International Finance 4832
Lecture 4: Exchange Rates in the Short Run - The Asset Approach

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This Lecture: Exchange Rates

This lecture - Exchange Rates in the Short Run and Integrated theory (LR and SR) (Chapter 15)

1. Last lecture: Exchange Rates in the **long run** - Monetary Approach to the ER
   - Flexible prices
   - PPP and UIP (both hold)
   - Quantity theory of money (with interest sensitive liquidity)
   - $i_h = r^* + \pi_h$ (Fisher equation with real rate convergence)
   - Exchange Rate $\longrightarrow$ determined by prices/inflation
2. Now: Exchange Rates in the **short run** (Chapter 15)
   - Fixed prices (sticky)
   - Long-run depreciation of ER is taken as given (as known)
   - Assumptions: UIP holds (PPP don't)
   - Quantity theory of money (but with $\bar{P}$)
   - i determined by $M/\bar{P}$ and $L(i)Y$
   - Exchange Rate $\longrightarrow$ determined by Interest Rates
3. Next: Integrating both approaches (LR and SR) (still Chapter 15)

Recap: UIP

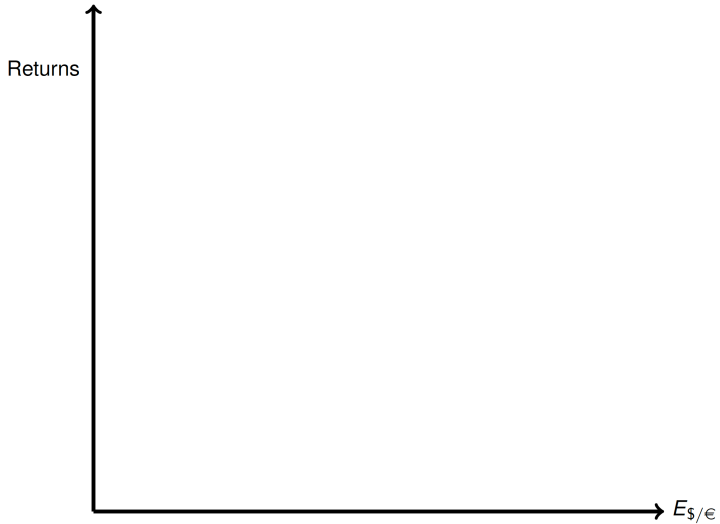
$$\underbrace{i_{\$}}_{\text{Domestic Return (DR)}} = \underbrace{\left(\frac{E^e_{\$/€}}{E_{\$/€}} - 1\right)}_{\text{Foreign Return (FR)}}$$

(notice we work here with the approximated UIP after taking logs. Conclusions are the same as with the first one)

- Left-hand side: return to investing in dollars (at home)
- Right-hand side: return to investing in euros (abroad)
- $\frac{E^e_{\$/€}}{E_{\$/€}} - 1 = d^e_{\$/€} \rightarrow$ Expected depreciation rate of the dollar
- Known/given variables: $i_{\$},\ i_{€},\ E^e_{\$/€}$
- Unknown (to be solved for): $E_{\$/€}$ (Spot ER)

Plotting both sides of the UIP

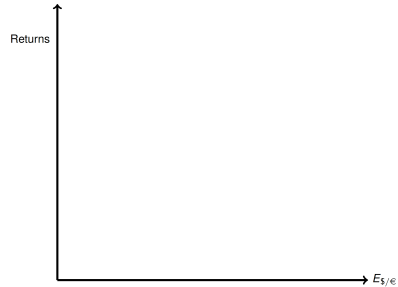
Figure: Foreign and Domestic Returns (in UIP)



Recap: UIP (cont.)

