International Macroeconomics
Master in International Economic Policy

Fixed versus floating exchange rates and the role of central bank interventions

Lectures 9-10

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Fixed versus floating exchange rates and the role of central bank interventions

• Motivation:
  – many central banks intervene to influence exchange rates in floating exchange rate regimes: dirty floating
  – Many countries belong to regional currency arrangements (Denmark, Baltic countries)
  – Many developing and emerging markets peg to the dollar (China)
  – Implications of these policies?
Lecture 9 and 10
Fixed versus floating exchange rates and the role of central bank interventions

1. How do central banks fix the exchange rate?
2. Policies under fixed exchange rates
3. Currency Unions
4. Currency Crisis
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Increasing bipolarity

The move toward bipolarity for advanced and emerging market countries continues, though at a slower pace.

(Percent of total number of countries)

Number of countries is in parentheses.

Source: IMF.

Source FMI 2007
Exchange Rate Choices in practice

Exchange Rate Choice can be considered a continuum, from most rigid (e.g. currency board) to least interventionist (pure free float).
How to fix the exchange rate?
Example: Denmark and euro

- Denmark participates in European Exchange Rate Mechanism II (ERM II) with a central rate of kr. 746.038 per 100 euro.
- Denmark has narrower fluctuation band of +/- 2.25 per cent (krone can only fluctuate between kr. 762.824 per 100 euro and kr. 729.252 per 100 euro).
- **Danmarks Nationalbank stabilizes the krone by buying and selling foreign currency in the market.** When sells foreign currency (and buys kroner), the krone tends to strengthen. When buys foreign currency (and sells kroner), the krone tends to weaken.
Central banks balance sheets

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign assets: 100</td>
<td>Deposits held by private banks: 200</td>
</tr>
<tr>
<td>Domestic assets: 500</td>
<td>Currency in circulation: 400</td>
</tr>
</tbody>
</table>

Central bank sells 10 in foreign assets (official reserves) on exchange market, Buyer pays in currency

| Foreign assets: 90         | Deposits held by private banks: 200  |
| Domestic assets: 500       | Currency in circulation: 390         |

A central bank that sells its reserves, reduces the money supply. A central bank that buys reserves, increases the money supply
Interest rates and fixed exchange rates

• With perfect capital mobility, interest parity condition, fix $\bar{E}$ exchange rate Dan/€ implies:

$$r_D - r_\varepsilon = (E^e - E)/E = 0 \quad \text{or} \quad r_D = r_\varepsilon$$

• The Danish central bank is obliged to follow the monetary policy of euro zone
• The Danish central bank effectively loses control of monetary policy
Exchange rate $E$

Return on D assets $r_D$

ECB increases interest rate
Denmark must do the same
Decrease money supply

Return on euro assets

$\tilde{E}$

$M'_D/P_D$

$M_D/P_D$

Real money supply/demand

Money market and exchange rate market equilibrium

$\tilde{E}$

$L(r_D,Y_D)$

$L(r_D,Y_D)$
Exchange rate $E$

Money supply $M_D/P_D$

Real money supply/demand

Return on D assets $r_D$

Money market and exchange rate market equilibrium

Recession in Denmark: To keep fixed exchange rate need restrictive money supply

$L(r_D, Y_D')$

$L(r_D, Y_D)$
Interest rates and non fully credible fixed exchange rates

If expected probability (10%) of a devaluation (30%): Expected depreciation is 3% so

\[ r - r_{e} = (E^e - E)/E + 3\%

If the fixed exchange rate is not fully credible: interest rate of country that fixes at $\bar{E}$ must be higher to compensate for possible depreciation

See Baltic states in ERM II during financial crisis
See in the beginning 90s countries like Italy or France had to have very high interest rates to compensate devaluation risk
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Monetary policy and fixed exchange rates

- Loss of monetary policy autonomy in a fixed exchange rate with free capital movements (interest parity condition: $r = r^*$)
- Link with EMU: if Denmark considers that instability of exchange rate with euro too costly (most of its trade is with euro zone), why have a national currency and no voice in euro monetary policy?
- Choice of France: EMS was Germany dominated, no monetary policy, better to have a say in common monetary policy
Capital mobility, fixed exchange rate and monetary policy autonomy

- Interest parity condition (arbitrage with free capital mobility): \( r - r^* = (E_e - E)/E = 0 \) or \( r = r^* \)

- Suppose restrictions on capital movements (taxes on capital inflows and outflows): breaks the interest parity condition

