International Economics II

Monetary Policy and Nominal Exchange Rate Determination

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Outline

1. The Quantity Theory of Money
2. Fiscal deficits, Inflation, and the Exchange rate
3. Balance of Payment Crises

Motivation

- We have investigated how the real exchange rate is determined, which depends on movements in relative prices between the domestic and and foreign economy.
- However, so far we remained silent on the role of the nominal exchange rate (NER).
- We will introduce a model that links movements in the NER to the differential in countries' changes in their money supplies and real activity.
- The model we will study will be based on the Quantity Theory of Money, and better thought of as a long-run model of NER determination, where prices adjust.
- This allows us to study different exchange rate policy.
- Before moving to the theory, we will go through basic's of central banks' intervention in the foreign exchange (FX) market, and how this is linked to domestic money supply.

Central Bank Intervention in the FX Market

- What are central bank's (government's) actions taken to manage the money supply? How can they keep it constant (so the exchange rate remains fixed)?
- To understand this we need to examine how central banks intervene in the foreign exchange market.
- To proceed we will first construct a simplified balance sheet for the central bank:
  - Records the assets and liabilities of a central bank.
  - Uses double-entry bookkeeping: each transaction enters the balance sheet twice.
  - Concept of "balance of payments" (or official settlement balance) = negative of official reserves plays key role.

Central Bank's Balance Sheet

Assets

- Foreign government bonds (official international reserves).
- Gold (official international reserves).
- Domestic government bonds.
- Loans to domestic banks.

Liabilities

- Deposits of domestic banks.
- Currency in circulation $\Rightarrow$ (Considered liability because previously central banks had to give up gold when citizens brought currency to exchange.)

Central Bank's Purchases and the Money Supply

- A purchase of any asset by the central bank will be paid for with currency or a check written from the central bank:
  - Both are denominated in domestic currency.
  - Both increase the supply of money in circulation.
  - The transaction leads to equal increases of assets and liabilities.
- When the central bank buys domestic bonds or foreign bonds, the domestic money supply increases:
  - Domestic money will be needed/created for this purchase, regardless of currency denomination of the asset.

Central Bank's Sales and the Money Supply

- A sale of any asset by the central bank will be paid for with currency or a check written to the central bank:
  - Both are denominated in domestic currency.
  - The central bank puts the currency into its vault or reduces the amount of deposits of banks
  - This causes the supply of money in circulation to shrink.
  - The transaction leads to equal decreases of assets and liabilities.
- When the central bank sells domestic bonds or foreign bonds, the domestic money supply decreases:
  - Domestic money will be withdrawn from circulation, regardless of currency denomination of the asset.

Central Banks and the FX Market

- Central banks trade foreign government bonds in the foreign exchange markets:
  - Foreign currency deposits and foreign government bonds are often substitutes: both are fairly liquid assets denominated in foreign currency.
  - Quantities of both foreign currency deposits and foreign government bonds that are bought and sold influence the exchange rate.
- For example, the Central Bank of China holds a large quantity of U.S. T-bills (foreign government bonds), which are considered very liquid. Holding these T-bills helps defend a fixed exchange rate.

Sterilization

- As we saw above, central banks' buying and selling of foreign bonds in the foreign exchange market affects the domestic money supply.
- Sometimes central banks do not want their FX activity to impact the money supply, so they will take another action to offset their FX activity:
  - Money supply does not change.
  - Offsetting action is called sterilization.
- For example, if the central bank sells foreign bonds in the foreign exchange markets (decrease money supply), it can buy domestic government bonds in bond markets (increase money supply).
- **Goal:** leave the amount of money in circulation unchanged.

Effects of €100 FX Intervention

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

Outline

The Quantity Theory of Money

- We begin by providing a simple theory of money, which will allow us to link the quantity of money in different countries to their nominal exchange rate.
- The quantity theory of money assumes that people will hold more-or-less a stable faction of their income in the form of money:

$$M^d = \kappa P \times Y \tag{1}$$

where M^d are money holdings, P is the price level, Y is real income, and κ is some constant.

$$\Rightarrow m^d \equiv \frac{M}{P} = \kappa Y \qquad \text{(real money demand)} \tag{2}$$

- A similar condition holds in the foreign economy.

Equilibrium in the Money Market

- The real demand for money holdings equal the real supply:

$$\frac{M^s}{P} = m^d, \tag{3}$$

where M^s is the nominal domestic money supply (quantity of bills and coins in circulation + checking deposits).

- A similar condition holds in the foreign economy:

$$\frac{M^{*s}}{P^*} = m^{*d}, \tag{4}$$

where M^{*s} is the nominal foreign money supply.

Solving for the Exchange Rate

- We can solve for the nominal exchange rate, $\mathcal{E}$, by first noting that the real exchange rate is

$$e = \frac{\mathcal{E}P^*}{P} \tag{5}$$

and substituting for P and P^* using the two previous equilibrium conditions:

$$e = \frac{\mathcal{E}M^{*s}/m^{*d}}{M^s/m^d} \tag{6}$$

$$\Rightarrow \quad \mathcal{E} = \frac{M^s}{M^{*s}}\left(\frac{em^{*d}}{m^d}\right) \tag{7}$$

where according to the quantity theory of money, m^d, m^{*d} and e are determined by non-monetary factors or real factors (aggregate output, the degree of technological advancement, etc).

- Can now see what (7) implies about the two polar exchange rate regimes.

Floating Exchange Rate Regime

- As noted above, under a float the market determines the nominal exchange rate $\Rightarrow$ it is an endogenous variable.
- Meanwhile, domestic and foreign central banks are free to adjust their money supplies, M^s and M^{*s} as they choose $\Rightarrow$ these variables are exogenous and are "policy" variables in the model.
- What does central bank policy imply about exchange rate changes?

