Slides for Chapter 15: Inflationary Finance and Balance of Payments Crises

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These are the slides for the textbook, "International Macroeconomics: A Modern Approach," by Stephanie Schmitt-Grohé, Martín Uribe, and Michael Woodford, Princeton University Press, 2022, ISBN: 9780691170640.

Road Map

This chapter explores the connection between fiscal deficits, money creation, and the exchange rate.

• It begins by studying a theory of exchange rate determination base on a theory known as the *quantity theory of money* (QTM).

• Within the Quantity Theory of Money, it shows how money creation leads to inflation and currency depreciation.

• Finally, it shows how a currency peg can end in a balance of payments crisis (BOP) when the government runs sustained fiscal deficits. A BOPis a situation in which the government goes from losing foreign reserves in a smooth way to losing massive amounts in a short period of time and becoming unable to defend a currency peg.

The Quantity Theory of Money

The Demand for Money

The quantity theory of money (or just quantity theory) asserts that a key determinant of the nominal price level is the quantity of money printed by the central bank.

A central building block of the quantity theory is the *demand for money*:

$$M_t^d = \frac{1}{V} P_t Y_t. \tag{1}$$

where $M_t^d =$ desired money holdings; $P_t =$ price level; $Y_t =$ real income, and $v > 0$ is a parameter ($1/V =$fraction of income households desire to hold in the form of money balances).

V is known as *money velocity*.

Equilibrium in the Money Market

Let M_t denote the nominal *money supply*: quantity of bills and coins in circulation plus checking deposits.

Equilibrium requires that money supply be equal to money demand,

$$M_t = \frac{1}{V} P_t Y_t. \tag{2}$$

Inflation as a Monetary Phenomenon

In its strongest version the QTM maintains that output is not determined by monetary factors.

Thus, under this view, equation (2) has two endogenous variables, P_t and M_t, one exogenous variable, Y_t, and one parameter, V.

It follows that increases in the moeny supply are associated with increases in the price level:

$$M_t \uparrow \Rightarrow P_t \uparrow$$

For example, if the central bank decides to double the quantity of money in period t, then the price level will also double

Intuition: when the central bank injects money households find themselves with more money than they wish to hold. As a result, they try to get rid of part of it by purchasing goods. However, the supply of goods is not affected by the money injection. The excess demand for goods leads to a generalized increase in prices.

Determination of the Exchange Rate

Recall that the real exchange rate, e_t, is the relative price of a basket of goods abroad in terms of baskets of goods at home:

$$e_t = \frac{\mathcal{E}_t P_t^*}{P_t}, \tag{3}$$

where $\mathcal{E}_t =$ nominal exchange rate and $P_t^* =$ foreign price level

The QTM maintains that e_t is not determined by monetary factors.

Combining (2) and (3) to eliminate P_t and solving for$\mathcal{E}_t$ gives

$$\mathcal{E}_t = M_t \frac{V e_t}{P_t^* Y_t}. \tag{4}$$

In (4) $\mathcal{E}_t$ and M_t. are endogenous variables and e_t and P_t^* are exogenously determined. So increases in the money supply are associated with currency depreciation:

$$M_t \uparrow \Rightarrow \mathcal{E}_t \uparrow$$

A Flexible Exchange Rate Regime

Under a flexible (or floating) exchange rate regime, the central bank controls M_t, and the market determines $\mathcal{E}_t$.

• Suppose the central bank increases M_t. Then, by (4) $\mathcal{E}_t$ also increases (currency depreciation) by the same proportion. By (2), P_t increases proportionally.

• Suppose now that Y_t exogenously falls (recession), and that the central bank keeps M_t unchanged. Then, by (4) $\mathcal{E}_t$ increases (currency depreciation). By (2), P_t increases proportionally.

• Suppose now that exogenously e_t increases or P_t^* falls (real exchange rate depreciation or foreign deflation) and that the central bank keeps M_t unchanged. Then, by (4) $\mathcal{E}_t$ increases (currency depreciation). Note that now, by (2), P_t is unchanged.

A Fixed Exchange Rate Regime

Under a fixed exchange rate regime, the central bank determines the path of $\mathcal{E}_t$ and M_t is endogenously determined by (4).

• Suppose Y_t falls. If the central bank keeps $\mathcal{E}_t$ fixed, by (4), M_t falls in the same proportion as Y_t.

• By (2), the fall in Y_t does not affect the price level, P_t (recall that M_t falls in the same proportion as Y_t).

• Note how different is the response of P_t to a fall in Y_t under a flexible exchange rate and a fixed exchange rate.

