Chapter 16: Emerging Market Crises: The Boom-Bust Cycles

16.1 International Crises in Emerging Markets

In July 1997, the Bank of Thailand was forced off to let the baht float freely; it immediately depreciated by 21 percent. By January 1998, it was 77 percent weaker against the dollar than it had been in June. Similarly, in November 1997, the Bank of Korea floated its currency after keeping its currency, the won, tightly managed against the dollar. By January 1998, the won had fallen in value by 60 percent.

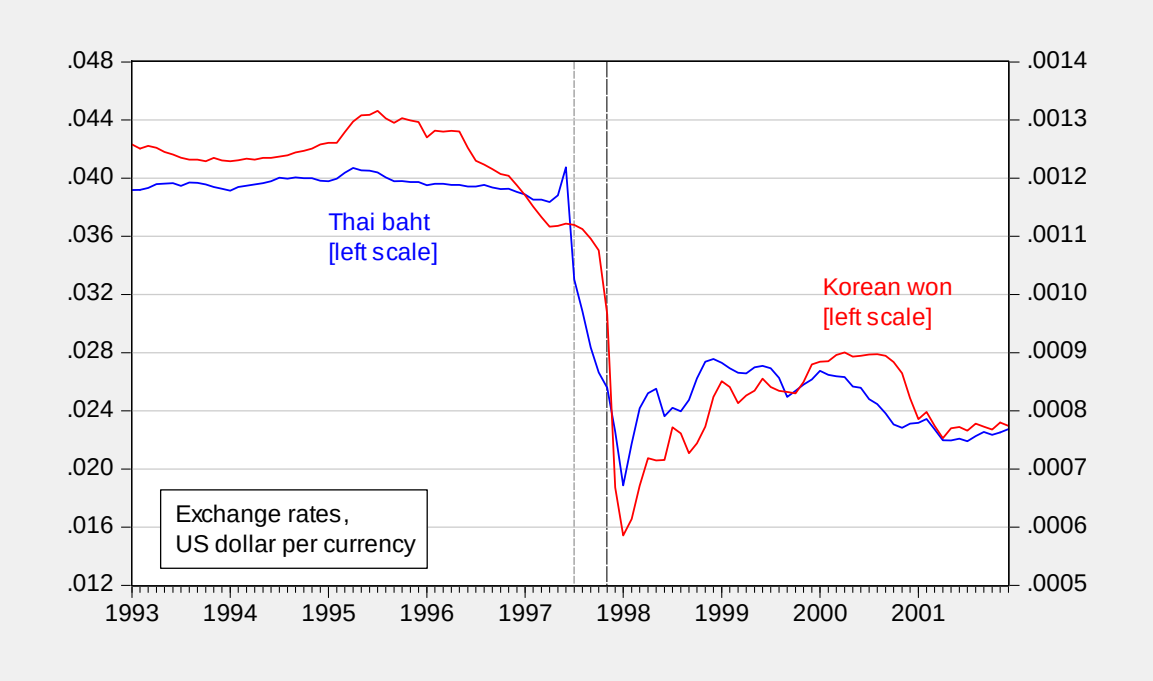


Chart 16.1: Thai and Korean exchange rates. Dashed lines at Thai and Korean ends of pegs.

The drop in the currency values of these two countries coincided with a sharp drop in economic growth. A year after the collapse in the Thai baht's value, year on year growth had collapsed to -15 percent. Korean growth hit a trough at 9 percent within a year of the won's drop.

How did these two countries, apparently enjoying rapid economic growth, suddenly descend into deep economic distress? And what role did the collapse in currency values play? In answering these questions, we are dealing with the phenomenon of currency crises.