Monetary Policy in a Floating Exchange Rate Regime

An Example

- What if the domestic central bank decreases the money supply M^s?
- From (7) it is clear that $\mathcal{E}$ will appreciate by the same proportion:

$$\frac{\Delta \mathcal{E}}{\mathcal{E}} = \frac{\Delta M^s}{M^s} \tag{8}$$

- **Intuition:** A fall in the domestic quantity of money increases its scarcity relative to the foreign currency, thus, *ceteris paribus*, decreasing the relative price of the foreign currency in terms of the domestic currency (i.e., $\mathcal{E}$).

Floating Exchange Rate Regime

Cost-Benefit Analysis

- Benefits:
  - Independent monetary policy. $\Rightarrow$ Provides an important tool for government to react to shocks and potentially prevent large fluctuations in economy.
  - Automatic stabilization.
- Costs:
  - High price variability (high uncertainty) for internationally traded goods.
  - The exchange rate imposes a target for the monetary authority. If the central bank is not credible, inflation can go loose before is too late.
  - However, other monetary regimes, such as *inflation targeting*, may also help with central bank credibility and providing guidance for inflation expectations.

Fixed Exchange Rate Regime

- Under a fixed exchange rate regime the nominal exchange rate is now determined by the central bank intervening in the FX market.
- Therefore, conditional on $\mathcal{E}$, M^{*S}, and em^{*d}/m^{d}, domestic money supply, M^{s} is now an equilibrium outcome.
- $\Rightarrow$ That is, M^{s} , is an endogenous variable while $\mathcal{E}$ is exogenous (policy decision).
- How does the central bank policy have to react then?

Monetary Policy in a Fixed Exchange Rate Regime

An Example

- Imagine that the real exchange rate, e, experiences a depreciation (it increases).
- To hold the exchange rate fixed at current $\mathcal{E}$, according to (7) M^s must fall.
- Further, to keep real money demand constant, by equilibrium condition (3), the domestic price level, P, must fall by the same proportion as the money supply.
- The economy experiences deflation.
- This is not what occurs under floating regime.

Fixed Exchange Rate Regime

Cost-Benefit Analysis

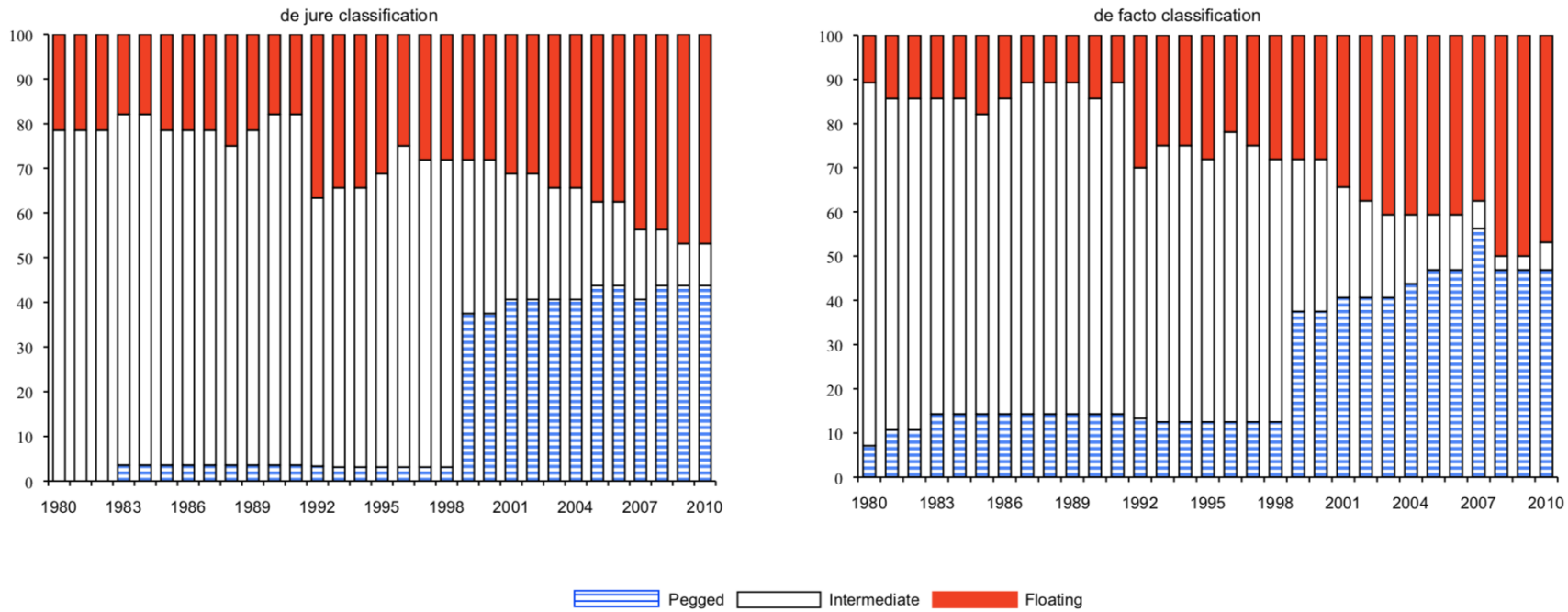
- Benefits:
  - Remove potentially damaging short- and long-run volatility of exchange rate.
  - Import inflation credibility by pegging to strong central bank.
  - Following periods of high price variability, pegging will anchor price inflation for internationally trade goods, which provides guidance for private-sector inflation expectations.
- Costs:
  - Loss of monetary policy independence (BIG ONE), unless country imposes capital controls.
  - Central bank costs of managing the exchange rate (e.g., FX reserves to do this could be gaining higher interest otherwise).