• Similar asymmetries take place in response to a real exchange depreciation (an increase in e_t) or a decrease in the foreign price level P_t^*: cause a depreciation and no inflation under a flexible exchange rate with M_t constant, but but no change in the exchange rate and price deflation under a fixed exchange rate.

Taking Stock

• The QTM says that under a flexible exchange rate regime the domestic price level is affected by domestic factors (e.g., changes in M_t and Y_t) but is isolated from foreign factors (e.g., changes in e_t or P_t^*).

• By contrast under a fixed exchange rate regime the domestic price level is isolated from domestic factors (M_t and Y_t) but is affected by foreign factors (e_t or P_t^*).

• A corollary of this is that under a fixed exchange rate regime the country *imports* foreign inflation, in the sense that foreign inflation (the growth rate of P_t^*) determines domestic inflation (the growth rate of P_t.

• All things considered, is the QTM a good or a bad theory? It depends on what use one makes of it. It is not a good theory to understand the short-run adjustment of low-inflation economies–e.g., the periphery of Europe during the GFC—where a model with nominal rigidity would be more useful. But it is a good framework to understand short-run dynamics in high-inflation countries or long-run inflation patterns across countries (horizons of 15 years or longer).

Fiscal Deficits, Inflation, and the Exchange Rate

A Monetary Economy with a Government Sector

What is the effect of fiscal policy on inflation and the exchange rate?

What role do expectations about future changes in monetary and fiscal policy play for the determination of prices, exchange rates, and real balances?

To address these questions, we expand the Quantity Theory of Money in two directions:

– We incorporate a fiscal authority

– We introduce a more realistic demand for money, that depends on the interest rate.

Four Building Blocks

(1) an interest-elastic demand for money;

(2) purchasing power parity;

(3) interest rate parity; and

(4) the government budget constraint.

An Interest Elastic Demand for Money

We now assume that the demand for money depends negatively on the nominal interest rate: this formulation is more realistic, because money is a non-interest-bearing asset, so its opportunity cost is the nominal interest rate on interest-bearing liquid assets, such as time deposits. Consider the money demand function

$$\frac{M_t^d}{P_t} = L(\underset{+}{C_t}, \underset{-}{i_t}), \tag{5}$$

We also changed Y_t for C_t (consumption), because we want to capture the fact that households use money to buy consumption goods. We assume that C_t is constant, so drop the subscript t.

The function $L(\cdot, \cdot)$ is also known as the *liquidity preference function*. Equilibrium in the money market requies that

$$\frac{M_t}{P_t} = L(C, i_t). \tag{6}$$

Purchasing Power Parity

We assume that there is a single traded good and no barriers to international trade. Therefore, prices are equalized across countries ($e_1 = 1$ at all times). When this happens, we say that purchasing power parity (PPP) holds:

$$P_t = \mathcal{E}_t P_t^*.$$

where P_t^* = foreign price level. Assume that $P_t^* = 1$, so

$$P_t = \mathcal{E}_t. \tag{7}$$

Then, the money market-clearing condition (6) becomes

$$\frac{M_t}{\mathcal{E}_t} = L(C, i_t). \tag{8}$$

The Interest Parity Condition

Assume that there is free capital mobility and no uncertainty.

We then have the interest parity conditiion

$$1 + i_t = (1 + i^*)\frac{\mathcal{E}_{t+1}}{\mathcal{E}_t}, \tag{9}$$

where i^* denotes the foreign interest rate.

The Government Budget Constraint

$$\mathcal{E}_t(B_t^g - B_{t-1}^g) + P_t G_t = P_t T_t + (M_t - M_{t-1}) + \mathcal{E}_t i^* B_{t-1}^g.$$

where T_t = tax revenue; $M_t - M_{t-1}$ = money creation; $B_t^g - B_{t-1}^g$ change in holdings of an internationally traded bond; $i^* B_{t-1}^g$ = interest earnings from bond holdings; G_t = government consumption

Dividing both sides by P_t, using $\mathcal{E}_t = P_t$ from (7)), and rearranging

$$B_t^g - B_{t-1}^g = \frac{M_t - M_{t-1}}{P_t} - \left(G_t - T_t - i^* B_{t-1}^g\right). \quad (10)$$

Here, note two important terms:

$$\frac{M_t - M_{t-1}}{P_t} \quad \text{(seignorage revenue)}$$

$$(G_t - T_t) - i^* B_{t-1}^g \quad \text{(secondary fiscal deficit, call it } DEF_t\text{)}$$

Financing the Fiscal Deficit

Using the definition of secondary fiscal deficit, write the gov't budget constraint (10) as

$$B_t^g - B_{t-1}^g = \frac{M_t - M_{t-1}}{\mathcal{E}_t} - DEF_t. \tag{11}$$

Thus a fiscal deficit ($DEF_t > 0$) causes
(a) money creation ($M_t - M_{t-1} > 0$) and/or
(b) a decline in the government's asset position ($B_t^g - B_{t-1}^g < 0$).