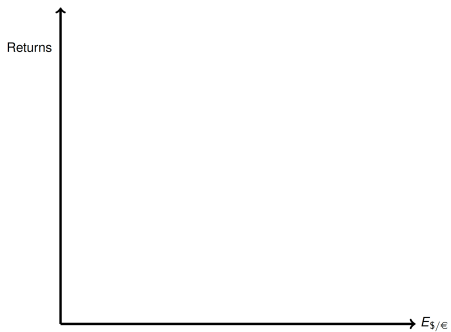
- Foreign Return (FR) curve: $FR = i_{€} + \left(\frac{E^{e}_{\$/€}}{E_{\$/€}} - 1\right)$
- Domestic Return (DR) curve: $FR = i_{\$}$
- How do the curves shift and what happens to $E_{\$/€}$ when:
  - (i) $i_{\$}$ increases?, (ii) $i_{€}$ decreases?, (iii) $E^{e}_{\$/€}$ decreases?

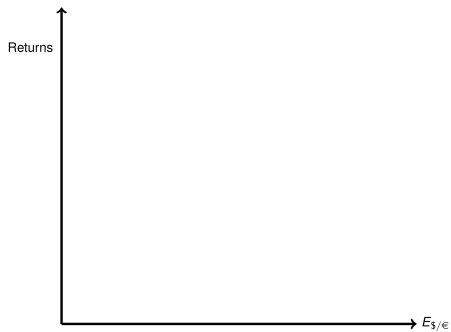
Figure: Foreign and Domestic Returns: Increase in $i_{\$}$



Recap: UIP (cont.)

Figure: Foreign and Domestic Returns: Decrease in $i_{\$}$ (left), and decrease in $E^{e}_{\$/€}$ (right)





Determining the Spot Exchange Rate

UIP: given known $i_{\$}$, $i_{€}$ and $E^e_{\$/€}$ we can determine: $E_{\$/€}$

But where do $i_{\$}$, $i_{€}$ and $E^e_{\$/€}$ come from?

- $i_{\$}$, $i_{€}$: come from Quantity Theory of Money in the Short Run
- $E^e_{\$/€}$: from the Quantity Theory and the PPP in the Long Run

This is why we analyze first the LR model and later the SR model

We solve for $E^e_{\$/€}$ first in the LR model and given that, we later get the Spot ER ($E_{\$/€}$)

Short Run nominal interest rates

Assumptions:

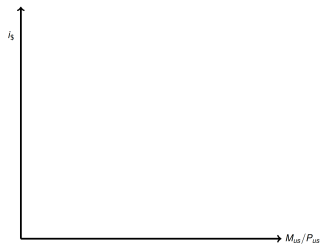
1. Prices level is fixed (sticky): $\bar{P}_{us}$, $\bar{P}_{eu}$
2. Nominal interest rate (i) adjusts to clear money market

Quantity Theory of Money with fixed prices:

$$\frac{M_{us}}{\bar{P}_{us}} = L(i_{us})\,Y_{us} \qquad \frac{M_{eu}}{\bar{P}_{eu}} = L(i_{eu})\,Y_{eu}$$

Here we focus on the US, but analogous results hold for EU (or any other location)

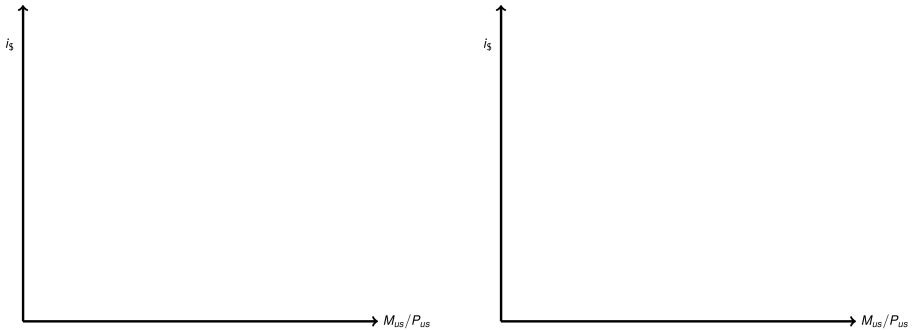
Figure: Home (US) money market



Home money market

How do the curves shift and what happens to $i_\$$ when: M_{us} increases? Y_{us} decreases?

Figure: Home (US) money market: Increase in M_{us} (left) and Decrease in Y_{us} (right)



Determining the Spot Exchange Rate (cont.)