Fixed vs. Floating Exchange Rates

- Regimes might find somewhere in between ("intermediate" or "soft pegs"):
  - Crawling peg
  - Exchange rate band
  - Crawling band
- See Obstfeld and Rogoff (1995) and Fischer (2001) for more details.
- Over time, tendency to move towards one end of spectrum – "bipolar" view of regime (Fischer, 2001).
- Sometimes what governments say they do ("de jure") is not what they actually do ("de facto").

Exchange Rate Regimes: Advanced Economies

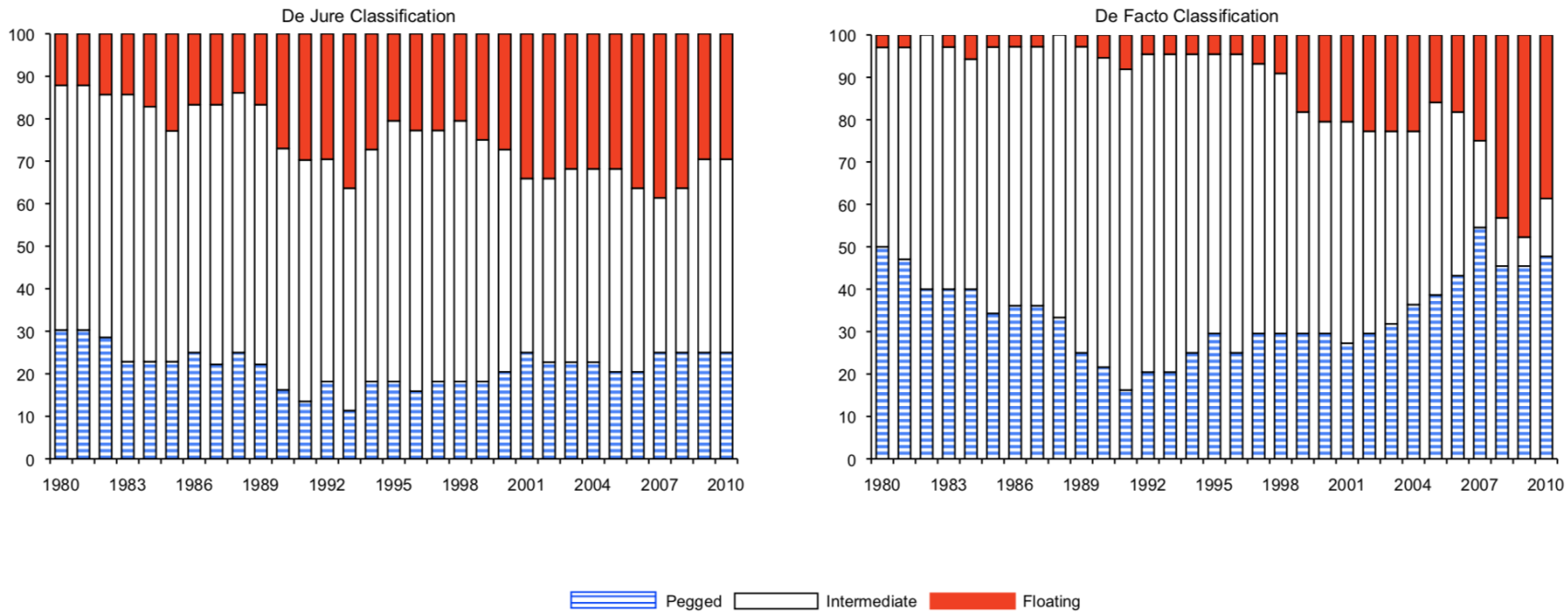
De Jure vs. De Facto Classification



Source: Ghosh, Qureshi, and Tsangarides (2011), IMF WP 11/112

Exchange Rate Regimes: Emerging Economies

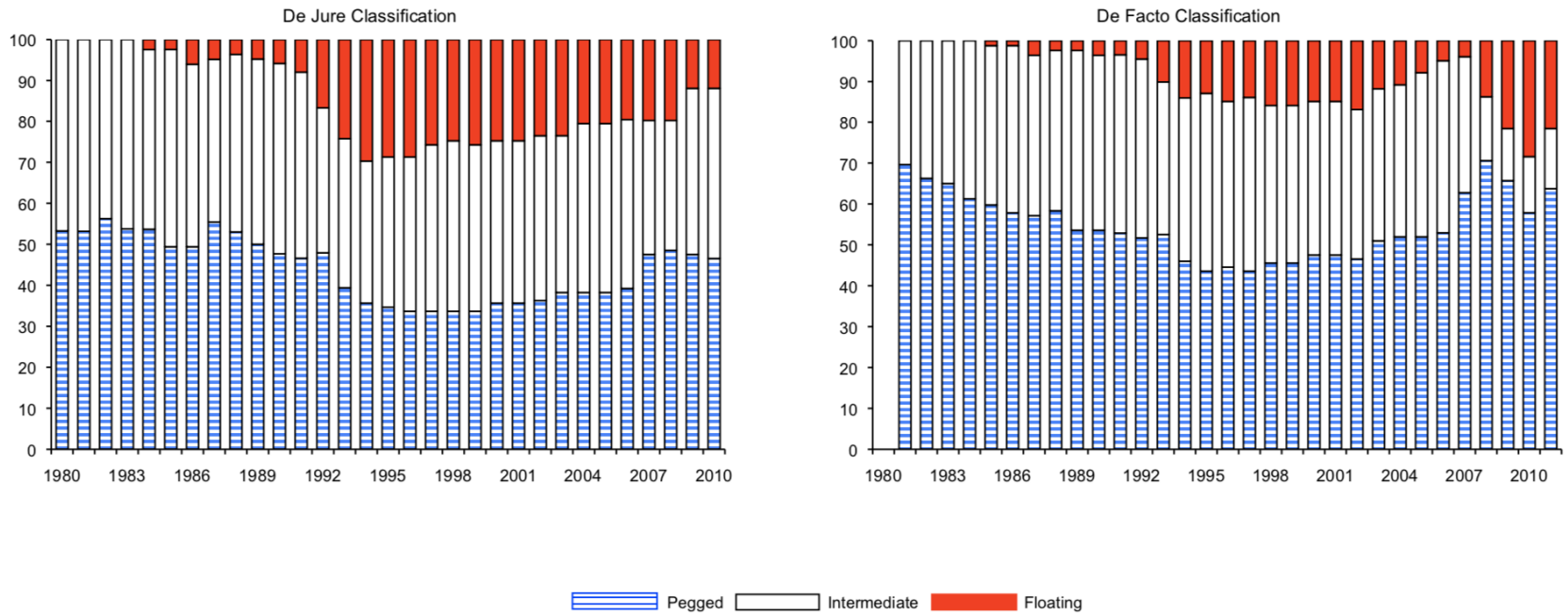
De Jure vs. De Facto Classification



Source: Ghosh, Qureshi, and Tsangarides (2011), IMF WP 11/112

Exchange Rate Regimes: Developing Economies

De Jure vs. De Facto Classification



Source: Ghosh, Qureshi, and Tsangarides (2011), IMF WP 11/112

Outline

A Simple Model

- The quantity theory of money provides a simple analysis of the relationship between money, prices, the nominal exchange rate, and real variables.
- It still leaves a number of questions unanswered. For example, what is the effect of fiscal policy on inflation?
- We will now incorporate the money demand in a richer model, where we can analyze the interplay between fiscal policy and the exchange rate policy.
- The model will have the main ingredients we already discussed:
  - small-open endowment economy with free capital mobility, a single trade good per period, and a government that levies lump-sum taxes to finance government purchases.

Model Ingredients

- For simplicity, we assume that there is no physical capital and hence no investment.
- Unlike the models studied thus far, we now assume that the economy exists, not just for 2 periods, but for an infinite number of periods.
- Differently than before, we will not focus on the household of the economy.
- Instead, we will discuss in detail each of the four building blocks that compose our monetary economy:
  1. The demand for money;
  2. Purchasing power parity;
  3. Interest rate parity;
  4. The government budget constraint

The Demand For Money

- Since money is a non-interest-bearing asset, the opportunity cost of holding money is the nominal interest rate on alternative assets, such as deposits or government bonds,
- Hence, we suppose that the demand for money depend not only on the level of real activity, but also on the nominal interest rate i_t.
- The higher the nominal interest rate i_t, the lower is the demand for real money balances.

The Demand For Money

- Formally, we assume a money demand function of the form:

$$\frac{M_t}{P_t} = L(\overset{+}{\overline{C}}, \overset{-}{i_t}) \tag{9}$$

  where $\overline{C}$ denotes consumption and i_t denotes the domestic nominal interest rate in period t.

