchange rate?

Hard Pegs

- Three big ways to (hard) fix your exchange rate to the USD (for instance):
  - Dollarize: Ecuador, El Salvador, Panama, Zimbabwe, the British Virgin Island, and several other small countries do not have their own currency and simply use the dollar (disadvantage is seniorage)
  - Currency board: have a centralized institution that holds US assets (in dollars), and exchanges dollars for domestic currency at the set rate (Hong Kong)
  - Currency Union: have all countries adopt a common currency, such as in the European Monetary Union (Euro)

Soft Pegs

- Soft pegs might allow for bands
- For instance, before the Euro, and after a fixed exchange rate (Bretton Woods) was abandoned, European countries agreed to fix their currencies within a $\pm 2.25\%$ band around the USD
- This created a "tunnel" around which the currencies could fluctuate
- But that allowed too much distance between European countries, so they also set a "snake in the tunnel" which said that bilateral values shouldn't trade by $\pm 2.25\%$ from one another
- International Monetary Fund coordinates some currency exchange and lending, with strings attached
- We'll talk more about how to control in a minute!

Monetary Small Open Economy with Flexible Exchange Rates

- This will look like our NK model with money, but now we'll also have $P = eP^*$ and trade/global r fixed:

$$Y = C + I + G + NX$$

$$P = eP^*$$

- The nominal interest rate is fixed by the Fisher relation: $R = r + i$
- We have standard Y^s and Y^d from before, plus money demand in **both** countries:

$$M^d = PL(Y, r^*)$$

- Given PPP, we get:

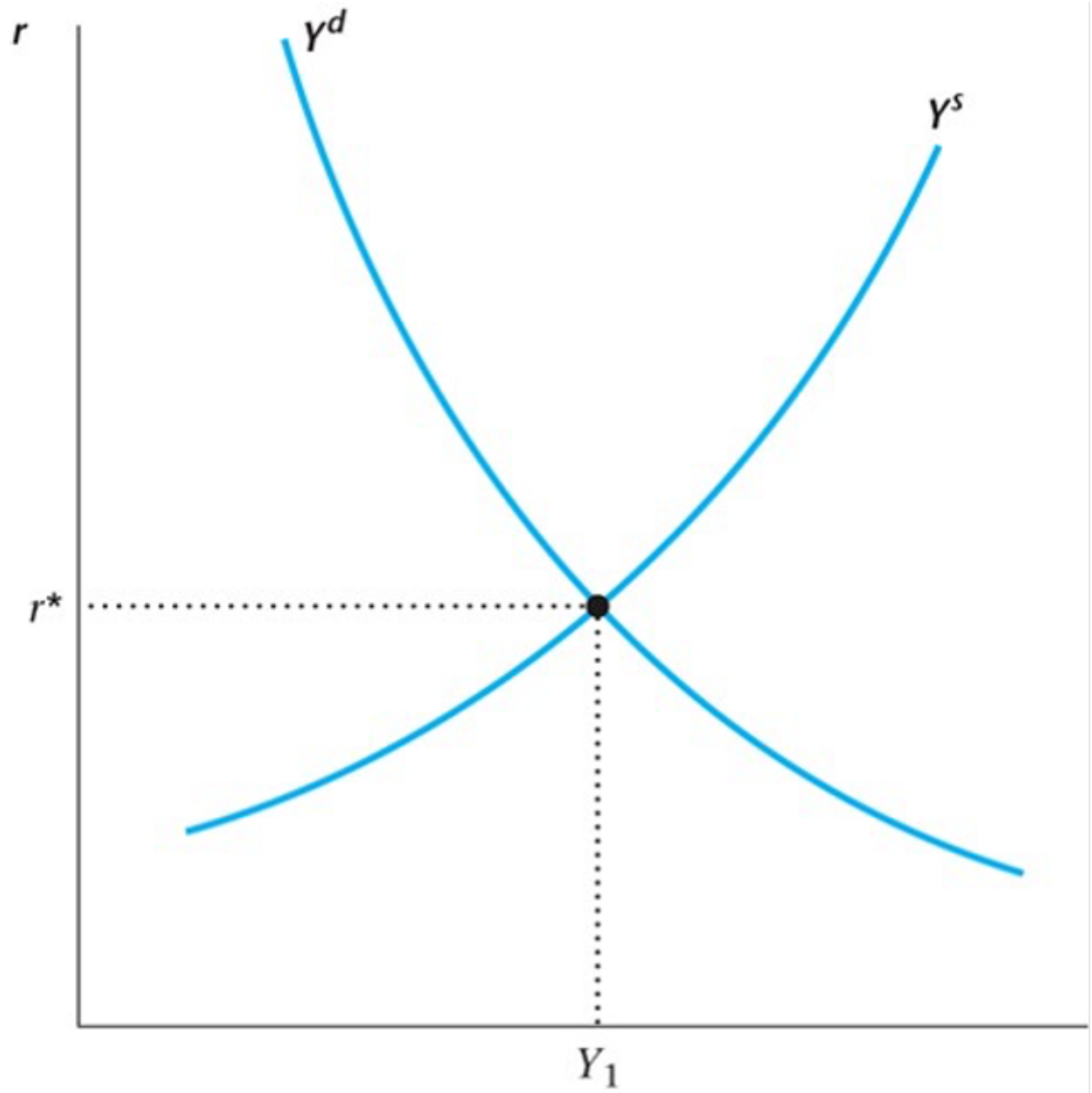
$$M^d = eP^*L(Y, r^*)$$

- In equilibrium:

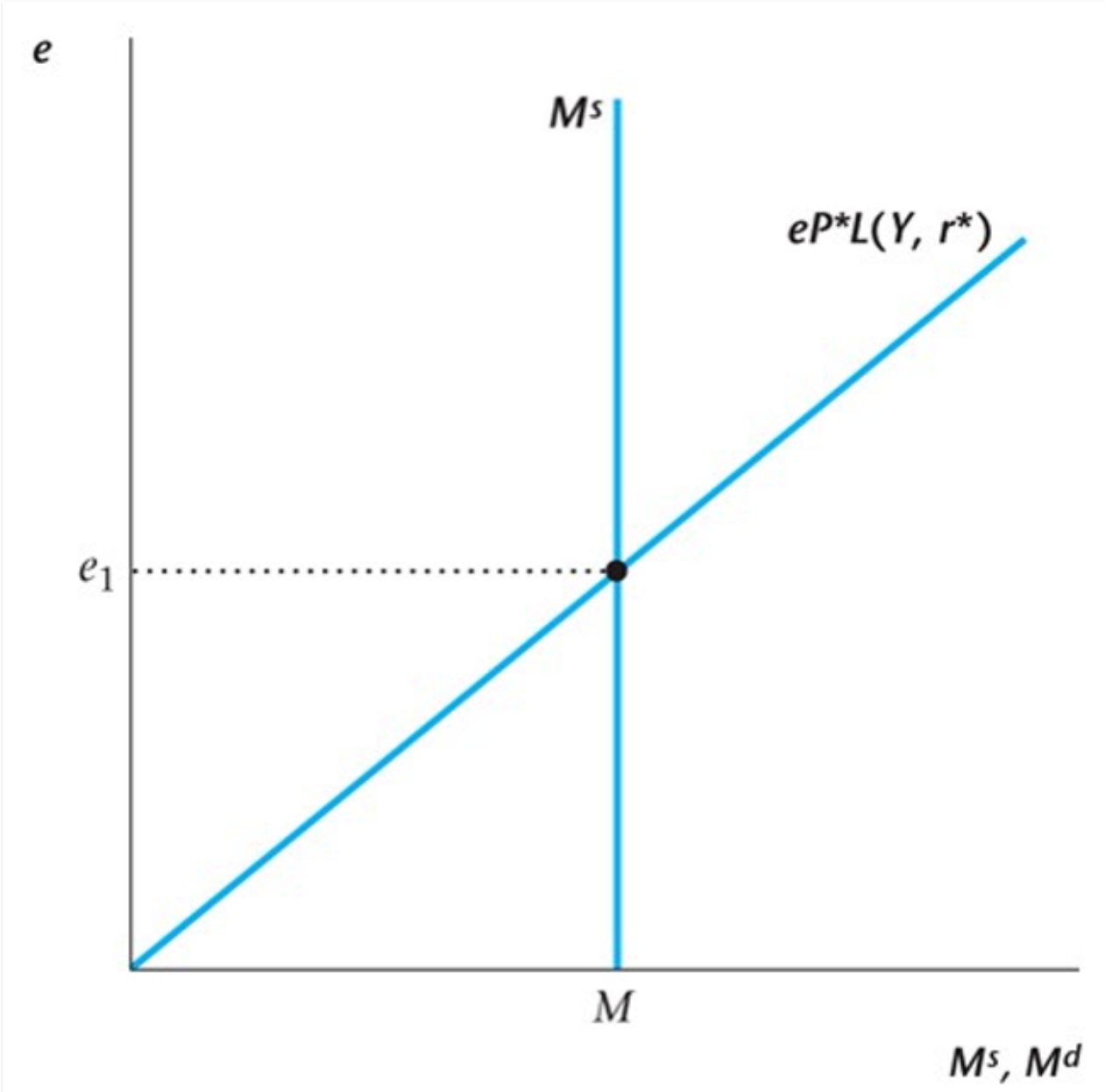
$$M = eP^*L(Y, r^*)$$

- Exchange rate is determined by money supply, like price level

Goods Market in the Monetary Small Open-Economy Model



Exchange Rates Set by Money Supply & Demand



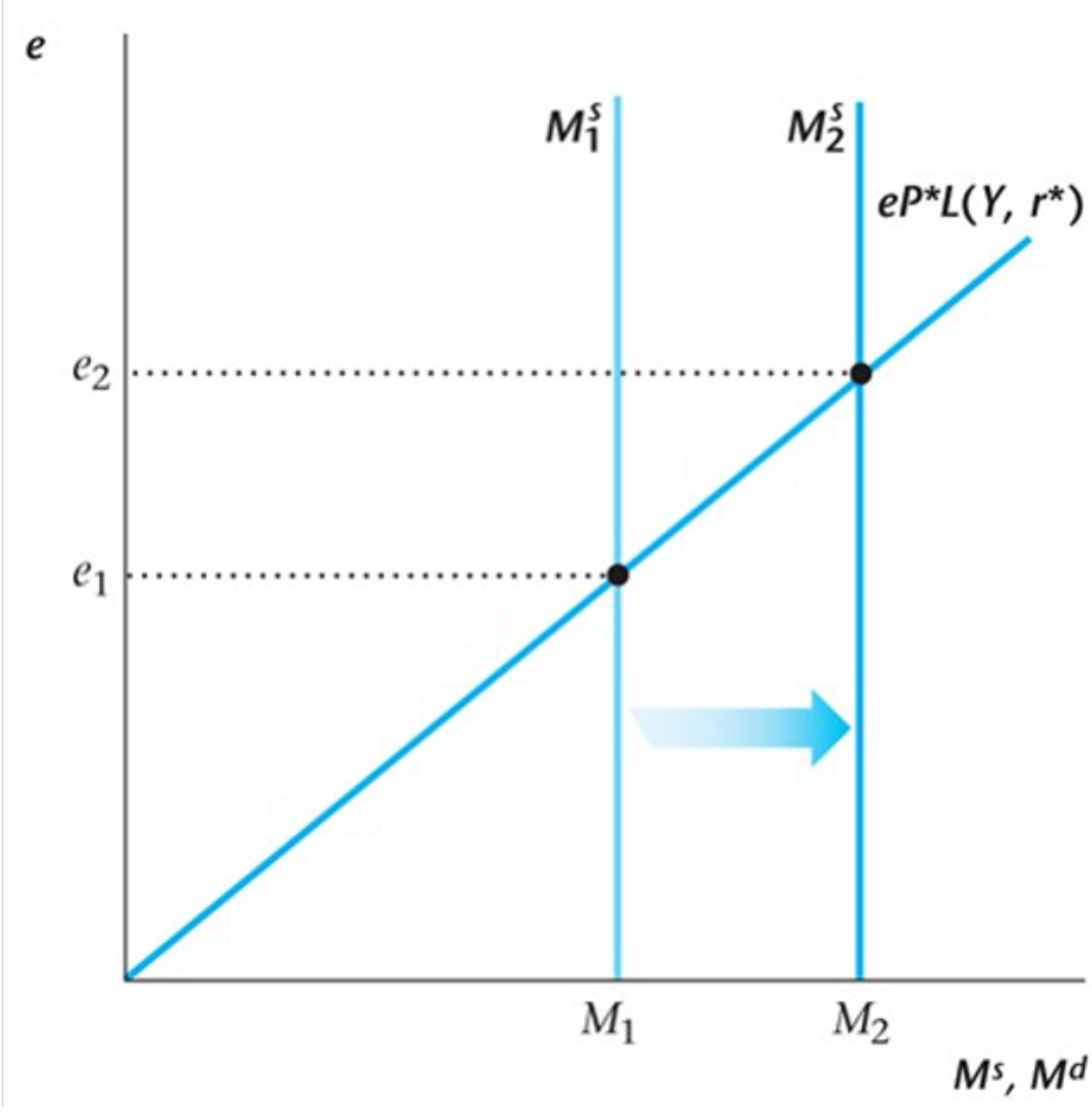
Experiment 1: Increase to M with Flexible Exchange Rates

- What happens if we increase the money supply 1% from M_1 to M_2?
- As before, P increases by 1%
- $e = \frac{P}{P^*}$, so the exchange rate increases by 1%
- Domestic currency "depreciates" (can buy less of foreign currency) but real exchange rate is fixed
- Could see it from:

$$\frac{M}{e} = P^* L(Y, r^*)$$

- If P^*, Y, r^* fixed, then M/e is fixed
- Note that right now we have flexible prices! Sticky prices coming soon.