Fiscal Deficits and the Sustainability of Currency Pegs

Suppose the government keeps the exchange rate at the fixed level $\mathcal{E}$, so that $\mathcal{E}_t = \mathcal{E}$.

We established that when the government pegs the exchange rate, the money supply becomes endogenous variable.

With $\mathcal{E}_t = \mathcal{E}$, the PPP condition (7), implies that

$$P_t = \mathcal{E}.$$

This expression suggests that a country that wishes to stop high inflation could do so by pegging its currency to that of a low-inflation country.

Argentina did exactly that in 1991, by pegging the peso to the dollar at a 1-to-1 rate.

The currency peg and the interest parity condition (9) imply that

$$i_t = i^*.$$

Then, equilibrium in the money market mplies that

$$M_t = \mathcal{E}L(C, i^*).$$

So the money supply is consant in equilibrium.

The government budget constraint (11) becomes

$$B_t^g - B_{t-1}^g = -DEF_t. \tag{12}$$

In words, when the government pegs the exchange rate, it loses one source of revenue, seignorage. The fiscal deficit financed by running down governmnt asset holdings.

Currency Pegs Require Fiscal Discipline

To see this, suppose

$$DEF_t = DEF > 0.$$

Equaion (12) then implies that government assets fall over time,

$$B_t^g - B_{t-1}^g = -DEF < 0.$$

At some point, $B_t^g < 0$, implying that the government is a debtor.

Suppose that there is an upper limit on the size of the public debt. When the public debt hits this limit, the government must either:
— rduce the fiscal deficit (i.e., set $DEF = 0$)
– abandon the currency peg. This is called a *balance of payments crisis*.

Fiscal Consequences of a Devaluation

An unexpected devaluation acts as a tax that generates revenue for the government. To see this,
– The central bank unexpectedly devalues the currency from $\mathcal{E}$ to $\mathcal{E}' > \mathcal{E}$.

– By the PPP condition, equation (7), P_t, jumps from $\mathcal{E}$ to $\mathcal{E}'$, so the devaluation is inflationary.

– The devaluation does not affect the interest rate, because $\mathcal{E}_t$ is expected to remain at $\mathcal{E}'$ in the future. So $i_t = i^*$, for all t.

Then, the liquidity preference equation (8) says that the demand for nominal money balances increases from $\mathcal{E}L(C, i^*)$ to $\mathcal{E}'L(C, i^*)$.

(The explanation continues on the next slide.)

Fiscal Consequences of a Devaluation (concluded)

The government budget constraint (11) in period 1 becomes

$$
\begin{aligned}
B_1^g - B_0^g &= \frac{M_1 - M_0}{\mathcal{E}'} - DEF \\
&= \frac{\mathcal{E}' L(C, i^*) - \mathcal{E} L(C, i^*)}{\mathcal{E}'} - DEF.
\end{aligned}
$$

Note that the first term on the right-hand side of the last equality is positive.

As a result, the government asset position improves; $B_1^g - B_0^g$.

Therefore, a surprise devaluation increases government revenue in the period in which the devaluation takes place.

No effects after period 1, because the exchange rate remains constant at $\mathcal{E}'$.

Inflationary Finance of Fiscal Deficits

A Constant Money Growth Rate Regime

Consider a floating exchange rate regime in which the central bank targets a path for the money supply.

Suppose that the central bank expands the quantity of money at a constant, positive rate μ,

$$M_t = (1+\mu)M_{t-1}. \tag{13}$$

for $t = 1, 2, \ldots$ To find the equilibrium values of $\mathcal{E}_t$, P_t, and i_t, guess and verify that in equilibrium the currency depreciates at the rate μ from period 2 on:

$$\frac{\mathcal{E}_{t+1}}{\mathcal{E}_t} = 1 + \mu,$$

for $t = 1, 2, \ldots$.

Verify the validity of the Conjecture

By the PPP condition (7), P_t must also grow at the rate μ,

$$\frac{P_{t+1}}{P_t} = 1 + \mu,$$

for $t = 1, 2, \ldots$. In words, inflation equals the rate of growth of the money supply (as in the QTM).