- The function $L()$ is known as liquidity preference function. It is increasing in consumption and decreasing in the nominal interest rate.

- For simplicity we will assume C is constant over time (thus, it does not have a time subscript).

- In principle, such function could be derive from a full utility function maximization problem where households have preference for money (e.g. money in the utility function).

Purchasing power parity (PPP)

- In our economy, there is a single traded good and no barriers to international trade.
- Hence, purchasing power parity must hold: $e = 1$.
- Then PPP implies that in any period t:

$$P_t = E_t P_t^* \tag{10}$$

  - P_t and P_t^* are the domestic and foreign price of the good (in their own respective currencies) in period t.
  - E_t the nominal exchange rate in period t.

- Assume that the foreign currency price of the good is constant and equal to 1 ($P_t^* = 1$ for all t) $\Rightarrow P_t = E_t$.

The Interest Parity Condition

- In this economy, there is free capital mobility and no uncertainty.
- Free capital mobility implies that returns of bonds and deposits in the domestic country should be equal to returns in the rest of the world.
- Furthermore, there is no uncertainty, so forward rates and the expected exchange rate will be equal to the actual future exchange rate: $F_t = E^e_{t+1} = E_{t+1}$.
- This implies that the following interest rate parity condition holds:

$$(1 + i_t) = (1 + i^*_t)\frac{E_{t+1}}{E_t} \tag{11}$$

- Notice that because price is constant in the foreign country, foreign inflation is zero, $\pi^*_t = 0$, and thus: $i^*_t = r^*_t$.

The Government Budget Constraint

- The government has three sources of income:
  1. real tax revenues, T_t;
  2. money creation, $M_t - M_{t-1}$;
  3. interest earnings from holdings of international assets, $E_t i^* B^g$ [**note:** B^g is denominated in foreign currency, and $B^g > 0$ implies that the government is a creditor].

- Let the government purchases as $P_t G_t$, the per period government budget constraint:

$$E_t(B_t^g - B_{t-1}^g) + P_t G_t = P_t T_t + (M_t - M_{t-1}) + E_t i^* B^g \quad (12)$$

- The left hand side is government's use of resources and right hand side the sources.

The Government Budget Constraint

- Recall $E_t = P_t$ and $r_t^* = i_t^*$, we can express the gov. budget constraint in real terms by diving the equation by P_t:

$$B_t^g - B_{t-1}^g = \frac{M_t - M_{t-1}}{P_t} + T_t - G_t + r^* B^g. \tag{13}$$

  - $M_t - M_{t-1}/P_t$: is the seignorage revenue, the real revenue from money creation.
  - $G_t - T_t - r^* B^g \equiv DEF_t$ is the secondary fiscal deficit, the difference between government expenditures and income.

- Equation (13) makes it transparent that a fiscal deficit $(DEF_t > 0)$ must be associated with money creation $(M_t - M_{t-1} > 0)$ or with a decline in the government's asset position $(B^g - B^g < 0)$, or both.