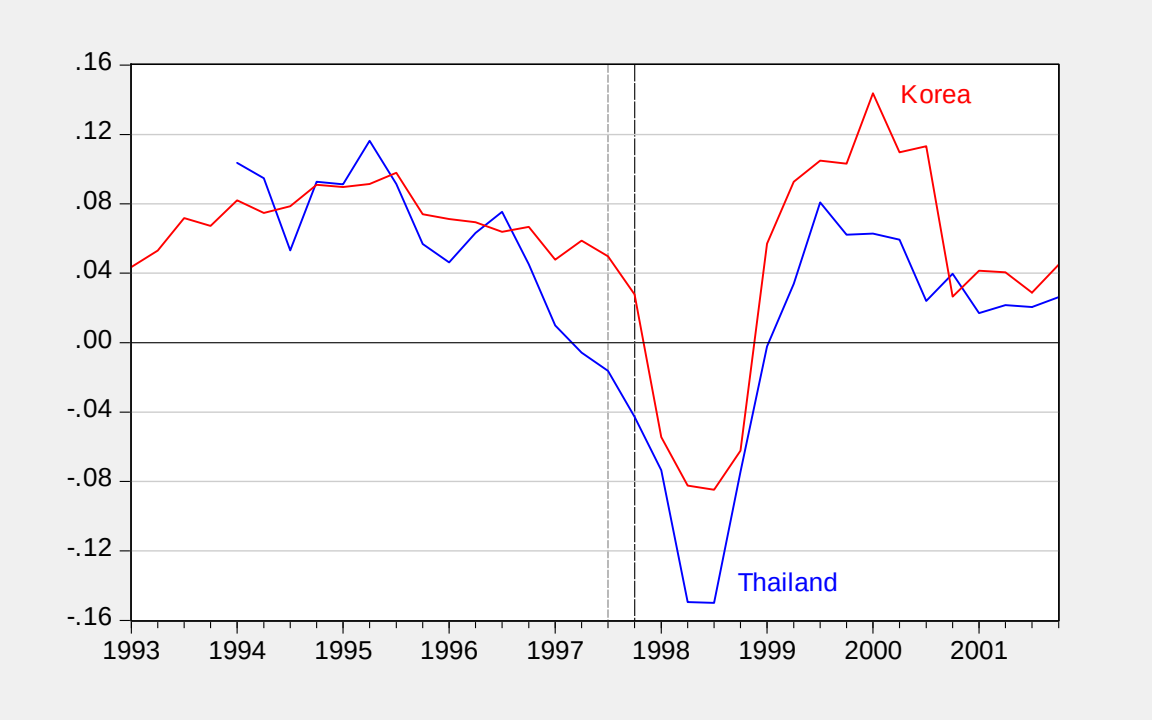


Chart 16.2: Annual growth rate of GDP for Thailand (blue) and Korea (red).

To understand these phenomena, it's useful to have a little background on how the international financial system has evolved. The defining characteristic of the last half century is the increasing integration of the global economy. Ever greater shares of economic activity are engaged in international trade in goods and services. Households devote ever larger proportions of their spending to imported goods, while firms rely more and more on components produced in many countries. However, the most remarkable transformation is in finance. The ease with which borrowing and lending now takes place is unprecedented. As a consequence, productivity and consumer choice have been enhanced; people can now smooth consumption over time. Consequently, cross-border holdings of assets and liabilities have increased dramatically.

These trends have been in play all around the globe, but they have been extremely pronounced in emerging market and developing economies. And it's in these countries that the implications of these developments have become most apparent.

In short, openness to international trade and particularly finance tends to amplify the boom and bust cycle. In this chapter, we trace out the implications of financial globalization, and the challenges they pose for policymakers in emerging market economies. That is, how to deal with the good times, as well as the bad times, which often follow.

16.2 Capital Surges and Reversals

In chapters 12 and 13, we examined situations in which financial capital mobility took on a range of values. One of the characteristics of the modern international economy is the fact that

financial capital is quite mobile, moving with ease between countries, so that an appropriate modeling of the economy would take capital mobility, if not perfect, as very near.

As the magnitude of capital flows have increased over the past few decades, they have also tended to reverse direction with surprising regularity. That is, while capital might on net flow to a country – or set of countries – for several years, at certain points the flow can reverse. The reversal can occur quite swiftly, and if it does, it can catch policymakers off guard.