By the interest parity condition (9)

$$1 + i_t = (1 + i^*)\frac{\mathcal{E}_{t+1}}{\mathcal{E}_t} = (1 + i^*)(1 + \mu),$$

for $t = 1, 2, \ldots$. We summarize the positive relationship between i_t and μ by writing

$$i_t = i(\underset{+}{\mu}),$$

for $t = 1, 2, \ldots$

Verify the validity of the Conjecture (concluded)

Use the last expression to eliminate i_t from the money market-clearing condition (8)

$$\frac{M_t}{\mathcal{E}_t} = L(C, i(\mu)). \tag{14}$$

The RHS of (14) is constant, so its LHS must also be constant. This implies that M_t and $\mathcal{E}_t$ grow at the same rate, μ, for $t = 2, 3, \ldots$.

This confirms the initial conjecture that $\mathcal{E}_{t+1}/\mathcal{E}_t = 1 + \mu$, for $t = 2, 3, \ldots$.

Condition (14) says that the higher the rate of money growth μ, the lower real money holdings, M_t/P_t, will be.

Fiscal Consequences of Money Creation

We just established that increasing the money growth rate μ reduces real money holdings, M_t/P_t.

In turn, holding lower real money balances makes it harder for people to perform economic transactions, which is likely to be welfare decreasing.

So why do some countries print money at high rates?

One reason is that printing money is a way to collect resources to finance fiscal deficits. We explore this idea next.

The Inflation Tax

Let's recall the government budget constraint (11),

$$B_t^g - B_{t-1}^g = \frac{M_t - M_{t-1}}{\mathcal{E}_t} - DEF_t. \qquad \text{(11 R)}$$

Suppose the government has been expanding M_t at the constant rate μ and is expected to continue to do. Then, by (14)), $M_t = \mathcal{E}_t L(C, i(\mu))$, so we can write

$$\begin{aligned} \frac{M_t - M_{t-1}}{\mathcal{E}_t} &= \frac{\mathcal{E}_t L(C, i(\mu)) - \mathcal{E}_{t-1} L(C, i(\mu))}{\mathcal{E}_t} \\ &= L(C, i(\mu)) \left(\frac{\mathcal{E}_t - \mathcal{E}_{t-1}}{\mathcal{E}_t} \right). \end{aligned}$$

When M_t grows at the rate μ, $\mathcal{E}_t$ grows at the rate μ as well. So we can rite the first term of the above equaton (seignorage) as

$$\frac{M_t - M_{t-1}}{\mathcal{E}_t} = L(C, i(\mu)) \left(\frac{\mu}{1+\mu} \right). \qquad (15)$$

The Inflation Tax (concluded)

Since in equilibrium μ equals the inflation the RHS of (15) can be interpreted as the government's *inflation tax revenue*. Thus,

$\mu/(1+\mu) =$ inflation-tax rate

$L(C, i(\mu)) =$ inflation-tax base

The Inflation Tax Laffer Curve

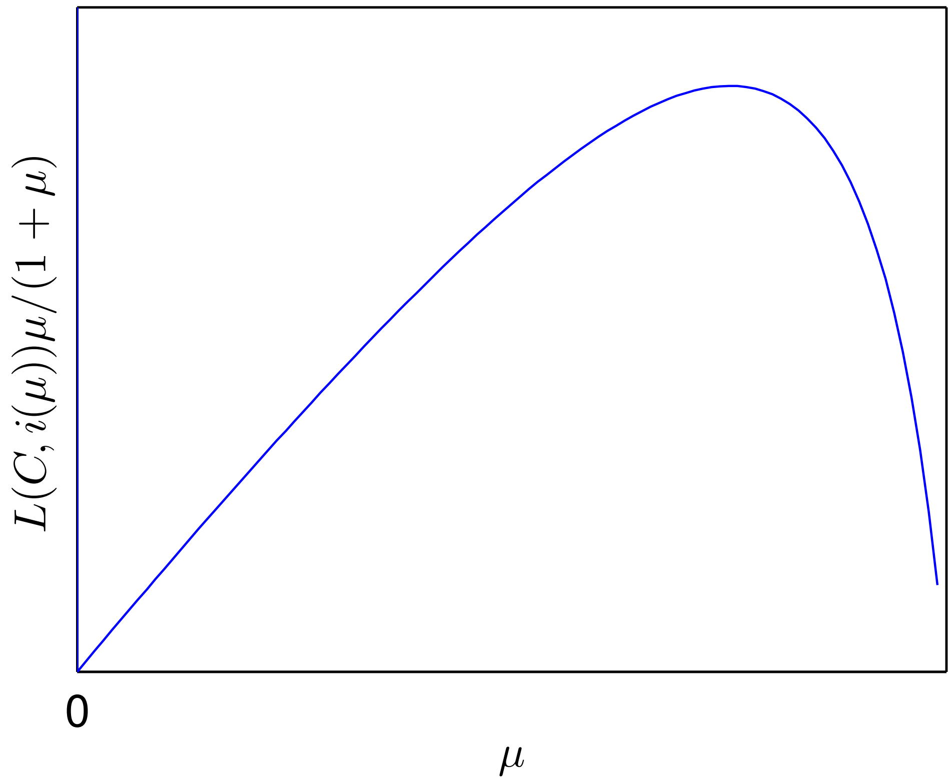
The tax base, $L(C, i(\mu))$, is decreasing in μ
the tax rate, $\mu/(1+\mu)$, is increasing in μ