Fixed Exchange Rate Regime

- To complete the description of the economy, we must specify the exchange rate regime. Let's start with a fixed exchange rate.
- Under a fixed exchange rate, the government intervenes in the FX market in order to keep the exchange rate at a fixed level $\Rightarrow E = E_t$ for all t.
- We can show that in this regime, the money supply M_t has to be fixed in all periods in the absence of any real shocks:
  - By PPP: $E = P$, so prices have to be constant.
  - By interest rate parity: $E_{t+1} = E_t \Rightarrow i_t = r_t^*$.
  - The money demand implies: $M_t = EL(\overline{C}, r_t^*)$
- In the absence of changes in consumption or in the world's real interest rate, M has to be constant.

Fiscal Deficits and the Sustainability of Currency Pegs

- Since the money supply is constant, the government foregone the seignorage revenue, and the fiscal deficits must be financed entirely through the sale of assets:

$$B_t^g - B_{t-1}^g = -DEF_t \tag{14}$$

- If the government runs a constant deficit over time, $DEF > 0$, eventually will accumulate a large negative debt ($B^g < 0$).

Fiscal Deficits and the Sustainability of Currency Pegs

- If there is an limit on the size of the public debt such that international creditors stop lending, when the government hits the limit it has to either:
  1. eliminate the fiscal deficit (i.e., set $DEF = 0$);
  2. or default on its debt;
  3. or abandon the exchange rate peg (a *Balance of Payment Crisis*).
- Latin American countries in the 90's and Southern European countries in 2012 had to go through some combination of the three.
- For a fixed exchange rate regime to be sustainable, it is necessary that the government displays fiscal discipline.

An Once-and-for-all Devaluation

- Suppose the domestic country decides to undertake an once-and-for-all devaluation of its currency.
- This policy is equivalent to a lump-sum tax on the holdings of real balance (i.e M/P).
- If in period 1 the government unexpectedly announces an increase in the nominal exchange rate from E to $E' > E$:
  - By the PPP price level jumps to $P' = E'$.
  - Interest parity does not change in any period: $i_t = r_t^*$.
    - in period 0 the HH did not expected the devaluations so expected inflation was 0.
    - in the following periods the gov. will keep the exchange rate constant **[note: what if we do not trust the government anymore?]**.
  - The demand for nominal money balances increases from $M = EL(\overline{C}, r^*)$ to $M' = E'L(\overline{C}, r^*)$.

An Once-and-for-all Devaluation

- The devaluation implies an increase from M to M' and seignorage revenue of:

$$= \frac{M - M'}{E'} \tag{15}$$

$$= \frac{E'L(\overline{C}, r^*) - EL(\overline{C}, r^*)}{E'} = L(\overline{C}, r^*)\frac{E' - E}{E'} \tag{16}$$

- Who loses? The household still wants to hold the same level of real balance M/P.
- Since the price level increases, in order to rebuild their desired real balances, the households will sell part of their foreign bonds to the central bank in return for domestic currency.
- The private sector ends up with a lower foreign asset position but the same level of real balances, whereas the government gains real resources as it exchanges money created by itself for foreign assets.

Floating Exchange Rate Regime

- Consider now a regime that does not directly target a path for the nominal exchange rate and instead let the nominal exchange float.
- The government still has to decide how to implement its monetary policy.
- Let's consider a very simple rule in which the central bank expands the quantity of money at a constant, positive rate μ each period:

$$M_t = (1 + \mu) M_{t-1} \tag{17}$$

- This simple rule could be interpreted as a form of inflation target, and in fact it generates inflation of rate μ.

Fiscal Deficits and the Sustainability of Currency Pegs

- Let's verify that prices grow at rate μ: $P_{t+1} = P_t(1+\mu) \Rightarrow \pi_t = \mu$.
- If this is case, by the PPP: $E_t = P_t \Rightarrow E_{t+1} = E_t(1+\mu)$.
- and by the interest rate parity:

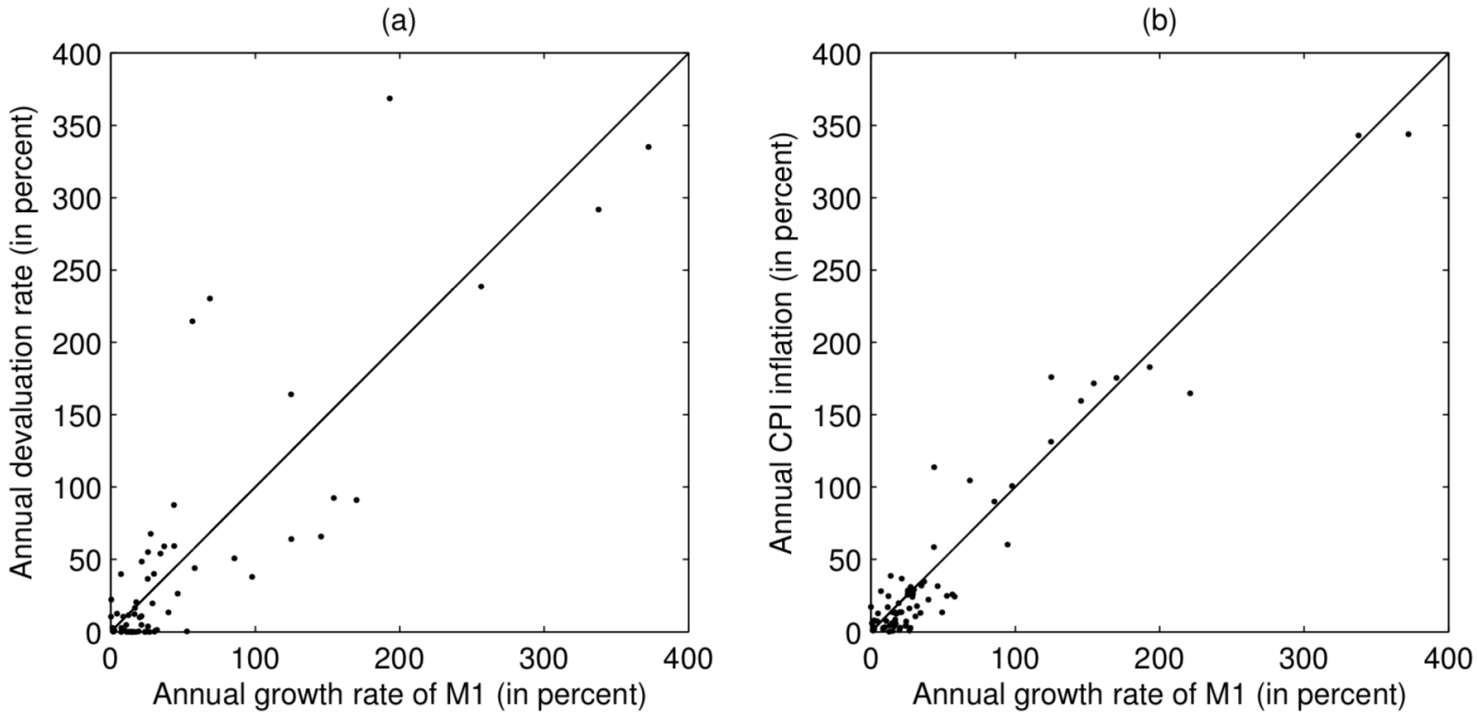
$$(1+i_t) = (1+i_t^*)\frac{E_{t+1}}{E_t} = (1+i_t^*)(1+\mu) \tag{18}$$