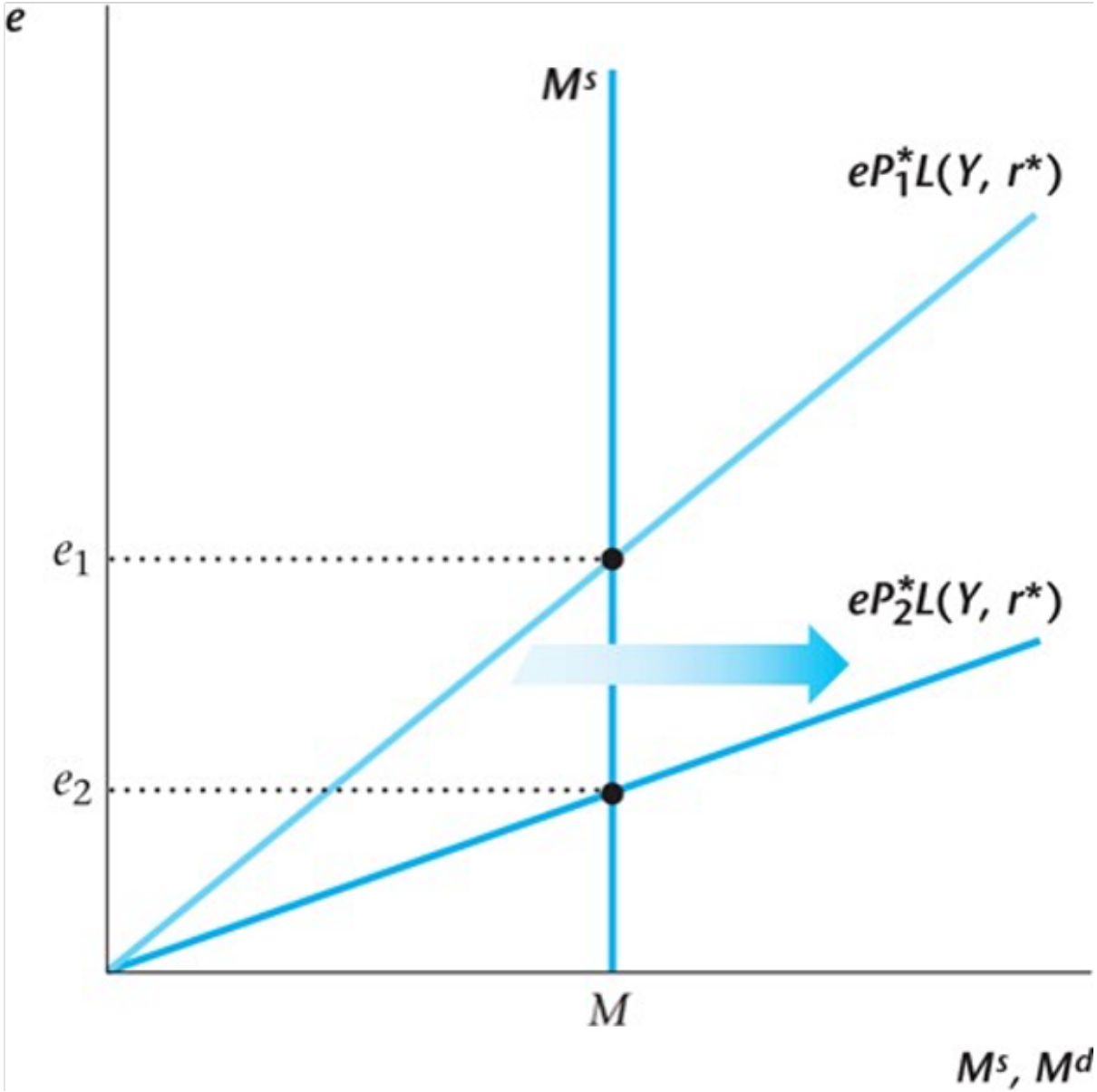
Exchange Rates Set by Money Supply & Demand



Experiment 2: Increase to P^* with Flexible Exchange Rates

- We saw what happens when M increases
- What if in the foreign country, P^* increases (say because M^* increased)
- Then eP^* increases (clockwise shift in money demand)
- A fall in the exchange rate
- $\frac{M}{P} = L(Y, r^*)$ doesn't change, so $e = \frac{P^*}{P}$ determines e

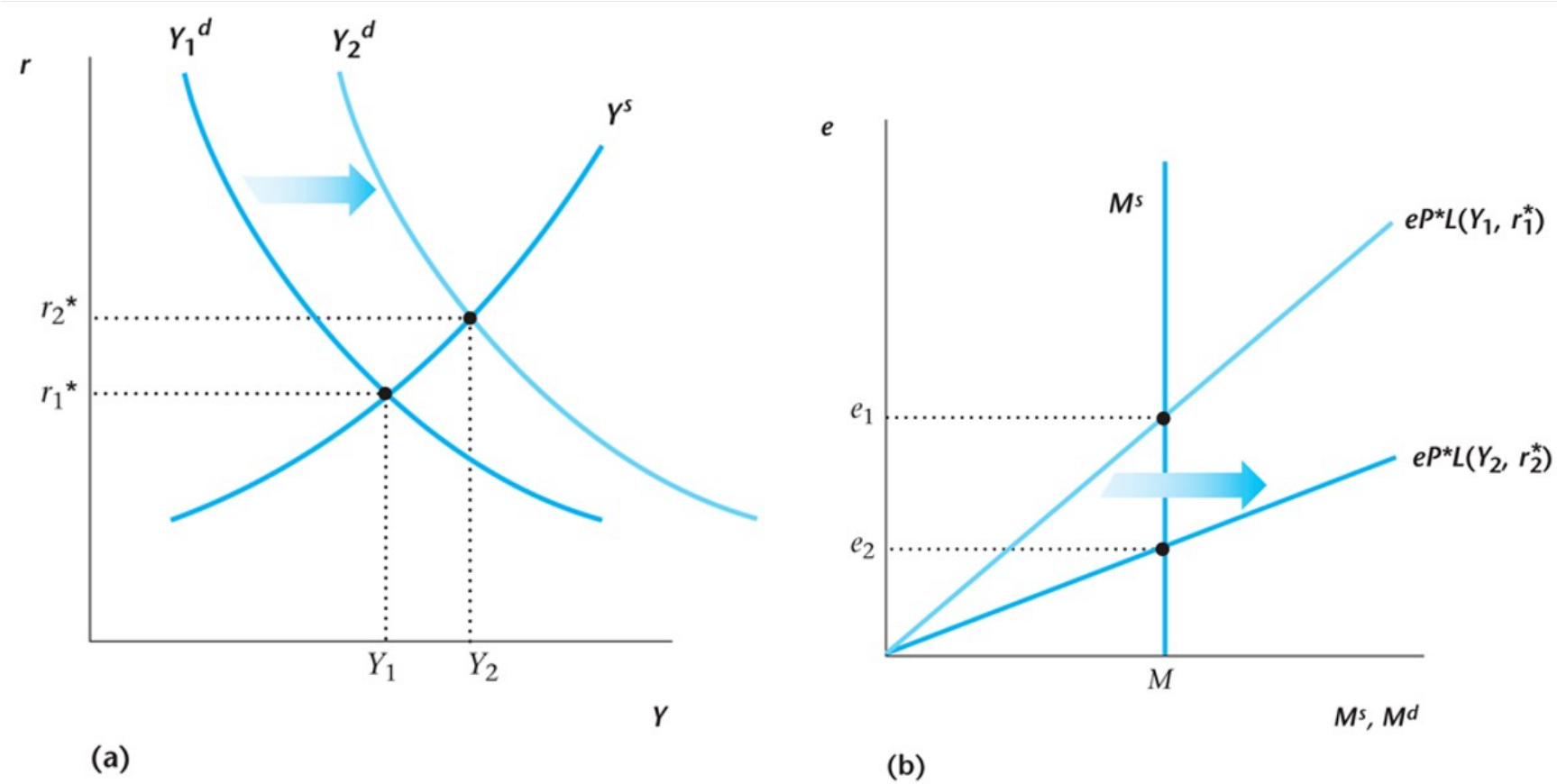
Experiment 2: Increase to P^* with Flexible Exchange Rates



Experiment 3: Increase in world real interest rate

- Now let's say global real interest rates increase from r_1^* to r_2^*
- Y^d shifts out, Y^s shifts out (not depicted) but total production rises
- Increase in interest rates causes a decline in consumption and investment, though increase in income might rise consumption
- As r^* increases, output increases, so real money demand increases (assuming income effect ¿ interest rate effect)
- If money demand increases, while money supply stays same, then exchange rate should fall (dollar more valuable)

Experiment 3: Increase in world real interest rate



Pivoting to Fixed Exchange Rates

- Now we pivot to fixed exchange rates
- Difference is that now, central bank is going to fix e
- Specifically, government says it will buy or sell foreign currency at a given price (must have foreign currency to do so!)