So it is not clear whether seignorage increases or decreases with the rate of expansion of the money supply, μ.

Typically, seignorage revenue is increasing in μ for low values of μ and decreasing for high values of μ.

The next slide depicts the relationship between seignorage revenue and μ, called the inflation-tax Laffer curve.

The Inflation Tax Laffer Curve



Notes. The inflation tax Laffer curve depicts the relationship between the money growth rate, μ, and seignorage income, $(M_t - M_{t-1})/P_t$, in an economy in which the government expands the money supply at a constant rate. In equilibrium, seignorage income equals $L(C, i(\mu))\frac{\mu}{1+\mu}$. The first factor is decreasing in μ and the second increasing. This feature can give rise to a nonmonotonic relationship between the money growth rate and seignorage income, like the one depicted in the figure. In equilibrium, inflation equals the money growth rate, so the horizontal axis can be interpreted as measuring either variable.

Inflationary Finance

Consider a situation in which
– the government runs s constant fiscal deficit, $DEF_t = DEF > 0$
— has reached its borrowing limit, so $B_t^g - B_{t-1}^g = 0$.

Then, the government budget constraint (11) becomes

$$DEF = \frac{M_t - M_{t-1}}{\mathcal{E}_t}.$$

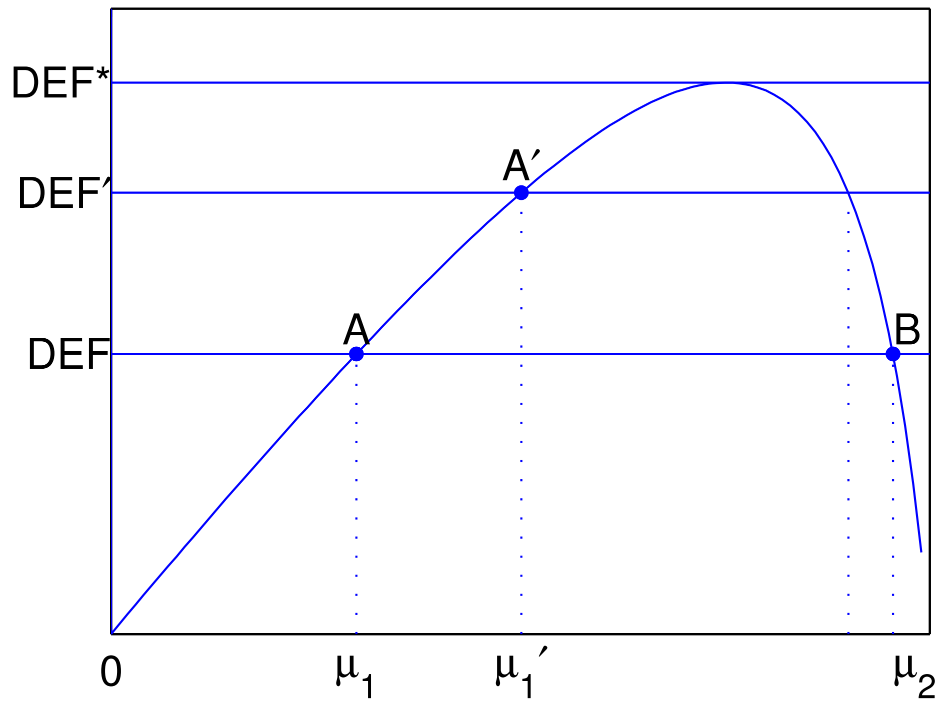
It says that the government finances the fiscal deficit by printing money (*monetization of the fiscal deficit*).