$$\Rightarrow \quad i_t \approx i_t^* + \mu = r_t^* + \mu \tag{19}$$

- so the nominal interest rate depends on the world's rate and the money growth rate, $i(\mu)$.
- Since $i(\mu)$ is constant over time, the money demand $L(\overline{C}, i(\mu))$ is also constant over time.
- Because in equilibrium $M_t/P_t = L(\overline{C}, i(\mu))$, it must be that if M_t grows at rate μ, P_t has to grow at rate μ.

Devaluation, inflation, and money growth

Figure: Argentina 1901-2005



Devaluation and inflation go hand in hand with money growth.

The Inflation Tax

- Recall that the seignorage revenue is given by: $(M_t - M_{t-1})/P_t$.
- Given that $M_t = E_t L(\overline{C}, i(\mu))$, we have:

$$\frac{M_{t-1} - M_t}{P_t} = L(\overline{C}, i(\mu)) \frac{E_t - E_{t-1}}{E_t} \tag{20}$$

$$= L(\overline{C}, i(\mu)) \frac{\mu}{1+\mu} \tag{21}$$

- intuitively, μ affects the inflation tax
  - negatively by decreasing the money demand, $L(\overline{C}, i(\mu))$: high μ, implies higher nominal interest rate, so agents hold less money;
  - positively through the term $\mu/(1+\mu)$.
- The first term is the "tax base", the second is the "tax rate".

Inflationary Finance

- Let's come back to the example of a country that ran consecutive deficits, DEF, and reached its borrowing limit so international markets do not lend anymore (i.e. B^g cannot grow).
- Under these circumstance the gov. budget constraint (13) becomes

$$DEF_t = (M_t - M_{t-1})/E_t \tag{22}$$

- so any additional deficit has to be paid through monetization of the fiscal deficit.

Inflationary Finance

- In some cases, the fiscal deficit is so large that the government is forced to increase the money supply at a faster rater.
- However, agents stop holding the domestic currency whatsoever and the "tax base" of the inflationary tax decrease.
- In the end, the inflation rate, the rate of depreciation of the domestic currency, and the nominal interest rate are all higher.
- The result is often hyperinflation with households holding foreign currency instead (dollars).
- Plenty of examples throughout history.

A Couple of Last Points

- In principle, the exchange rate policy by itself does not generate the crisis.
- Both floating and fixed exchange rates can be dangerous if combined with constant and high fiscal deficits.
- Also, in our simple model, we impose two crucial assumptions:
  1. Prices adjust instantaneously $\Rightarrow$ money is neutral.
  2. Free capital flows (fully open economy).

Money Non-neutrality

- There is some evidence that in the short run, there is some degree of price stickiness.
- This implies that in the short run money is non-neutral and potentially affect output through increase in demand.
- Recall: $M/P = L(\overline{C}, i)$.
- If P is fixed, an $\uparrow M$ means $L(.)$ should adjust, through a combination of increase in C and/or decreasing in i.
- If i_t responds, by the interest rate parity, E_{t+1}/E_t should go in the same direction.
- Since domestic prices are sluggish, this implies an overshoot of the nominal exchange rate.
- This is the **Dornbusch overshooting model**. You can find more here.

Capital Controls

- We saw that in a SOE, there is a tight connection between the monetary policy and the exchange rate policy.
- Fixing the nominal exchange rate E implied that M had to adjust to shocks to keep the peg - i.e. the country loses its monetary policy.
- It is possible to keep both the monetary policy and the nominal exchange rate if the country is a closed economy.
- This means that the country has to impose capital controls (as well as good controls) so both the interest rate parity condition and the PPP condition break.
- Thus, in practice, a government can choose only two out of three: (i) monetary policy, (ii) fixed exchange rate, and (iii) free capital mobility.
- This is known as the impossible trinity.

Outline

What is a Balance-of-Payments Crisis?

- A balance-of-payments (BOP) crisis is a situation in which the government is unable or unwilling to meet its financial obligations.
- Arise if government fails to meet obligations, such as payment of domestic/foreign public debt, or suspension of currency convertibility.
- Historically, these crises hit countries that have a fixed exchange rate regime.
- They are often associated with a sudden stop, a sharp reversal in capital flows and in the current account.

