Monetary Macroeconomics

Chapter 5:
International Monetary Systems

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Questions we would like to answer using our simple OLG model are

- What is the role of fiat money in economies with more than one country and currency?

- How are exchange rates determined?

The Model

Consider an overlapping generations model as before.

There are two countries which have their own currency.

	Country a	Country b
population growth rate	n^a	n^b
fiat money expansion rate	z^a	z^b

There is one type of consumption good that the citizens of both countries like to consume.

There is free trade between countries (no tax, no transportation cost etc.)

If a consumer buys something from the other country, then he has to pay in that country's currency.

In equilibrium if both countries' monies are valued, then the exchange rate should be

$$e_t = \frac{p_t^b}{p_t^a}$$

i.e. what is the value of country a's money in terms of country b's money.

Otherwise, people would not accept one of the currencies for trade anymore.

Flexible Exchange Rates with Currency Controls

Assume that the citizens of each country are permitted to hold over time only the fiat money of their own country.

Note: In the history, this has been the case to protect the national currency's value.

There will be trade between countries but young people will have to save in their own currency, thus they will be affected by the changes in the exchange rate directly!

With currency controls, each country will have its own money demand. So there will be two separate equations for the money markets.

In equilibrium, in country a

$$M_t^a = p_t^a N_t^a (y^a - c_{t,t}^a)$$

Similarly, in country b,

$$M_t^b = p_t^b N_t^b (y^b - c_{t,t}^b)$$

Thus the price levels in each country will be

$$p_t^a = \frac{M_t^a}{N_t^a (y^a - c_{t,t}^a)} \quad \text{and} \quad p_t^b = \frac{M_t^b}{N_t^b (y^b - c_{t,t}^b)}$$

So the exchange rate between the two currencies will be

$$e_t = \frac{p_t^b}{p_t^a} = \frac{\frac{M_t^b}{N_t^b(y^b - c_{t,t}^b)}}{\frac{M_t^a}{N_t^a(y^a - c_{t,t}^a)}}$$
$$= \frac{M_t^b}{M_t^a} \quad \frac{N_t^a(y^a - c_{t,t}^a)}{N_t^b(y^b - c_{t,t}^b)}$$

Here the first term on the right hand side is the relative money supply, and the second term is the relative money demand of these countries.

How Does the Exchange Rate Change Over Time?

$$\frac{e_{t+1}}{e_t} = \frac{\frac{p^b_{t+1}}{p^a_{t+1}}}{\frac{p^b_t}{p^a_t}} = \frac{p^b_{t+1}}{p^b_t}\frac{p^a_t}{p^a_{t+1}}$$

Last time we have shown that in a stationary economy the prices evolve over time according to

$$\frac{p_{t+1}}{p_t} = \frac{z}{n}$$

where z is the money supply expansion rate and n is the population growth rate.

Therefore

$$\frac{e_{t+1}}{e_t} = \frac{p^b_{t+1}}{p^b_t}\frac{p^a_t}{p^a_{t+1}} = \frac{z^b}{n^b}\frac{n^a}{z^a}$$

$$\frac{e_{t+1}}{e_t} = \frac{z^b}{n^b}\frac{n^a}{z^a}$$

If country a's population grows at a faster rate and country b's money stock expands at a faster rate (i.e. $n^a > n^b$ and $z^b > z^a$), then $e_{t+1} > e_t$.

Hence country a's currency appreciates, i.e. its money's value increases (exchange rate here is the value of country a's money in terms of country b's money).

And country b's currency depreciates.

Fixed Exchange Rates

Countries can act together and fix their exchange rate so that

$$\frac{e_{t+1}}{e_t} = 1$$

This implies that

$$\frac{z^b}{n^b}\frac{n^a}{z^a} = 1$$

Hence, say, country a sets its money supply expansion rate at z^a such that

$$z^a = z^b\frac{n^a}{n^b}$$

So if country b inflates its money supply, then country a has to increase its money supply as well to keep the exchange rate fixed.

Country a loses its independence in monetary policy by following a fixed exchange rate policy.

Indeterminacy of the Exchange Rate

Assume that there are no currency controls (i.e. people are free to hold and use any currency they want) and the exchange rate is flexible.

Now people are allowed to hold the currency of either country — we cannot determine the money demand of each country separately!

So we have to set world's money supply equal to world's demand for money.

In terms of the consumption good,

$$\frac{M_t^a}{p_t^a} + \frac{M_t^b}{p_t^b} = N_t^a(y^a - c_{t,t}^a) + N_t^b(y^b - c_{t,t}^b)$$

We have one equation but *two* unknowns, p_t^a and p_t^b!

We can equivalently, substitute $p_t^a = \frac{p_t^b}{e_t}$.