Combining the above expression with (15), we obtain

$$DEF = L(C, i(\mu)) \left(\frac{\mu}{1+\mu}\right). \qquad (16)$$

The figure on the next slide plots the left- and right-hand sides of this expression.

Inflationary Finance and the Laffer Curve of Inflation



Notes. The figure shows that there are two values of the money growth rate, μ_1 and μ_2, that generate enough seignorage revenue to finance the fiscal deficit DEF. In one equilibrium inflation is high (point B), and in the other it is relatively low (point A). Typically, economies are on the upward-sloping side of the Laffer curve, so point A is more relevant. An increase in the deficit from DEF to DEF' requires a higher rate of monetary expansion, $\mu_1' > \mu_1$, and results in higher inflation. Deficits above DEF^* cannot be financed by printing money and lead the economy into hyperinflation if the economy has exhausted its ability to issue debt.

What Does the Figure Say?

• The horizontal axis measures the money growth rate, but can also be interpreted as measuring inflation, or the depreciation rate, since in equilibrium they are all equal to one another.

• There are two rates of monetary expansion, μ_1 and μ_2, that generate enough seignorage revenue to finance the fiscal deficit DEF.

• The more realistic scenario is described by point A, in which the DEF is financed with the smaller of the two money growth rates, μ^A.

• An increase in the fiscal deficit from DEF to $DEF' > DEF$ requires increasing the money supply at a faster rate (point A').

• It follows that an increase in the fiscal deficit, increases inflation and the depreciation rate.

• If the fiscal deficit is larger than DEF^*, there is no money growth rate that can finance it, and the economy falls into a hyperinflation.

Balance of Payments Crises

What's a Balance of Payments Crisis?

A balance of payments (or BOP) crisis is a situation in which the government is unable or unwilling to meet its financial obligations. These difficulties may manifest themselves in a variety of ways, such as the failure to honor the domestic or foreign public debt or the suspension of currency convertibility.

A Policy Induced BOP

We will analyze a BOP crisis that occurs because of an unsustainable situation in which the government pegs the nominal exchange rate and at the same time runs a fiscal deficit.

Key Prediction of the Model

An empirical regularity associated with this type of BOP crises is that right before the peg is abandoned, the central bank suffers a speculative attack, in which it loses vast amounts of foreign reserves (much more than what it was losing to finance the fiscal deficit) in a short period of time. We will check whether the model predicts a speculative attack.

Description of the Environment

Consider a country that is running a constant fiscal deficit $DEF > 0$.

Suppose that the country is embarked on a currency peg. Specifically, assume that the government fixes the nominal exchange rate at $\mathcal{E}$.

The analysis starts in period 1, but think of the currency peg as having been implemented before period 1.

Suppose that at the beginning of period 1 the government has a positive stock of foreign assets, $B_0^g > 0$. Think of B_t^g as the foreign reserves with which the government can defend the currency peg.

In Words, theMaking of a BOP Crisis

We already showed that as long as the peg is expected to continue to be in place next period, the fiscal deficit will cause the government to lose reserves over time at the rate DEF (i.e., $B_t^g - B_{t-1}^g = -DEF$).

At some point, the government will run out of foreign reserves. Let such period be denoted $T-1$, so $B_{T-1}^g = 0$. Suppose foreign lenders would not lend to this government, because they think the government will not eliminate the fiscal deficit.

We want to show that in period $T-1$, the government loses an amount of foreign reserves larger than DEF, i.e., $B_{T-1}^g - B_{T-2}^g < -DEF$. This is what we mean by *a speculative attack.*

With its foreign reserves depleted, starting in T, the government has to abandon the peg and start financing the fiscal deficit by printing money.

The 3 Phases of a BOP

(1) The pre-collapse phase, $t < T - 1$: the peg is in place and is expected to be in place also next period.

(2) The BOP crisis: takes place in period $T - 1$. The government suffers a speculative attack, and although the peg is in place, it is expected to be abandoned in period T.

(3) The post-crisis: from period T onward. The peg is no longer in place. and the government has ran out of foreign reserves and prints money to finance the fiscal deficit.

(1) The Pre-Crisis Phase: From $\boldsymbol{t = 1}$ to $\boldsymbol{t = T - 2}$

In any period $t = 1, 2, \ldots, T - 2$, the exchange rate is pegged in the previous period, in the current period, and in the next period; that is, $\mathcal{E}_{t-1} = \mathcal{E}_t = \mathcal{E}_{t+1} = \mathcal{E}$, for $t = 1, 2, \ldots T - 2$.