UIP: given $i_\$$, $i_€$ and $E^e_{\$/€}$ $\longrightarrow$ get $E_{\$/€}$

But where do $i_\$$, $i_€$ and $E^e_{\$/€}$ come from?

- $i_\$$, $i_€$: come from Quantity Theory of Money in the Short Run (last slide)
- $E^e_{\$/€}$: from the Quantity Theory and the PPP in the Long Run

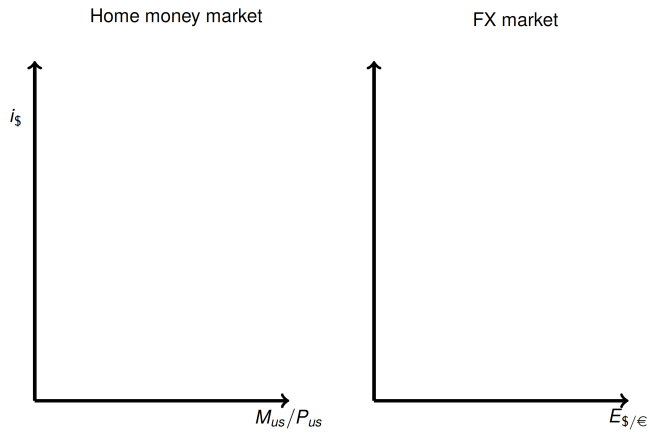
Now: Put together quantity theory and UIP in the short run.

(Short run analysis only in this step: Thus take $E^e_{\$/€}$ as given for now)

Short run part of the model

Markets in which $E^e_{\$/€}$ is taken as given (see how axes do not change with $E^e_{\$/€}$)

Figure: Joint determination of Interest rates and Spot ER



Determining the Spot Exchange Rate

The central bank in each economy determines M (Money Supply)

The equilibrium interest rate i will be such that real supply of money equals demand: $\frac{M}{P} = L(i)Y$

Via UIP: $i_\$$ and $i_€$ (and $E^e_{\$/€}$) determine the spot ER: $E_{\$/€}$

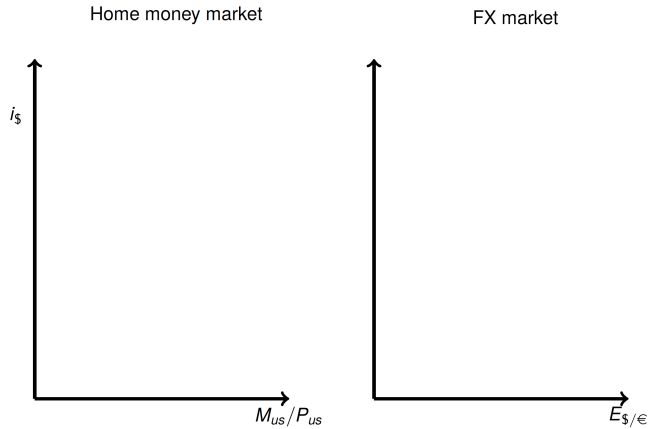
What if M_{US} temporarily increases?

Can analyze the "temporary" increase case here because the expectations of future ER won't change
(so we can keep taking expected ER as given)

If permanent (increase): we have to change $E^e_{\$/€}$ as well and the resulting spot ER will differ
(we check this case some slides ahead)

Temporary increase in home money supply (M_{us})

Figure: Joint determination of Interest rates and Spot ER



Determining the Spot Exchange Rate (cont.)