- The interest can be lower (with taxes on capital outflows) or higher (with taxes on capital inflows) than foreign interest rate with less capital outflows or inflows
The «impossible trinity» of Mundell

- Independent monetary policy
- Fixed exchange rate
- Free capital movements

- China 1990s
- US/EU
- Denmark/UE
Policies under fixed exchange rate

- Loss of monetary autonomy if capital mobility
- What about fiscal policy?
- Fiscal policy becomes more efficient under fixed exchange rates if capital mobility (see graph)
- But necessity of policy coordination
- Laxist fiscal policy can threaten the peg and leads to speculative attacks
  (see currency and debt crisis)
Fiscal policy with fixed exchange rate

Fiscal policy becomes efficient due to accommodative monetary policy
Cumulative fiscal multiplier in fixed and flexible exchange rate regimes

Fixed or Floating exchange rates?

The case for fixed exchange rate:

• Discipline on price stabilization
• Reduces speculation and money market disturbances
• Promotes international trade and investment
• Coordination of economic policies

But ...

• Loss of monetary policy autonomy
• Exchange rate movements act as an automatic stabilizer
• Fixed exchange rate regimes can be subject to large adjustments (currency crisis)
Flexible exchange rate regimes as an automatic stabilizer: reaction to a fall of demand in flexible and fixed exchange rates
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Currency Union: Optimum Currency Area (Mundell)

Two regions constitute an optimum currency area if

• Transaction costs considerations are important

• There is a lot of trade between the regions

• There are macroeconomic shock absorbers other than the exchange rate
  
  • High labor mobility

  • Large fiscal transfers

• The two regions have a similar production structure, so there is little need for macroeconomic shock absorbers.
Mundell’s Analysis
2 countries, 2 regions
Shocks common across regions
Mundell’s Analysis
Other ways to cushion shock of fall-off in demand for Western goods
Macroeconomic costs of currency union

- Loss of monetary instrument and of the nominal exchange rate as a stabilization tool (exchange rate is irremediably fixed)
- This loss is all the more costly if:
  - Wages and prices are rigid: if not, demand shocks have no real effect and monetary policy is not very useful. Its loss is not costly.
  - Macroeconomic shocks are asymmetric
  - Business cycles are not synchronized across regions
  - Labor force is not very mobile and/or fiscal transfers are difficult
An asymmetric negative demand shock in Italy but not Germany

Flexible exchange rates or multiple currencies

Irremediably fixed exchange rate: single currency
Symmetric/Asymmetric shocks

- Asymmetric negative shock in Italy but not Germany: Euro depreciates (stabilizes) but not as much as Lira would
- The ECB can react by monetary expansion but not as much as a Italian national central bank would
- Cost for Italy: not enough depreciation, stabilization and monetary response
- Cost for Germany: too much depreciation and monetary expansion; inflation (imported through depreciation and direct through monetary expansion)
Currency Union: current tensions in the euro area

• PIGS (Italy, Spain, Portugal, Greece, Ireland) face adjustment problems (fiscal and external).

• Large current account deficits and negative shocks cannot be offset by an exchange rate depreciation

• Cost of fiscal adjustment larger with fixed exchange rates

• International transfers and labor mobility are not large

• One way of adjusting seems to have real wage growth slower than other euro area economies. Tough in a low inflation environment

• Other solutions?
Will it hurt? Macroeconomic effects of fiscal consolidation (IMF 2010)

![Graph showing the effect of a 1% consolidation on GDP over time. The x-axis represents years after the start of consolidation, ranging from 0 to 3. The y-axis represents the percent change in GDP, ranging from -1.4 to 0.2. The graph includes lines for different country characteristics: All, Open Economy, Large Economy, and Fixed ER. The source is GS Global ECS Research.]
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Currency crises

- Often just seen as a large devaluation
- Speculative attack with sudden loss of confidence in the central bank promise to keep the exchange rate fixed: run on the central bank foreign reserves: to defend the fixed exchange rate the central bank sells its reserves

- But *not all attacks succeed* – distinguish between currency crash (large devaluation) and crisis, when authorities defend exchange rate peg
  - with sharp spike in interest rates
  - sharp fall in foreign exchange reserves
The dangers of managed exchange rates
And 11 years later... Iceland
And 11 years later... Pakistan

Current account

Reserves and exchange rate (up is depreciation)