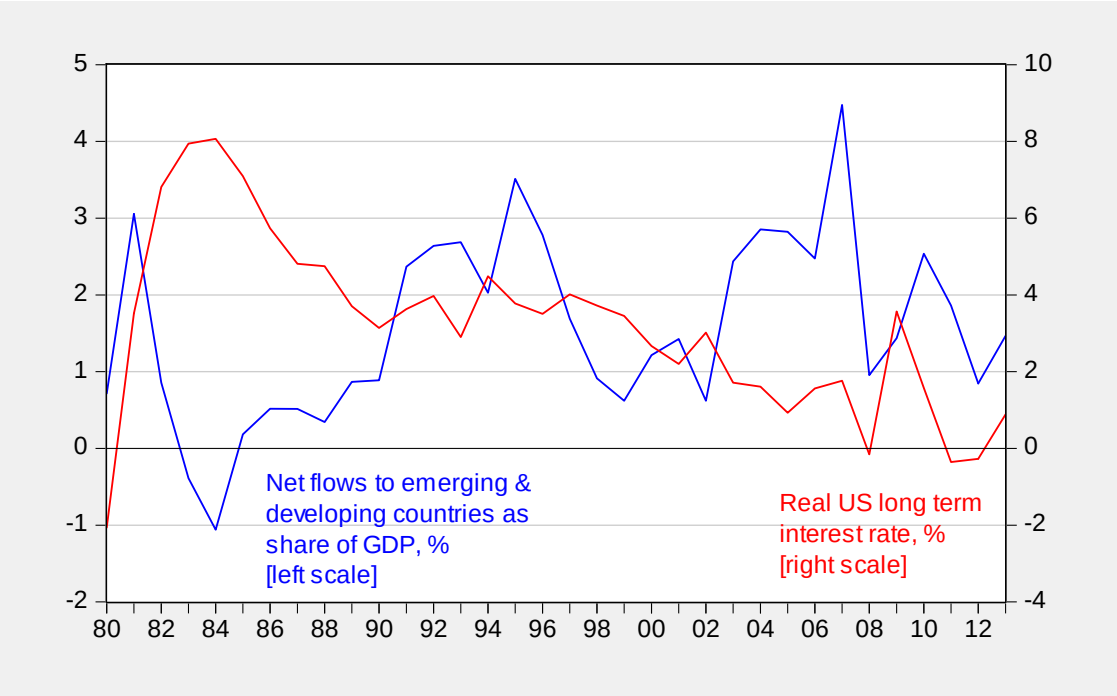


Chart 16.3: Net financial flows to emerging and developing countries as a share of GDP (blue), and US ten year interest rates minus current inflation rate (red). Source: For flows and GDP, IMF, *World Economic Outlook*, April 2014; for interest rates, Federal Reserve Board, for annual inflation, BLS.

Notice that capital flows to emerging markets and developing countries follows a cyclical pattern: a surge peaking in1981, a trough in 1984, a long boom that peaks in 1995, a trough around the turn of the century, and then a boom peaking in 2007. There is a final boom in 2010. The relationship is (roughly) inverse. The inflows tend to rise when real returns in the advanced economies drop (proxied in Chart 16.3 by the ten year US interest rate adjusted by inflation).

What are the real world implications of these financial flows? The financial flows provide more resources for consumption and investment, so it's not surprising that output booms during periods of net inflows, as shown in Chart 16.4