Assets	Liabilities
Foreign Exchange Reserves	Outside Money
	Interest-Bearing Government Debt

- If desired exchange rate is 1 dollar for 1 pound, but market wants 1 dollar for 0.5 pounds ("too few" pounds, so they're more valuable), UK should sell pounds and buy dollars to depreciate (easy)
- If desired exchange rate is 1 dollar for 1 pound, but market wants 1 dollar for 2 pounds ("too many" pounds, so they're not valuable enough) then UK should buy bounds and sell dollars to appreciate (hard!)

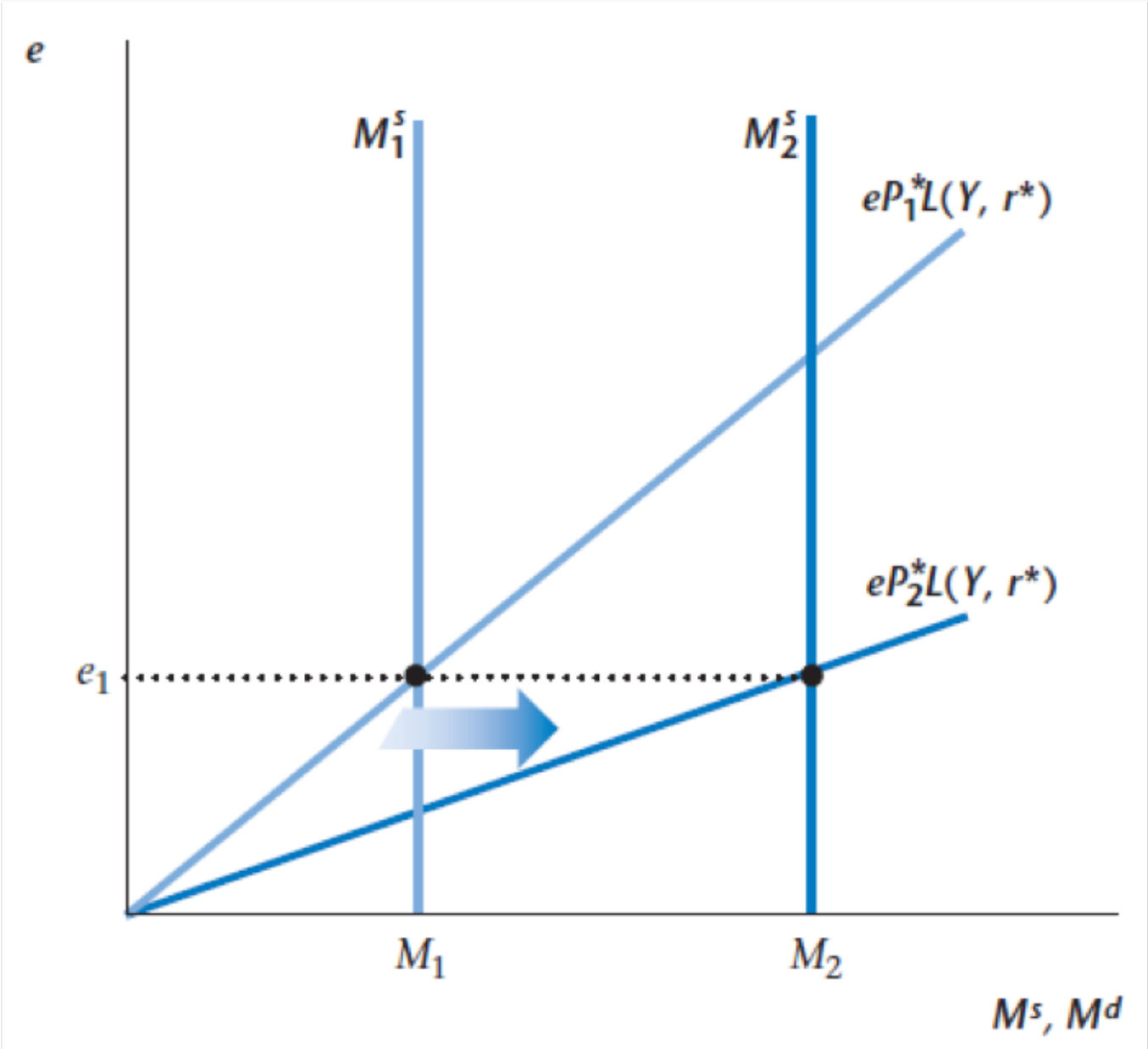
Fixed Exchange Rates

- Perhaps an easier way to see this is with money supply & demand
- To fix exchange rate, foreign country must adjust money supply
- Loses control of M if it uses it to fix e
- Now we can analyze: rather than P and P^* determining e, fixed e will determine M

Experiment 1: An Increase in the Foreign Price Level (fixed exchange rate)

- Say that P^* increases, and we're trying to fix our exchange rate to that country's currency
- If $P = eP^*$, and P^* increases, e fixed, then it must be that P increases
- To increase P, we must increase M

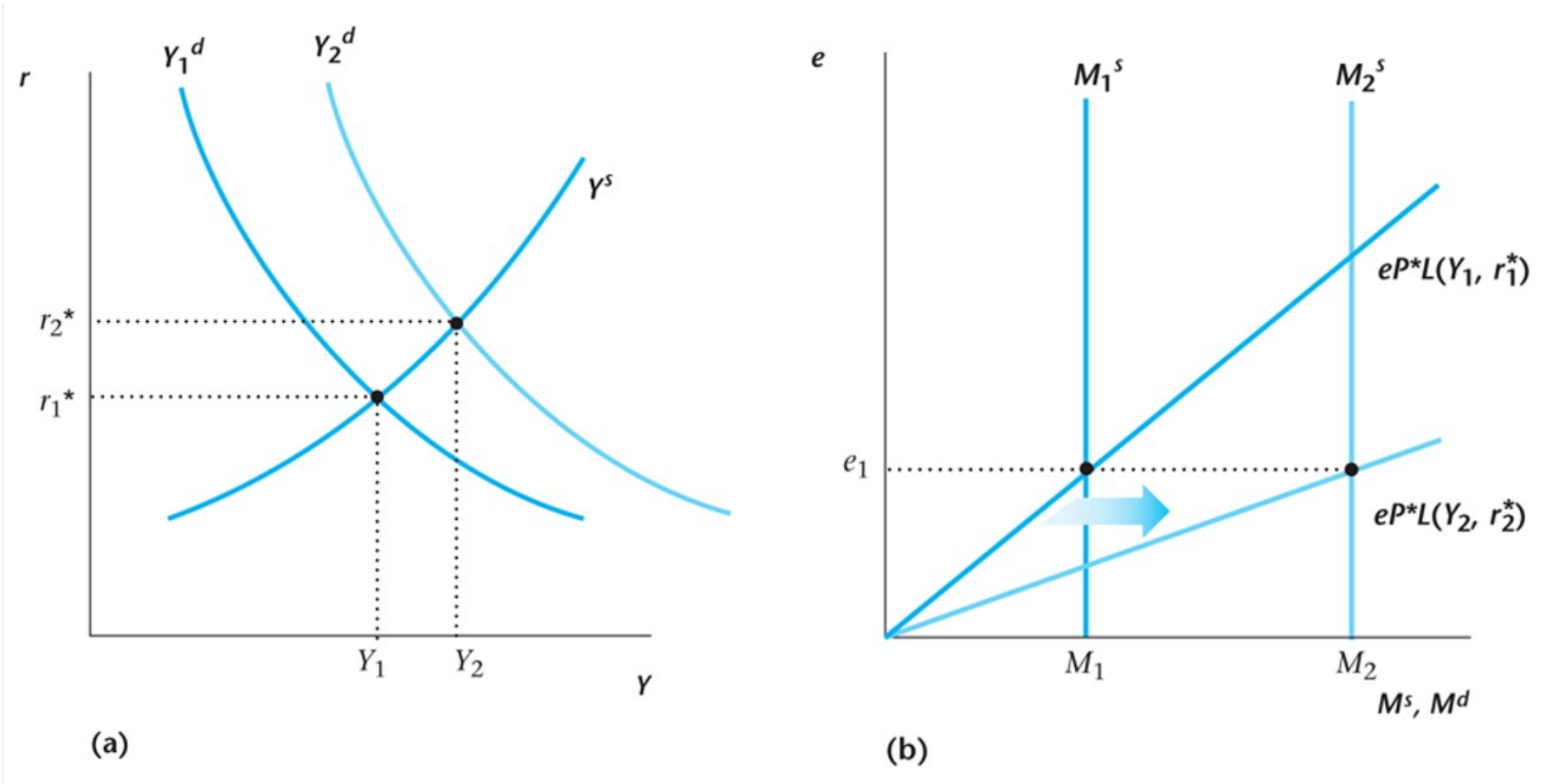
Experiment 1: An Increase in the Foreign Price Level (fixed exchange rate)