Causes of BOP Crises

- A BOP crisis often occurs where there a country runs an unsustainable combination of monetary and fiscal policies.
- Recall the government budget constraint:

$$B_t^g - B_{t-1}^g = \frac{M_t - M_{t-1}}{P_t} - DEF_t \tag{23}$$

- One example, is a country pegging its exchange rate while government runs continuing fiscal deficits.
  - Cannot finance deficit via seignorage.
  - At some point government will not be able to raise more debt.
- Change of policy or force $DEF = 0$ (either by defaulting on debt or sharp decrease in $G - T$).

Government Policy Options

1. Stop servicing debt. E.g., Mexico in 1982. Beginning of 1980s debt crisis in developing countries.

2. Fiscal adjustment program to get government spending under control, and increase tax revenue. Closer to what Southern European countries did in 2012.

3. Abandon exchange rate peg or devaluation. Occurred repeatedly in Latin American between 1970s and 1990s. Often associated with a huge depletion of foreign reserves right before crisis as people make a run from domestic currency in anticipation of devaluation.

Latin American Crises

- In the 1980s, high interest rates and an appreciation of the U.S. dollar caused the burden of dollar-denominated debts in Argentina, Mexico, and Brazil (among others) to increase drastically.
- A worldwide recession and a fall in many commodity prices also hurt export sectors in these countries.
- Linked to oil shocks of late 1970s and early 1980s.

Latin American Crises: Mexico

- In August 1982, Mexico announced that it could not repay its debts, mostly to private banks.
- The Mexican government implemented several reforms due to the crisis. Starting in 1987, it
  - Reduced government deficits.
  - Reduced production in the public sector (including banking) by privatizing industries.
  - Reduced barriers to trade.
  - Maintained an adjustable fixed exchange rate ("crawling peg") until 1994 to help curb inflation.
- Political instability and loan defaults at private banks contributed to another crisis in 1994, after which the Mexican government allowed the value of the peso to fluctuate $\Rightarrow$ Tequila Crisis.

Latin American Crises: Argentina

Starting in 1991, Argentina carried out similar reforms; it

- Reduced government deficits.
- Reduced production in the public sector by privatizing industries.
- Reduced barriers to trade.
- Enacted tax reforms to increase tax revenues.
- Enacted the Convertibility Law, which required that each peso be backed with 1 U.S. dollar, and it fixed the exchange rate to 1 peso per U.S. dollar $\Rightarrow$ a currency board.

Latin American Crises: Argentina

- Because the central bank was not allowed to print more pesos without having more dollar reserves, inflation slowed dramatically.
- Yet inflation was about 5% per annum, faster than U.S. inflation, so that the price/value of Argentinean goods appreciated relative to U.S. and other foreign goods.
- Due to the relatively rapid peso price increases, markets began to speculate about a peso devaluation.
- A global recession in 2001 further reduced the demand of Argentinean goods and currency.

Latin American Crises: Argentina

- Maintaining the fixed exchange rate was costly because high interest rates were needed to attract investors, further reducing investment and consumption expenditure, output, and employment.
- As incomes fell, tax revenues fell and government spending rose, contributing to further peso inflation.
- Argentina tried to uphold the fixed exchange rate, but the government devalued the peso in 2001 and shortly thereafter allowed its value to fluctuate.
- It also defaulted on its debt in December 2001 because of the unwillingness of investors to reinvest when the debt was due.

Latin American Crises: Brazil

- Brazil carried out similar reforms in the 1980s and 1990s; it
  - Reduced production in the public sector by privatizing industries.
  - Reduced barriers to trade.
  - Enacted tax reforms to increase tax revenues.
  - Fixed the exchange rate to 1 real per U.S. dollar. But government deficits remained high.
- High government deficits led to inflation and speculation about a devaluation of the real.
- The government did devalue the real in 1999, but a widespread banking crisis was avoided because Brazilian banks and firms did not borrow extensively in dollar-denominated assets.

BOP Crises

- Let's interpret the BOP Crises through the lens of the Model.
- Suppose the government start with positive reserves B^g and a fixed exchange rate, but run $DEF_t > 0$ so B_t^g decreases at a constant rate.
- Assume that the government does not have access to credit, so $B_t^g \geq 0$.
- Let T denote the period in which, as a result of having run out of reserves, the government abandons the peg and begins to monetize the fiscal deficit.

BOP Crises

Timing:

1. Pre-collapse phase: the currency peg is in effect. Lasts from $t = 1$ to $t = T - 2$.

2. BOP crisis: the central bank faces a run against the domestic currency, resulting in massive losses of foreign reserves. Happens at $t = T - 1$.

3. Post-collapse phase: nominal exchange rate floats freely and the central bank expands the money supply at a rate consistent with the monetization of the fiscal deficit. From $t = T$ onwards.

The strategy to solve for the dynamics of the crisis is to first characterize (1) and (3) before turning to the crisis phase in (2).

1. Pre-crisis phase: from $t = 1$ to $t = T - 2$

- As we saw in the previous section:
  - Exchange rate is constant: $E_t = E$.
  - PPP (and $P^* = 1$) $\Rightarrow P_t = E$.
  - UIP $\Rightarrow i_t = r^*$.
  - Money supply and money demand are constant.
- Dynamics of foreign reserves:

$$B_t^g - B_{t-1}^g = -DEF_t \tag{24}$$

3. Post-crisis phase: from $t = T$ onwards

- Since the government has no reserves anymore and cannot issue debt, it abandons the fixed peg and finance all its deficit through inflation tax:

$$DEF = L(\overline{C}, i(\mu))\frac{\mu}{1+\mu} \tag{25}$$

- Relative to pre-crisis:
  - Both the money supply, the domestic price level and the nominal exchange rate are growing at μ (inflation).
  - Interest rate increases: $1 + i_t = (1 + r^*)(1 + \mu)$.
  - Real money balances, (M/P), is lower, since the higher nominal interest rate lower demand for money.