Source: IMF
Currency crises are common

• Most “fixed” exchange rate regimes eventually come under severe strain (and flexible rates can also suffer sudden depreciation)

• Balance of payments crises have been frequent in the past and also since the 1990s
  – 1992/1993 : European Monetary system and the attack on Pound
  – 1994 : Mexico
  – 1997/1999 : Thailand, South Korea, Indonesia, Brazil, Russia
  – 2000/2001 : Turkey, Argentina
  – 2008 : Iceland, Pakistan, Hungary, Baltic states …
Proportion of countries experiencing a currency crisis

Missing data for 1911-19, 1941-45. 23 countries until 1971, 52 after.
Some countries experience repeated crises

Number of Currency Crises (1900-2010)
Currency crises are costly

- Eichengreen and Rose (2001) estimate that trying to defend an exchange-rate peg and failing costs about three percentage points of GDP

- Bordo et al. (2001) estimate that currency crises in the period 1973-97 lasted about 2 years and cost 3.8% of GDP (sample of 21 countries - for larger sample of 56 countries, cost averaged 5.9% of GDP)
Currency crises are costly

<table>
<thead>
<tr>
<th>Country</th>
<th>Year Before Crisis</th>
<th>Year of Crisis</th>
<th>Year After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina (2001)</td>
<td>−0.8</td>
<td>−4.4</td>
<td>−10.9</td>
</tr>
<tr>
<td>Indonesia (1997)</td>
<td>8</td>
<td>4.5</td>
<td>−13.1</td>
</tr>
<tr>
<td>South Korea (1997)</td>
<td>6.8</td>
<td>5</td>
<td>−6.7</td>
</tr>
<tr>
<td>Philippines (1997)</td>
<td>5.8</td>
<td>5.2</td>
<td>−0.6</td>
</tr>
<tr>
<td>Russia (1998)</td>
<td>1.4</td>
<td>−5.3</td>
<td>6.3</td>
</tr>
<tr>
<td>Thailand (1997)</td>
<td>5.9</td>
<td>−1.4</td>
<td>−10.5</td>
</tr>
<tr>
<td>Turkey (2001)</td>
<td>7.4</td>
<td>−7.5</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Three generations of crisis models

1) « Fundamental » balance of payments crisis (Krugman, 1979)

2) Crises with self-fulfilling expectations (Obstfeld, 1994-95)

3) Crises with balance sheet effects (also with self fulfilling expectations ), (Krugman, 1999)

- See 3 in the last lecture
Fondamentals based crises (Krugman, 1979)

The fixed exchange rate is « fundamentally » inconsistent with macro policy (fiscal and monetary) : monetary policy too expansionary (CB buys domestic assets)

- E.g., CB finances budget deficit; buys T-Bills
- For ER to remain fixed, \( r = r^* \), money supply remains fixed: CB must sell reserves at the same rate as it buys TBs:
- Central bank balance sheet:
  \[
  M^S = \text{Reserves} + \text{Domestic assets}
  \]

Does the fixed ER collapse when CB has no more reserves?
Rational speculators understand that at some point reserves will be exhausted and fixed ER will be abandoned.
Crisis will come before (speculative attack): run on CB reserves (all speculators want to sell domestic currency and buy reserves of the CB).
Looks like panic but the result of rational speculators who understand the fundamental inconsistency of the fixed ER
Shadow floating exchange rate: $E^s_t$ Shadow floating E that would prevail if no foreign reserves and the CB lets the exchange rate float.

Central bank fixes exchange rate at $E^F$; domestic assets increase over time (CB buys TBs); shadow exchange rate depreciates over time.
The logic and timing of the crisis

- Are reserves depleted at $T'$? If so, ER jumps from $E^F$ to $E^S_{T'}$ (currency depreciates from fixed exchange rate to shadow ER consistent with level of money supply): not possible as all speculators know this (rational); they could make money by buying all reserves (before they hit zero) at price $E^F$ and sell at $E^S_{T'}$

- Are reserves depleted at an earlier time $T''$? No because if so, ER jumps (currency appreciates) from $E^F$ to $E^S_{T''}$: speculators will not buy reserves at that price as they would loose money. They would sell home currency at low price or buy foreign currency at a high price
The logic and timing of the crisis

- The run on reserves comes exactly at $T$ when $E^F = E^S_T$.
- At $T$: all speculators go to the central bank sell domestic currency and buy foreign reserves.
- Looks like panic (all speculators rush to sell domestic currency) but this is a fundamental based speculative attack with rational agents.
Strategic foundations of financial crises: speculative attacks with self-fulfilling expectations