Experiment 2: A real foreign shock (fixed exchange rate)

- Now let's say that r_1^* increases to r_2^*
- We again have an increase in domestic output, decrease in investment, ambiguous affect on consumption, and increase in CA
- But recall that $eP^*L(Y_1, r_1^*)$ increases to $e(P')^*L(Y_2, r_2^*)$
- It must be that M increases to offset increased domestic demand for currency

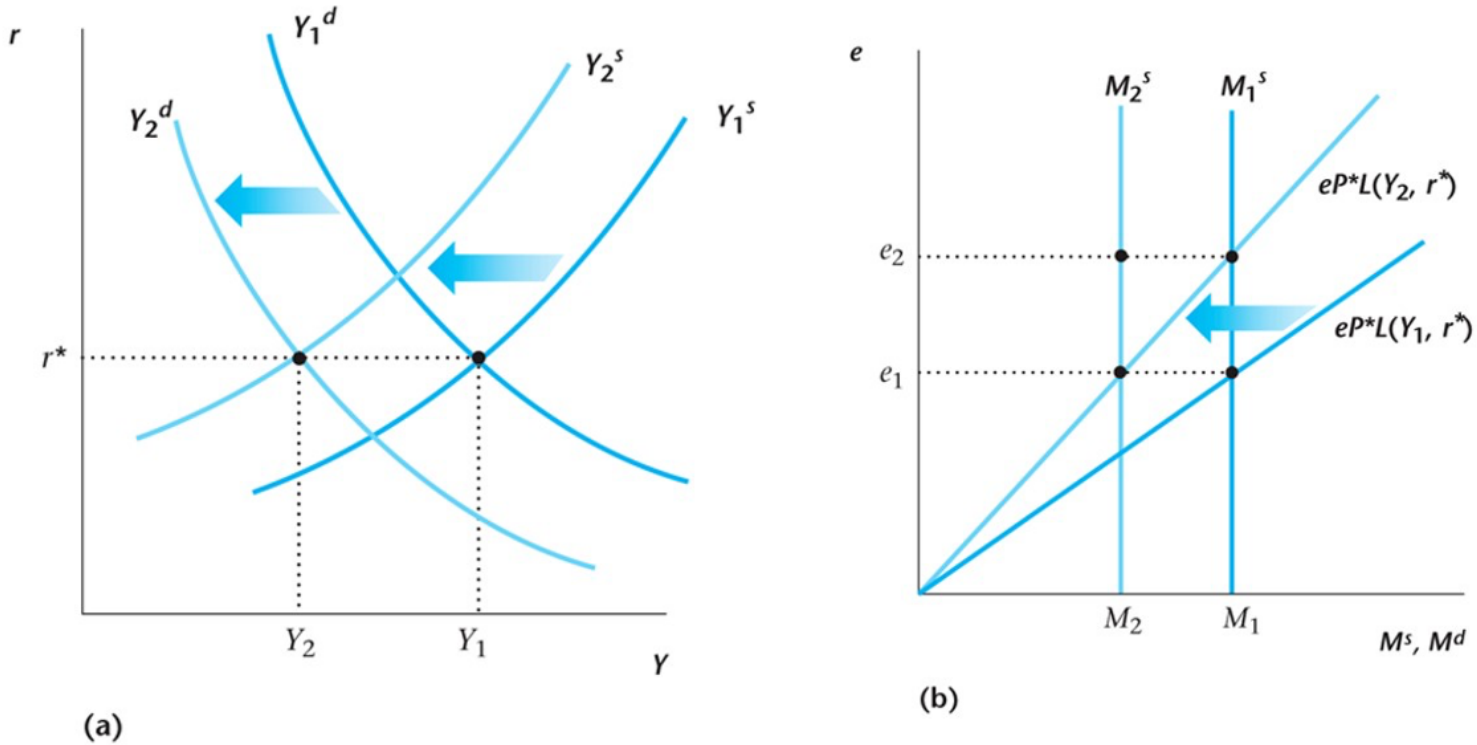
Experiment 2: A real foreign shock (fixed exchange rate)



Experiment 3: Devaluation

- What happens if the economy is hit with a negative productivity shock?
- Normally, the exchange rate would rise (local prices rise)
- To fight inflation/exchange rate appreciating, government would have to shift in money supply
- But this is expensive! Government has to buy back money.
- So tension between desire to keep e and desire to not lose money via $M_1 \to M_2$, $M_2 < M_1$.

Experiment 3: TFP shock–devaluation, or defend?



Flexible vs. Fixed Exchange Rates

- What's better, a flexible or a fixed exchange rate?
- Flexible exchange rate helps absorb nominal shock in a foreign price level, stabilizes domestic prices
- But fixed exchange rate means real shocks from abroad have a small effect on local price level, by acting as shock absorber
- Flexible exchange rate means you have control over your own monetary policy–could be good or bad!

Balance of Payments

- We need to understand the capital account & balance of payments, so we can talk about capital controls
- When foreigners buy a U.S. asset, it is a positive capital inflow, when a U.S. citizen buys a foreign asset, it is a capital outflow
- If funds flow into your country to buy assets, it's an inflow.
- Balance of payments is current account surplus plus capital account surplus:

$$BP = KA + CA$$

- Balance of payments should always be zero:

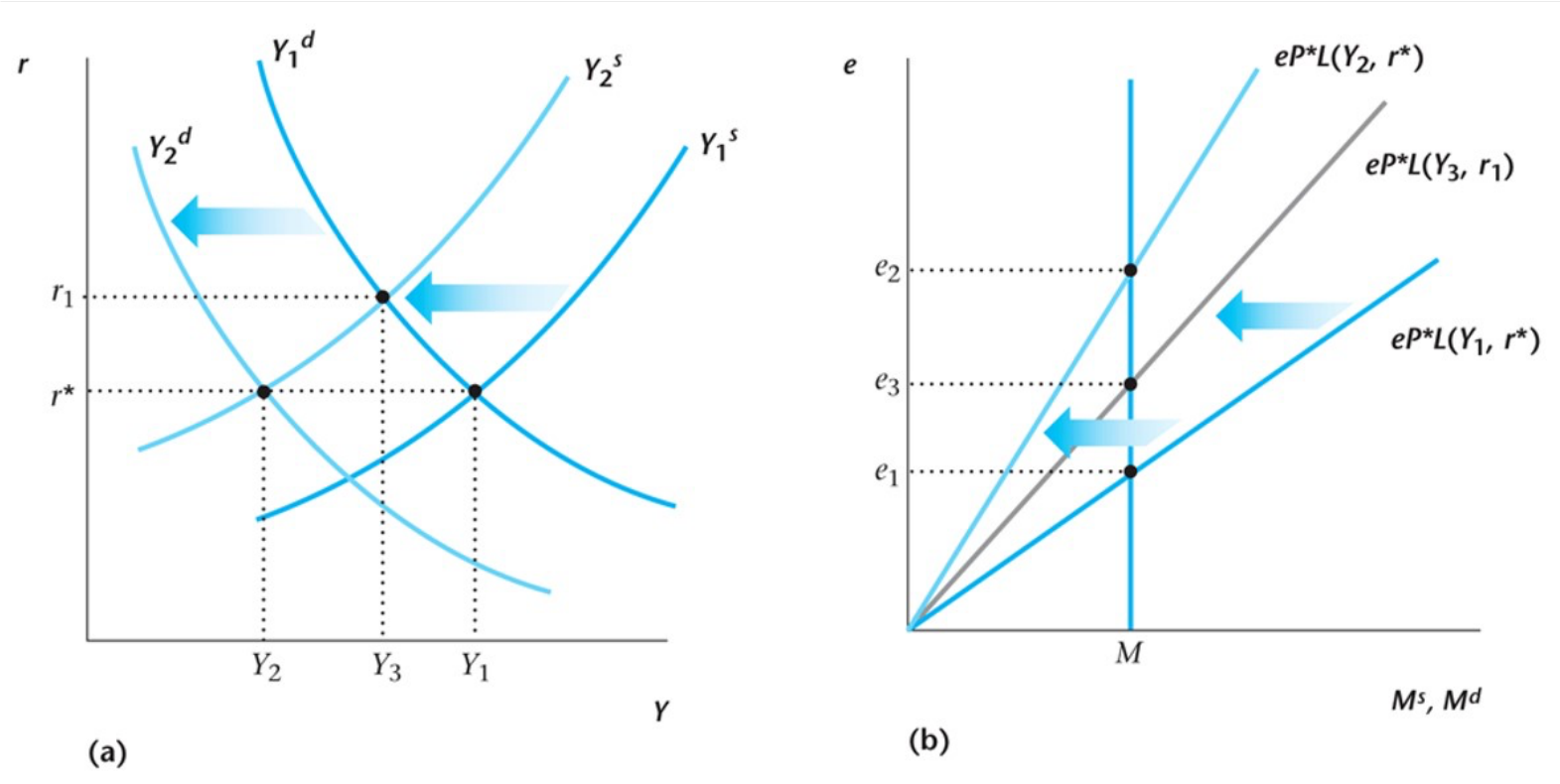
$$KA = -CA$$

- Idea is that if a country is sending you things on net (I get an iPhone, but send them no good or service back), then it must be that I owe them something (they have an asset in this country, possibly debt, or cash).

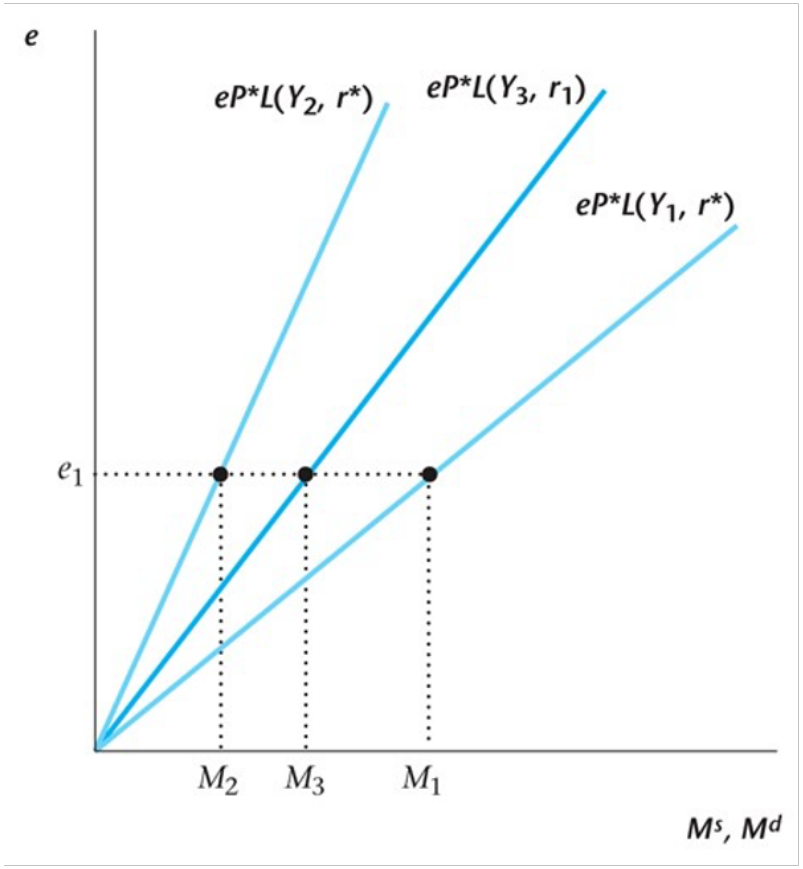
Capital Controls

- Now, it might make sense how capital controls affect trade!
- $KA = -CA$
- Say we're hit with a decrease in TFP, so Y^s falls
- If r is fixed, then total demand falls until equilibrium r is the global r, total income falls
- But if trade is banned, and r is flexible, then Y^d doesn't fall, so total Y doesn't fall by as much
- Another way of thinking about it: if our economy less productive, if we can trade we can smooth consumption by importing rather than making things inefficiently at home, going into debt. If we're banned from trading, economy "sucks it up" and works more than if it had debt available.

Capital Controls (Flexible e)



Capital Controls (Fixed e)



Economy otherwise similar to flexible e: capital controls reduce fall in Y

Capital Controls in Practice

- Controlling capital is hard
- Example from Chile: any time you purchased Chilean assets, you had to hold some of it at the Bank of Chile, at no interest
- But investors just avoided the controls (many clever schemes)

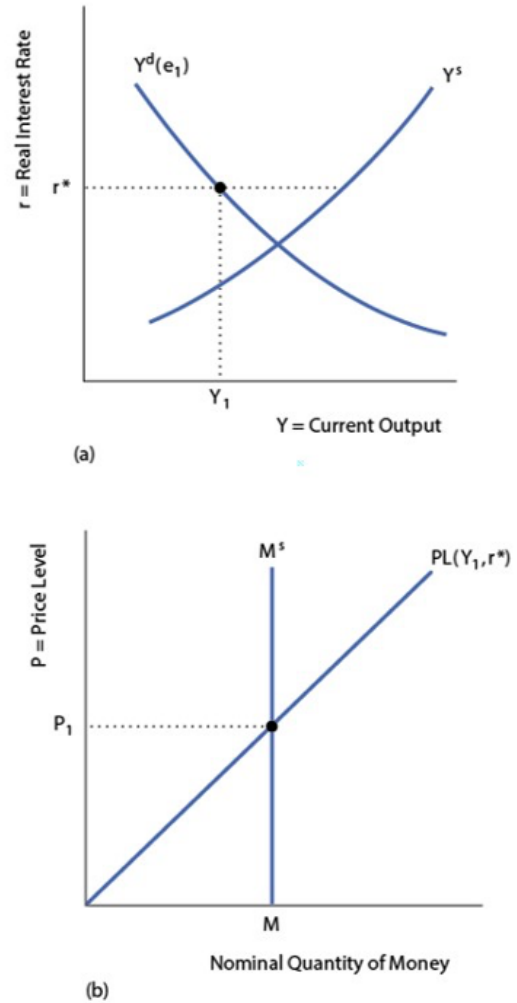
Net Export Demand

- Now we want to combine our New Keynesian model with our trade model
- Some goods made domestically, some internationally, but both are *imperfect substitutes* for one another
- Net exports is a positive function of the real exchange rate: $NX\left(\frac{eP^*}{P}\right)$
  - When takes more dollars buy less foreign currency ($e \uparrow$), export more/import less
  - When foreign prices are higher ($P^* \uparrow$), export more/import less
  - When local prices are higher ($P \uparrow$), export less/import more
- Real exchange rate: when I give up fewer local goods to buy foreign goods, I do so