Then

$$e_t\frac{M_t^a}{p_t^b} + \frac{M_t^b}{p_t^b} = N_t^a(y^a - c_{t,t}^a) + N_t^b(y^b - c_{t,t}^b)$$

$$\underbrace{\frac{1}{p_t^b}(e_t M_t^a + M_t^b)}_{\substack{\text{real value of} \\ \text{world's money} \\ \text{supply}}} = \underbrace{N_t^a(y^a - c_{t,t}^a) + N_t^b(y^b - c_{t,t}^b)}_{\substack{\text{aggregate real} \\ \text{demand for money}}}$$

The second term on the left hand side is world's total money supply in terms of country b's currency.

With one equation and two unknowns there are infinitely many solutions!

The exchange rate, $e_t = \frac{p_t^b}{p_t^a}$, is not determined.

Since a nation is no longer restricted to use its own currency, there is no separate money demand for each currency. But then the exchange rate cannot be determined based on the individual money supply and demand for money.

Fluctuations in the Exchange Rate

When people are free to hold and use any currency they want and when the exchange rates are flexible, then the exchange rate will be whatever people believe it should be.

So if these beliefs fluctuate, then so will the exchange rate!

These fluctuations do not need to be tied to fundamental changes in the economy.

For example, after Nixon announced that the US abandoned its efforts to fix the exchange rate in 1971, there were huge fluctuations in the exchange rates that cannot be traced back to changes in the real output, nominal money supply etc. in similar magnitudes.

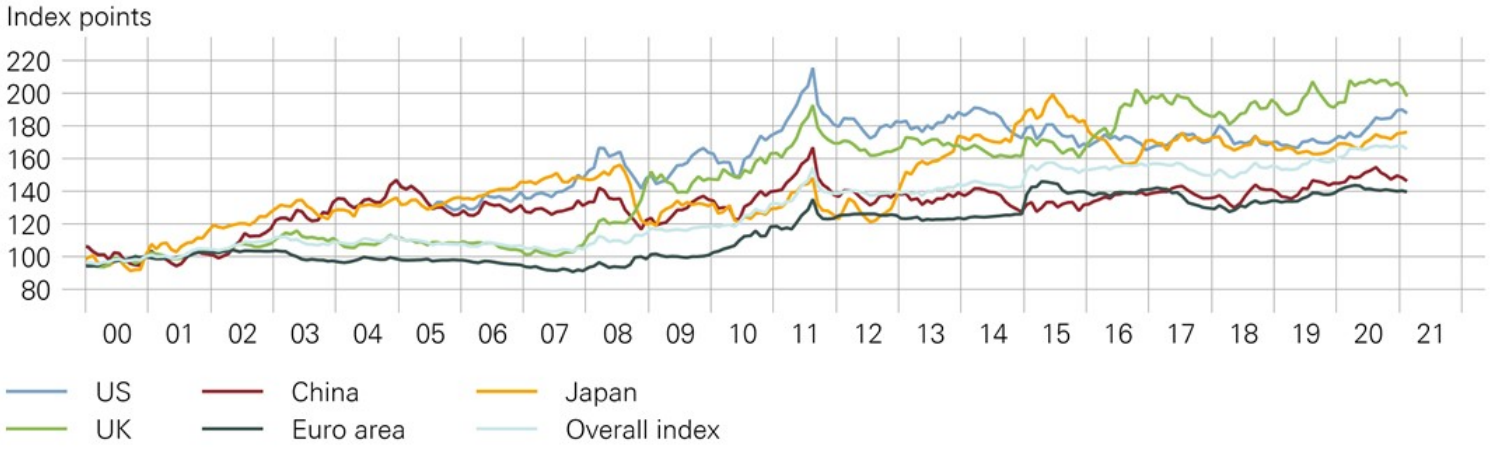
There are some multinational institutions holding a balanced portfolio of several exchange rates. So they are hedged against the exchange rate fluctuations.

But most individuals who do not hold such a portfolio will be adversely affected by these fluctuations.

Public

NOMINAL BILATERAL INDICES AND NOMINAL EFFECTIVE OVERALL INDEX

Monthly basis; December 2000 = 100



Source: SNB

Purchasing Power Parity

Recall that in equilibrium if both countries' monies are valued, then the exchange rate should be

$$e_t = \frac{p_t^b}{p_t^a}$$

This is also called purchasing power parity. PPP states that the price of a traded bundle of goods will be the same in every country which engages in trade.

Is this really the case in the data?

Not exactly!

Reasons for failure of PPP: Barriers to trade, non-traded goods, non-traded components of traded goods (e.g. store rents, labor costs, distribution) etc.

Based on PPP reasoning, the British magazine *The Economist* regularly assesses (in a lighthearted way) whether currencies are overvalued or undervalued by comparing BigMac prices and actual exchange rates across countries.

From the Economist, January 2021

The Big Mac Index

Conclusion

In our model the exchange rate is determined based on relative demand and relative supply of different currencies.

However, in the case of flexible exchange rate there is indeterminacy of exchange rate since we cannot isolate the separate demands for each currency. Then the expectations of people on what the exchange rate should be will move the exchange rates.

In the simple OLG model there is nothing that says that each country should have its own currency. On the contrary, having a currency union would eliminate the exchange rate fluctuations and facilitate easier trading.