So, as analyzed earlier in this chapter:
$P_t = \mathcal{E}$ for $t = 1, 2, \ldots, T - 2$.
$i_t = i^*$, for $t = 1, 2, \ldots, T - 2$.
$M_t = \mathcal{E}L(C, i^*)$, for $t = 0, 1, \ldots, T - 2$.
$\Rightarrow$ seignorage $= (M_t - M_{t-1})/P_t = 0$, for $t = 1, 2, \ldots, T - 2$.
$\Rightarrow B_t^g - B_{t-1}^g = -DEF$, for $t = 1, 2, \ldots, T - 2$; that is, the goverment loses foreign reserves in the amount DEF each period.

(3) The Post-Crisis Phase: From $t = T$ Onward

The government has no foreign reserves ($B_t^g = 0$, for $t = T-1, T, \ldots$).

Consequently, it must resort to printing money at the rate μ to finance the fiscal deficit; that is, $M_t = (1+\mu)M_{t-1}$.. So, as we analyzed earlier in this chapter:*

$\mathcal{E}_t/\mathcal{E}_{t-1} = 1+\mu$,, for $t = T, T+1, \ldots$

$\Rightarrow P_t/P_{t-1} = 1+\mu$, for $t = T, T+1, \ldots$

$\Rightarrow 1+i_t = (1+i^*)(1+\mu)$, (or $i_t = i(\mu)$), for $t = T-1, T, \ldots$

$\Rightarrow M_t = P_t L(C, i(\mu))$, for $t = T-1, T, \ldots$

$\Rightarrow$ seignorage $= (M_t - M_{t-1})/P_t = L(C, i(\mu))\frac{\mu}{1+\mu}$, for $t = T, T+1, \ldots$

No foreign reserves$\Rightarrow DEF = L(C, i(\mu))\frac{\mu}{1+\mu}$, for $t = T, T+1, \ldots$

*Actually, we haven't shown here that $\mathcal{E}_T/\mathcal{E}_{T-1} = 1+\mu$, but we do so in the book. It requires solving a system of 3 equations in 3 unknowns.

Comparing the Pre- and Post-Crisis Phases

(a) Price Stability Disappears n the Post-Crisis: In the pre-crisis period, the money growth rate, the inflation rate, and the depreciation rate are all 0, while in the post-crisis period they are all equal to μ.

(b) Different Sources of Deficit Finance: The fiscal deficit is financed with foreign reserves during the pre-crisis period but with money creation (i.e., with the inflation tax) in the post-crisis period.

(2) The BOP Crisis: Period $T-1$

The exchange rate peg has not yet collapsed
$\Rightarrow \mathcal{E}_{T-1} = P_{T-1} = \mathcal{E}$

But the exchange rate is expected to depreciate in T, $\mathcal{E}_T/\mathcal{E}_{T-1} = 1+\mu$.
$\Rightarrow 1 + i_{T-1} = (1+i^*)(1+\mu)$, or $i_{T-1} = i(\mu)$.
$\Rightarrow M_{T-1}/P_{T-1} = L(C, i(\mu))$.
Recall that $M_{T-2}/P_{T-2} = L(C, i^*)$.
$\Rightarrow$ seignorage $= (M_{T-1} - M_{T-2})/P_{T-1} = L(C, i(\mu)) - L(C, i^*) < 0$ (recall that $i(\mu) > i^*$).
So, by th governments budget constraint
$B^g_{T-1} - B^g_{T-2} = L(C, i(\mu)) - L(C, i^*) - DEF < DEF$.