A New Keynesian Sticky Price Open-Economy Model

- Now, P_1 is fixed, r^* is fixed (globally) and M^s is fixed
- Money market determines Y $M^s = PL(Y, r)$, but M^s, P, and r are set, so Y moves to clear money supply=money demand

New Keynesian Model with Flexible Exchange Rate

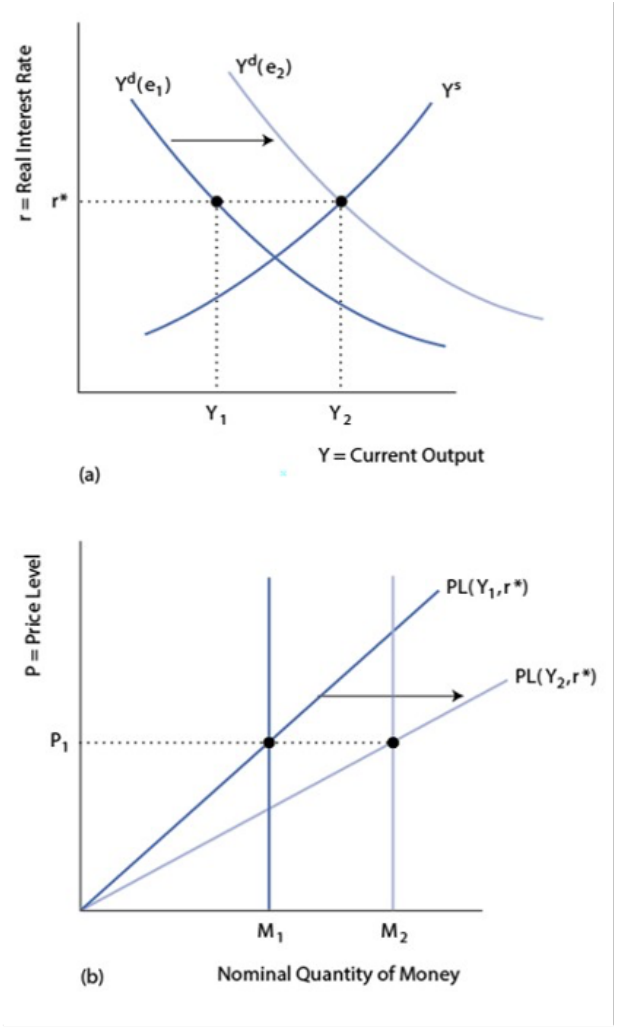


No trade, then Y is pinned down by M^s (exogenous), P (fixed) and r (global)

Monetary Policy

- Now, if P, r, M are fixed, when M^s shifts out, P can't rise, and central bank doesn't control r!
- Because P is fixed in the short run, $P = eP^*$ doesn't hold (purchasing power parity doesn't hold in short run)
- When M^s increases, e rises (dollars more plentiful, so more dollars to buy one unit of foreign currency), increasing net export demand
- In other words, home goods are cheaper to foreigners now, so they demand more
- Output demand shifts out, and GDP rises
- This worked similarly to the closed Keynesian model, but now it went $M \uparrow \rightarrow e \uparrow \rightarrow NX \uparrow \rightarrow Y^d \uparrow$

Monetary Policy (Flexible Exchange Rate)

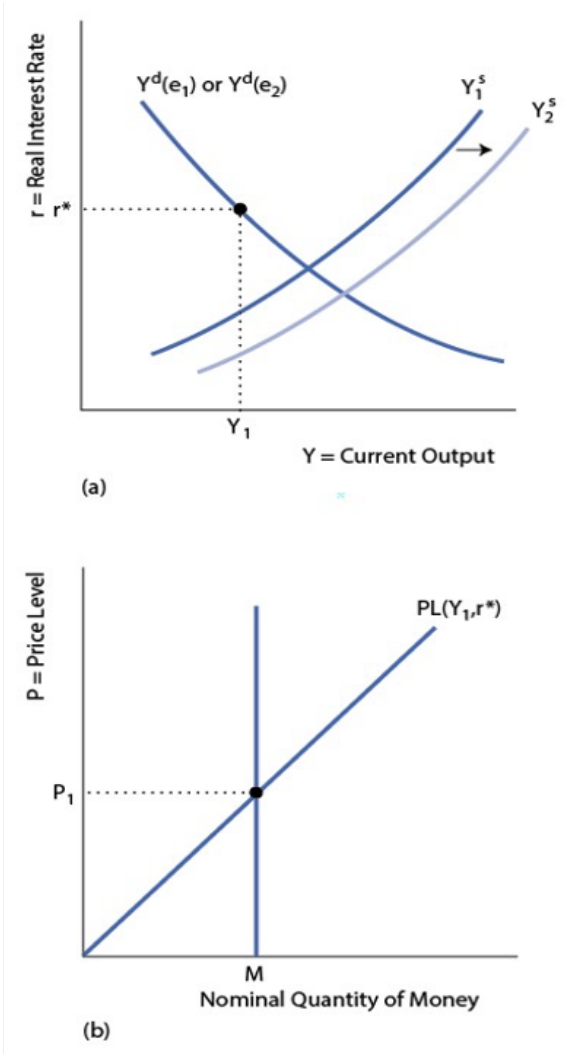


As M shifts out, e rises, $NX\left(\frac{eP^*}{P}\right)$ rises, so Y^d rises

Fiscal Policy

- Now let's say G increases
- $M = PL(Y, r)$ **determines** Y, and if M P, r fixed, then Y is too.
- If Y is fixed, but govt now demanding more, it must be that NX falls (e falls)
- Nothing changes, government spending crowds out exports
- Idea: if Y determined by money market, then can't increase–must be that e moves to clear demand market

Fiscal Policy (Flexible Exchange Rate)

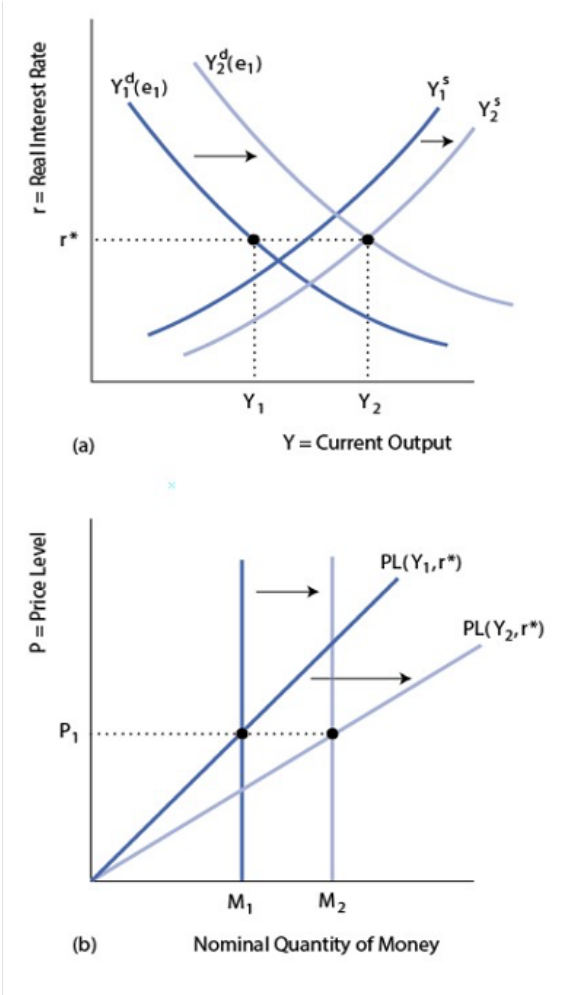


As G shifts out, e shifts down (more demand for dollars), $NX\left(\frac{eP^*}{P}\right)$ falls, and Y stays same