Temporary increase in M_{us}:

(Key) **temporary**: $E^e_{\$/€}$ does not change (expected future ER is the same)

1. Real money supply curve shifts (prices are fixed and M rises)
2. $i_\$$ lowers to new equilibrium
3. DR curve shifts down
4. Dollar depreciates (spot) $\uparrow$ $E_{\$/€}$: from $E^1_{\$/€}$ to $E^2_{\$/€}$

Putting the Long Run and Short Run theories together

Outline

Exchange rates in the **long run**

- Flexible prices
- PPP and UIP hold
- Quantity theory of money (with P)
- $i_h = r^* + \pi_h$ (Fisher)
- Exchange rate determined by prices/inflation (we use this block to get expected future ER)

Exchange Rates in the **short run**

- Fixed prices (sticky)
- Long-run depreciation is given (exogenous)
- UIP holds, PPP does not
- Quantity theory of money (with $\bar{P}$)
- i determined by $\frac{M}{\bar{P}}$ and $L(i)Y$
- Exchange rate determined by interest rates (we use this block to get Spot ER)

Integrated approach (SR and LR)

Now we integrate the long-run (LR) and short-run (SR) models

- LR model (PPP) pins down expectations ($E^e_{\$/€}$)
- Short-run model takes expectations from LR model and pins down Spot ER (with UIP gets $E_{\$/€}$)

With a model that also includes the LR we can think about permanent changes in the variables

Before we could only check temporary ones with the SR model only

In a nutshell:

SR Model: $E^e_{h/f}$ Fixed	SR and LR Model: $E^e_{h/f}$ can change

Short-run model

UIP:

$$i_{\$} = i_{€} + \left(\frac{E^e_{\$/€}}{E_{\$/€}} - 1 \right)$$

Quantity theory with theory with sticky prices ($\bar{P}$):

$$\bar{P}_{us} = \frac{M_{us}}{L_{us}(i_{\$})} Y_{us} \qquad \bar{P}_{eu} = \frac{M_{eu}}{L_{eu}(i_{€})} Y_{eu}$$

$E^e_{\$/€}$ is given (in reality comes from LR model but from SR perspective is just exogenous)

Solution given inputs above:

i comes from money market equilibrium, $E_{\$/€}$ is obtained from FX market equilibrium

Long-run model

Purchasing power parity (PPP):

$$E^e_{\$/€} = \frac{P^e_{us}}{P^e_{eu}}$$

Quantity theory with flexible prices: (i.e. with P instead of $\bar{P}$)

$$P_{us} = \frac{M_{us}}{L_{us}(i_\$)} Y_{us} \qquad P_{eu} = \frac{M_{eu}}{L_{eu}(i_€)} Y_{eu}$$

Model is set in terms of expected future variables

(if it holds today, we can just think of the whole thing in terms of expectations)

From this model we get: $E^e_{\$/€}$

Permanent change in M_{us}

Short-run model: $E^e_{\$/€}$ had to be fixed. Then it only could describe temporary shocks

A permanent shock would change $E^e_{\$/€}$

Now: with LR and SR $\rightarrow$ Can study permanent shocks

Example: money grows permanently in the US to a new level (from M^1_{us} to M^2_{us})

We solve this model "backwards":

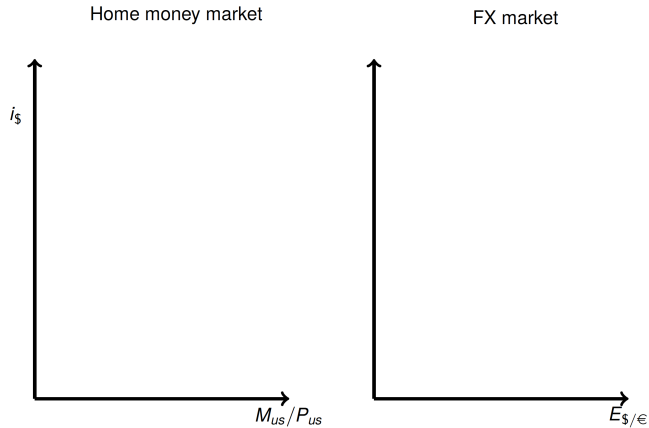
1. We solve the long-run $\rightarrow$ getting $E^e_{\$/€}$
2. We solve the short-run with the new value of $E^e_{\$/€}$ and with constant prices

After the second step we get the new interest rate ($i_\$$) and the new spot ER ($E_{\$/€}$)

Once we get everything we work out the adjustment from short-run values to the long-run

Permanent increase in home money supply (M_{us})