So-called second generation crises (Obstfeld):
Models with self-fulfilling expectations

≈ bank run: speculation against a fixed ER regime generates the objective conditions that make the crisis possible

Multiple equilibria: the determination of the realized equilibrium (crisis with devaluation or no crisis and no devaluation) does depend only on fundamentals but also on speculators expectations
A simple model with three agents with self-fulfilling expectations driven crashes

- CB: holds a fixed amount of reserves ($R_s$) to fix the exchange rate peso/$ = 1; must sell its reserves ($) if peso depreciates and vice-versa

- Two (more in real world) speculators hold pesos (6 each) who can hold or sell them to central bank (to buy $)

- Cost of attacking currency: -1 (in peso); (they have to borrow the pesos to sell them)
First case: «good fundamentals»; a sufficient amount of reserves to defend the fixed exchange rate

If $R = 20 > 6 + 6$

Even if both speculators sell the domestic currency, the CB has enough reserves to sell them at price 1 (the fixed exchange rate)

The fixed exchange rate is maintained whatever the action of speculators

In equilibrium no speculator wants to sell his pesos

**UNIQUE Nash equilibrium: no devaluation**
Second case: « bad fundamentals », low amount of reserves

R = 6; one speculator who sells is enough to eliminate reserves; CB cannot defend the fixed ER: peso must be devalued

**Assumption**: in case of devaluation the peso depreciates by 50%

gain for speculators: sells to CB 3 pesos at rate 1 = 3$

Devaluation of 50%: buys back peso at 0,5

gain of 1.5; net gain of cost of speculation = 1.5 - 1 = 0.5

Dominant strategy: sell, devaluation

**Equilibrium**: no speculator holds pesos

all rush to CB to sell pesos and buy $

(note there are not enough of them)

Unique Nash equilibrium: devaluation

<table>
<thead>
<tr>
<th>Speculator 1</th>
<th>hold</th>
<th>sell</th>
</tr>
</thead>
<tbody>
<tr>
<td>hold</td>
<td>(0,0)</td>
<td>(0,2)</td>
</tr>
<tr>
<td>sell</td>
<td>(2,0)</td>
<td>(1/2,1/2)</td>
</tr>
</tbody>
</table>
Third case: « intermediate fundamentals »: the case of strategic complementarity and self-fulfilling expectations

R = 10; one speculator who sells the domestic currency and buys the reserves of CB is not enough for the speculative attack to succeed

The fixed exchange rate can be maintained if crisis expected

Assumption: if devaluation peso depreciates by 50%

One speculator sells: net gain: = -1

Both sell (total maximum sold = 10= 5+5)

Both gain: 2,5 – 1= 3/2

(sell at 1 and buys back at ½ each

5 units of reserve)

**MULTIPLE** Nash equilibria

Expectation of devaluation triggers devaluation: rational to attack

Vice versa if expect no devaluation,

Expectations are rational ex-post
Self-fulfilling attacks

In other words, in this last case:

• Conditional on speculators not expecting a depreciation, the government keeps the peg

• Conditional on speculators expecting a depreciation, the government abandons the peg

multiple equilibria: the speculative attack is self fulfilling
Example: Tequila crisis, 1994-95
Example: Tequila crisis, 1994-95

Prior to the collapse, the Mexican peso had been operating a fixed parity against the $US. However, leading up to the end of 1994, there were several underlying weaknesses in the Mexican economy which led speculators to question the sustainability of the peg. 
Including:
(1) PPP calculations which indicated that prices/costs had risen in excess of trading partners, implying that the fixed exchange rate was overvalued. This was indicated as the cause of a growing current account deficit, which rose to 7% of GDP in 1993 and 8% in 1994.
Example: Tequila crisis, 1994-95

(2) Central bank reserves were running down and defending the currency was requiring higher interest rates. But at a time when Mexico was in recession suffering high unemployment. (3) There was a lot of political pressure for a devaluation. Mexico had a history of devaluing in election years. Civil unrest at the hard economic conditions culminated in the assassination of Luis Donaldo Colosio, the ruling party’s presidential candidate. Monetary policy was relaxed in the build-up to elections and, at the same time, the election year rise in public spending had weakened the government’s fiscal position.
Contagion

• a country might be forced to give up fixed exchange rate (devalue) because of its competitors
  
- one country devalues

- speculators believe (geographical or economic) ‘neighbours’ are now uncompetitive, they come under speculative attack, are forced to devalue

• or market psychology may take the fall of one currency as a ‘wake-up call’ signalling weakness of others

• but hard to identify true contagion: contemporaneous or sequential crises may follow common external shock(s)
Early warning indicators

Can we forecast currency crashes? What do the alternative theories imply about the leading indicators?