Fixed Exchange Rates

- Again, consider an increase in G, but under fixed exchange rates (monetary policy passive, fixing e)
- Now, as G increases, e would fall (more demand for dollars!), but to counteract, Fed increases money supply. Real incomes fall, and Y^s and Y^d both rise, just as before, equilibrating at r^* (if G chosen correctly)
- Before, Y moved to clear money markets. Now, M must move
- Now G can change Y, back to the old NK model

Fiscal Policy (Fixed Exchange Rate)



As G shifts out, e shifts down (more demand for dollars), $NX\left(\frac{eP^*}{P}\right)$ falls, and Y stays same

Conclusions

- Famous model in Macro, the "Mundell-Fleming" model widely taught
- But has embarssing assumptions (downward-sloping "IS" curve)
- This NK model recovers one of the big findings:
  - When you have fixed exchange rate, monetary policy is not effective (must move to fix exchange rate)
  - When you have a flexible exchange rate, fiscal policy is not effective (increased demand for dollars decreases e and thus NX, offsetting increase)
- Now you have a model of exchange rates!

Uncovered Interest Parity

- Recall purchasing power parity came from a law of one price
- But I should be able to get same return in dollars investing in dollars today vs foreign currency
- Return if invest in dollars: $1 + R$ (domestic currency tomorrow/domestic currency today)
- Return if invest in Euro:
$$\frac{e'}{e}(1 + R^*) = \frac{\frac{\text{domestic currency tomorrow}}{\text{foreign currency tomorrow}}}{\frac{\text{domestic currency today}}{\text{foreign currency today}}} \frac{\text{foreign currency tomorrow}}{\text{foreign currency today}} = \frac{\text{domestic currency tomorrow}}{\text{domestic currency today}}$$
- Therefore:
$$\frac{e'}{e} = \frac{1 + R}{1 + R^*}$$
- The (proportional) change in exchange rate should be equal to difference in nominal interest rate
- "Uncovered interest parity"

Uncovered Interest Parity

- Let's say that we expect $e' = e$ (no change in exchange rates) but that $1 + R > 1 + R^*$. What do?

$$\frac{e'}{e} < \frac{1+R}{1+R^*}$$

1. Borrow 1 unit of foreign currency, accrue debt of $1 + R^*$ in foreign currency to pay off tomorrow
2. Take 1 unit, change to dollars, now have e domestic currency.
3. Invest to get $(1 + R)e$ units of domestic currency tomorrow
4. Now take $(1 + R)e$ units of domestic currency tomorrow, and exchange for $\frac{1}{e'} \cdot \frac{1+R}{e}$ units of foreign currency tomorrow

- Question: are your assets $(\frac{e}{e'} \cdot (1 + R))$ more than your liabilities $(1 + R^*)$?
- Yes! By assumption, $\frac{e'}{e}\frac{1}{1+R} < \frac{1}{1+R^*}$, or:

$$\frac{e}{e'} \cdot (1 + R) > 1 + R^*$$

- You've minted free money
- This happens in reality(!?!?)

Uncovered Interest Parity

- Could rewrite:

$$\frac{e'}{e} < \frac{1+R}{1+R^*}$$

- To be:

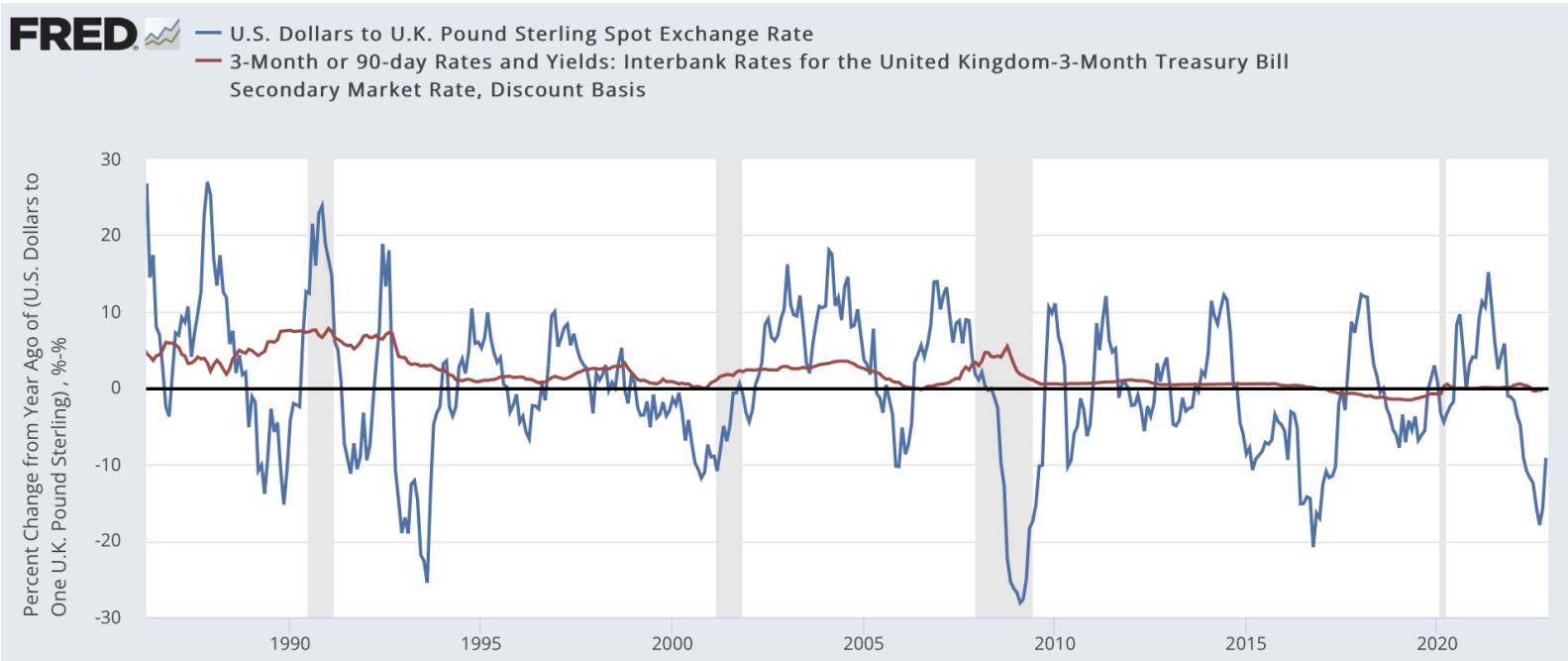
$$\Delta\%e = \Delta\%R$$

- Percent change in exchange rate should equal percent difference in nominal interest rates

- Otherwise free money

- Let's graph out

Uncovered Interest Parity



Two lines *should* be roughly equal.

Failures of Uncovered Interest Parity

- Very weird. When blue line greater than red line, US dollar depreciated but interest rates comparable, so could have made money borrowing in USD
- Active area of research!
- Frictions? Don't know e'?
- But people do make big money.
- Also "covered" interest parity: could lock in e' with futures. Still a puzzle.