Figure: Long-run (permanent increase in money supply)



Equilibrium interest rate is the same (in the LR), but notice the Spot ER is different (USD depreciates)

Permanent change in M_{us}

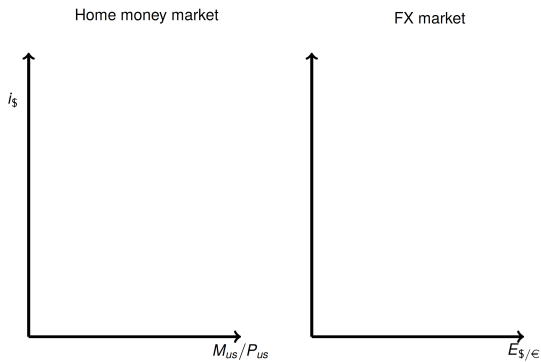
1. We solve the long-run $\rightarrow$ getting $E^{e}_{\$/€}$
   Done! the LR Exchange Rate goes from $E^{1}_{\$/€}$ to $E^{4}_{\$/€}$ (increased)

   The money market won't change (because P adjusted to change in M).

   However, FR curve shifts permanently and the ER is permanently depreciated

2. Now: We solve the short-run with the new value of $E^{e}_{\$/€}$ and with constant prices

Figure: Short-run (permanent increase in money supply)[fig. 15-12 in FT]



Permanent change in M_{us} (cont.)

1. We solve the long-run $\rightarrow$ getting $E^e_{\$/€}$

   Done! the LR Exchange Rate goes from $E^1_{\$/€}$ to $E^4_{\$/€}$ (increased)

   The money market won't change (because P adjusted to change in M).

   However, FR curve shifts permanently and the ER is permanently depreciated

2. Then, we solve the short-run with the new value of $E^e_{\$/€}$ and with constant prices

   Done! In the short run:

   - FR shifts up as in the long-run

   - interest rates fall because real money supply increases

   Short-run ER depreciates to $E^2_{\$/€} \rightarrow$ a larger depreciation than will be seen in the LR: $E^2_{\$/€} > E^4_{\$/€}$

   We then say the short-run ER "overshoots" the long-run ER

   i.e., it instantly overreacts in the same expected direction and later converges to the new long-run equilibrium

Adjustment from SR to LR

The economy eventually adjust from the SR to the LR:

- As P slowly changes $\rightarrow \frac{M}{P}$ falls until it returns to its initial (and long-run) level
- As $\frac{M}{P}$ falls, i increases until it is back to its initial level
- FR curve does not return to its original position: there has been a permanent change in expected inflation (and then in LR depreciation) because the increase in money supply is permanent
- The ER eventually **appreciates** to $E^{4}_{\$/€}$

Notice the "appreciates" of the last point. How is this possible? wasn't the ER supposed to depreciate with the increase in money supply?

Well, in the SR the ER overreacts and depreciates too much (**overshooting**) ... from there the ER has to gradually lower (appreciate) to its new LR value (which is higher than the ER before the money change)

We can see the trajectory of these variables over time in the next slide

Permanent increase in M_{us}: Path of variables over time

Overshooting

- Key to *overshooting*: change in expectations
- Expectations change because the change in money supply (M) is permanent
- With a temporary change, the only change in the FX market is $i_\$$ ...
- In contrast, with a permanent change the shift of FR provides the extra depreciation in the SR

Why did the FR shifted? because of the increase in the expected (future) ER

Reminder: $$FR = i_€ + \left(\frac{E^e_{\$/€}}{E_{\$/€}}\right) - 1$$

Summary

- Long Run model: can handle permanent changes
- Short Run model: can handle temporary changes
- LR and SR models together: allows us to study the effect of permanent shocks (in the short run)
- What is new: the long run model lets people forecast the future ER
  - In the SR this makes FR shift $\rightarrow$ prompting a larger depreciation of the USD.
- In the SR: the exchange rate **overshoots** its new LR level (over reacts in the same direction of the LR change)
- Monetary policies (and shocks) that are expected to last longer create more volatility in the ER