2. BOP crisis: period $T-1$

- Agents are racional and antecipate what the government will do once the fixed exchange rate collapses $\Rightarrow$ they make a run for the remaining foreign reserves.
- In period $T-1$, the exchange rate is still E, but the nominal interest rate is already higher (at $i(\mu)$) because agents expect a devaluation of the domestic currency.
- Thus their demand for real balances fall and they make a run for foreign reserves:

$$\frac{M_{T-1}}{E} = L(\overline{C}, i(\mu)). \tag{26}$$

- Since E haven't adjust yet, the fall in real balance comes from a fall in nominal balances, M_{t-1}.

2. BOP crisis: period $T-1$

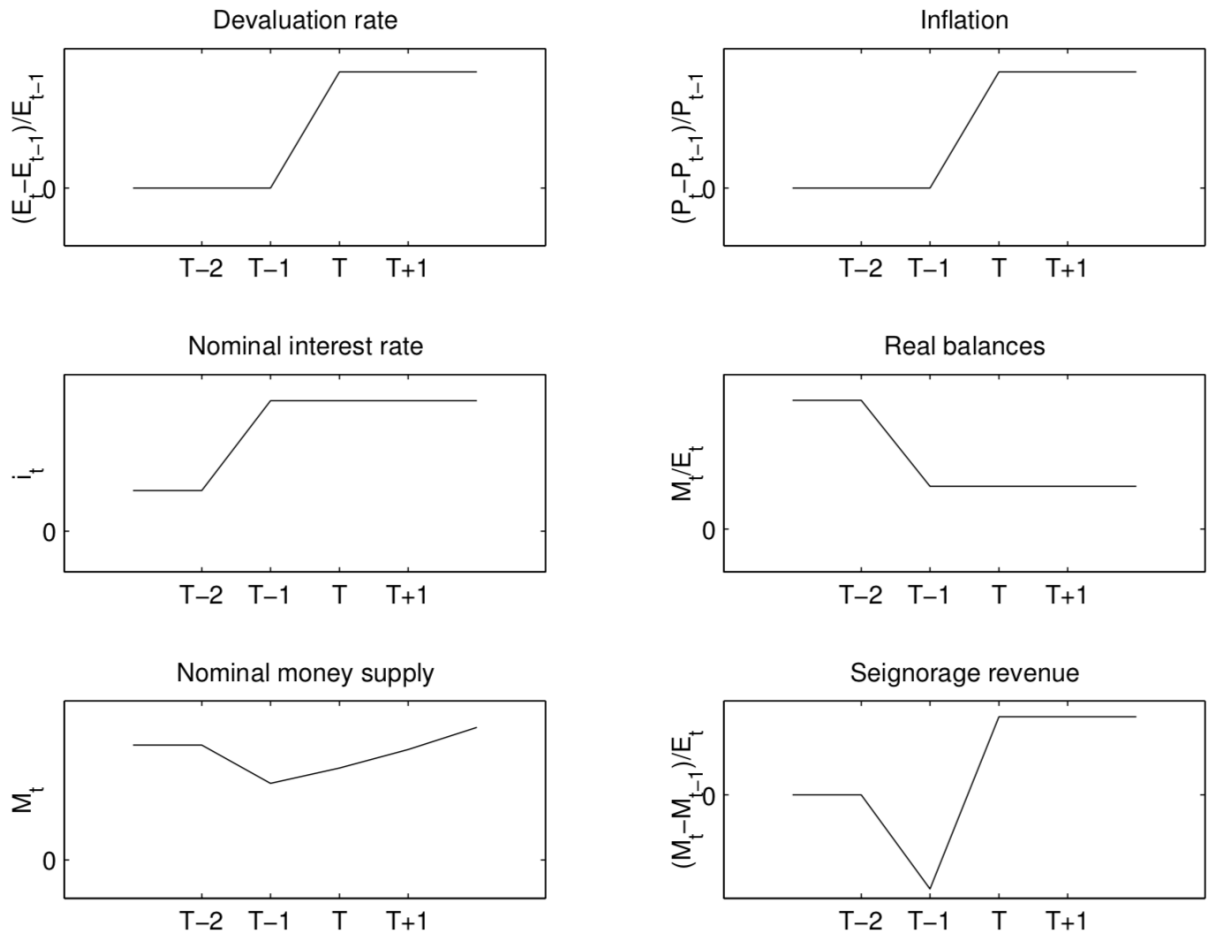
- This implies that at $T-1$ the reserves fall even further!
- Recall that the fall of reserves $B^g_{T-1} - B^g_{T-2}$:

$$B^g_{T-1} - B^g_{T-2} = \frac{M_{T-1} - M_{T-2}}{E} - DEF \tag{27}$$

$$= L(\overline{C}, i(\mu)) - L(\overline{C}, r^*) - DEF \tag{28}$$

- Since $i(\mu) > r^*$ then $L(\overline{C}, i(\mu)) < L(\overline{C}, r^*)$!
- Foreign reserves fall more than the fiscal deficit at $T-1$ as agents make a run on the central bank to unload their domestic currency!

Dynamics of a BOP crises



Taking Stock

- We have taken a look at how a Central Bank operates in the FX market.
- The simple quantity theory of money implies that, in an open economy, the monetary policy is closely related to the exchange rate.
- We outlined a simple model where we analyzed the dynamics of fiscal deficit together with the monetary and exchange rate policy.
- Then, we evaluate the dynamics of a Balance of Payment crisis through the lens of this model.