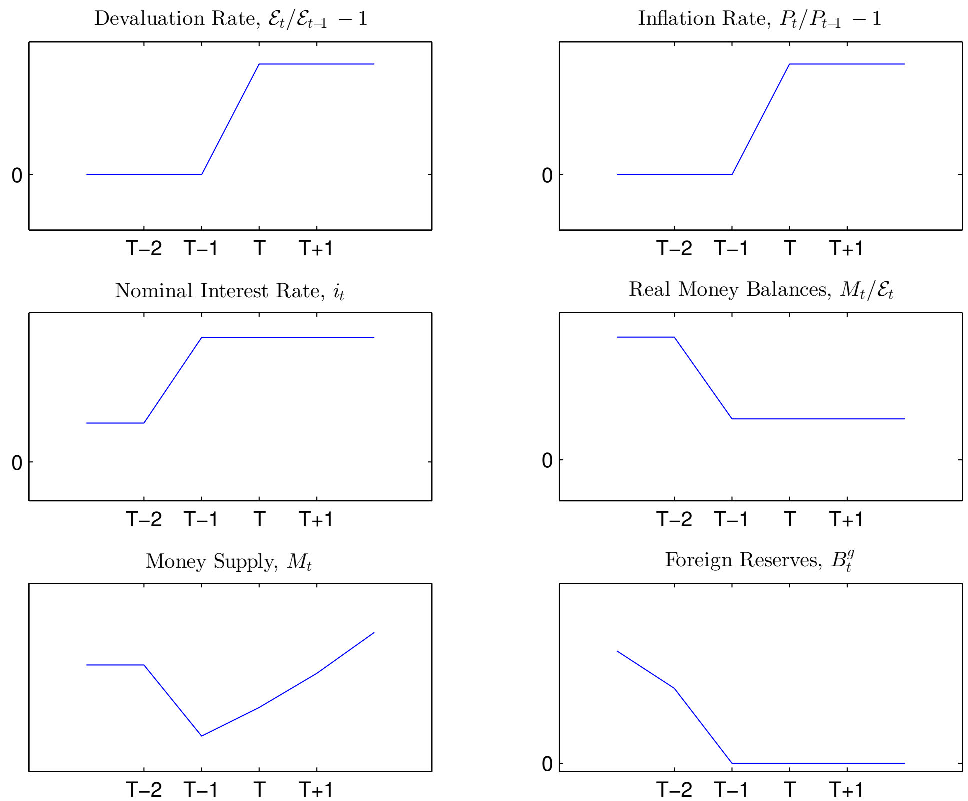
In words: the government was losing foreign reserves at the rate DEF to finance the deficit, but in $T-1$ the loss is larger. This is a speculative attack.

The Intuition Behind the Speculative Attack

In $T-1$ people get rid of part of their domestic-currency holdings because the interest rate goes up (and the interest rate goes up because of expectations of a devaluation). So they go to the central bank (who is still pegging the currency) and exchange domestic currency for foreign currency.

The next slide presents a graphical illustration of the dynamics of the BOP crisis.

The Dynamics of a Balance of Payments Crisis



Notes. The figure depicts the dynamics of a balance of payments crisis. The central bank initially pegs the currency, which results in zero inflation. However, fiscal deficits cause the stock of foreign reserves to fall steadily. In period $T-1$ there is a speculative attack in which the central bank loses an unusually large volume of foreign reserves. In period T the peg is abandoned and the central bank is forced to print money to finance the fiscal deficit, which causes an increase in the inflation rate.

Summing Up

• The quantity theory of money states that a key determinant of the price level and the nominal exchange rate is the money supply.

• The quantity theory assumes that real output and the real exchange rate are independent of monetary policy.

• In the quantity theory, an increase in the money supply causes an increase in the price level and a depreciation of the domestic currency.

• If the central bank follows a fixed exchange rate regime, it loses control over the money supply.

• Governments finance fiscal deficits either by issuing debt or by printing money.

• By pegging the currency to that of a low inflation country, the government can control the inflation rate. This is policy is known as an exchange rate-based inflation stabilization program.

• Chronic fiscal deficits render currency pegs unsustainable.

• A once-and-for-all unexpected devaluation causes an increase in the price level, has no effect on the nominal interest rate, and acts like a tax on private money holdings, redistributing real resources from households to the government.

Summing Up (concluded)

• If the central bank expands the money supply at the constant rate μ, in equilibrium inflation and the depreciation rate are both equal to μ, the difference between the domestic and the foreign interest rate is μ, and real money balances are constant over time and decreasing in μ.

• Inflation acts like a tax on real money holdings, where the tax base is real balances and the tax rate is an increasing function of inflation.

• When a government exhausts its ability to issue debt, it must finance the fiscal deficit by printing money.

• The inflation tax Laffer curve describes the relationship between the rate of money growth and seignorage income. It has an inverted U shape.

• Financing a higher fiscal deficit requires increasing the money growth rate and therefore increasing the equilibrium level of inflation.

• There is a maximum level of deficit that can be financed with money creation. Fiscal deficits beyond this level lead the economy into hyperinflation.

• A currency peg combined with fiscal deficits produces dynamics ending in a balance of payments crisis. Before the crisis, inflation is low and the government loses foreign reserves at a steady rate. In the period of the crisis, there is a speculative attack against the currency in which the government loses an unusually large amount of reserves. Then, the government is forced to abandon the peg and print money to finance the deficit, which increases the rate of inflation.