Most of the relevant variables move slowly, so they can’t be good ‘early-warning’ indicators

1. The Krugman model (fundamentals)

(a) fiscal imbalances
(b) growth of domestic credit relative to demand for money
(c) decline in international reserves
2. The self-fulfilling expectations story

(a) interest rate differentials
(b) vulnerability: high short-term debt, financial fragility
(c) Political cost and economic cost of defending the peg for the government
but hard to tie down because of ‘sunspot’ possibility

3. Contagion models: crisis in “neighbour” countries
## Early warning indicators

| Indicator                  | Noise/signal | % crises called | P(C|S) – P(C) |
|----------------------------|--------------|-----------------|-------------|
| **Monthly data**           |              |                 |             |
| Real exchange rate         | 0.22         | 58              | 35.2        |
| Stock prices               | 0.46         | 66              | 18.3        |
| Exports                    | 0.51         | 80              | 15.0        |
| M2/reserves                | 0.51         | 75              | 14.9        |
| Excess real M1             | 0.57         | 57              | 12.3        |
| Reserves                   | 0.58         | 72              | 12.2        |
| Domestic credit            | 0.68         | 57              | 8.3         |
| Real interest rate         | 0.77         | 89              | 5.5         |
| Real interest rate differential | 1.00    | 86              | -0.1        |
| **Annual data**            |              |                 |             |
| CA/GDP                     | 0.41         | 56              | 19.5        |
| CA/I                       | 0.49         | 31              | 15.1        |
| Budget deficit             | 0.58         | 22              | 11.5        |
| Short-term capital inflows | 0.59         | 29              | 10.9        |

Source: Goldstein *et al.* 2000. Domestic credit, budget deficit and short-term capital inflows all taken as % of GDP.

\[ P(C|S) – P(C) \] = probability of crisis when signal is observed *minus* unconditional probability of crisis

Noise/signal = sum of Type I and Type II errors as % of observed crisis signals
Early warning indicators

So the best signals are...

1. Deterioration of competitiveness – RER appreciation raises probability of attack (this is the only really strong predictor)
2. Stock prices down – probability of attack up
3. Exports down – probability up
4. Low reserves (or low relative to M2) – probability up
5. Money growth high – probability up
6. If most inflow of capital is FDI – probability lower
7. CA/GDP, CA/I highly negative – probability up
8. Budget deficit high relative to GDP – probability up

But overall predictive power low – poor trade off between Type I and Type II error
Policies against currency crises

- short run: interest rate defence, IMF programmes – but still controversial
- medium-long run: depends on causes of crises
- bad policy? – ‘easy’! get the policy into line
- speculators? make it harder for them
  - tax short-term capital movements (‘Tobin tax’)?
  - increased international cooperation?
  - capital controls - reverse financial globalisation?
- Reserves accumulation for precautionary motives
Crises and reserves accumulation

- Partly due to financial crisis of 2007-2008, emerging markets have accumulated massive amounts of foreign reserves.
- In part (in part only) at origin of global imbalances (US deficit), easy borrowing by the US, low interest rates, real estate bubble...
- Low return on those reserves (US T-bills) or even negative (if $ depreciates) : high cost of precautionary insurance.
- Better way to do it: IMF lends reserves in case of speculative attack (international insurance); G20 proposals.
- Two questions:
  - development; economic and social return to domestic investment is certainly higher than on reserves.
  - Other reasons to accumulate reserves: resist appreciation and export led growth strategies (China)
Foreign currency reserve holdings

Source: International Monetary Fund, Currency Composition of Official Foreign Exchange Reserves (COFER) data
Brief Summary

• Countries with fixed exchange rates and free capital mobility lose their monetary policy autonomy.

• Currency unions are less costly if (i) business cycles are synchronized, (ii) fiscal transfers across regions are easily implemented, (iii) labor is mobile across regions.

• Currency crisis are a common phenomenon in countries with pegged exchange rates. They can be due to misaligned policies but also to self-fulfilling expectations combined with weak fundamentals.

• Crisis prevention led emerging markets to accumulate large amounts of foreign reserves.