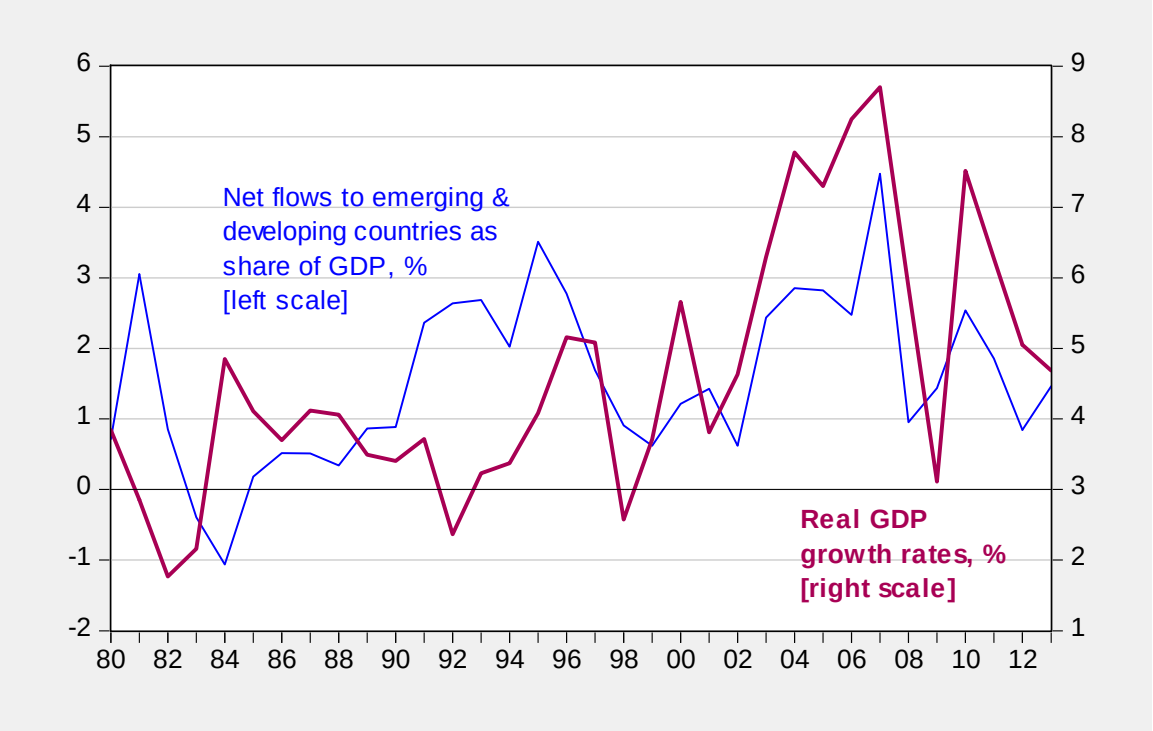


Chart 16.4: Net financial flows to emerging and developing countries as a share of GDP (blue), and real GDP growth in emerging and developing countries (purple). Source: For flows and GDP, IMF, *World Economic Outlook*, April 2014.

First we discuss the challenges faced during the boom times – called capital bonanzas by Reinhart and Reinhart (1998). Then, we address the busts. Calvo (2003) popularized the term "sudden stop", a term first coined by Dornbusch et al. (1995) to events in which financial capital inflows cease and even reverse. This boom-bust cycle was aptly described by the title of an account of the Argentine boom and bust of the 1990's and 2000's: "And the Money Kept Rolling In (and Out)."[1]

16.3 Interpreting the Boom

Capital flow surges to the emerging markets and developing countries occur with some regularity. Why do these surges in flows to the developing countries occur? Most economists would agree that it's a combination of "push" factors from the advanced economies – such as low interest rates – and "pull" factors in the developing countries. The big question is the relative importance of these sets of factors, and here there is much less agreement.

Regardless of the exact origins of these cycles, changes in capital flows pose a challenge to policymakers in emerging markets because they force difficult choices, even when conditions appear to be favorable. To see exactly what choices, consider a country on a fixed exchange rate, with high capital mobility, confronted by a sudden drop in rest-of-world interest rates, as in

[1] Blustein (1995). The title is originally a lyric from the musical, *Evita*.

Figure 16.1. To begin with, the economy is in internal and external equilibrium, with interest rate i_1 and income level Y_1.

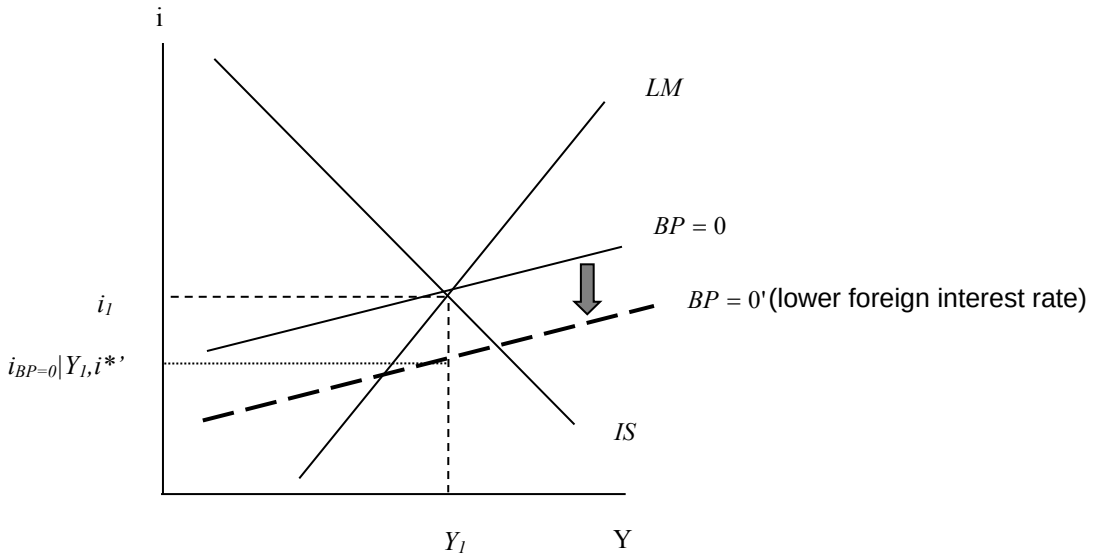


Figure 16.1: A drop in rest-of-world interest rates.

The BP=0 schedule shifts downward, as indicated by the dark gray arrow. The current interest rate is then greater than that required for external balance. Hence, BP > 0.

Policymakers face four options: (1) sterilize the inflows; (2) allow the inflows to swell foreign exchange reserves, so the LM shifts out; (3) revalue the currency, shifting the BP=0 curve back up; and (4) impose capital controls.

Consider the first option; if the authorities sterilize the increase in foreign exchange reserves, then the economy remains at i_1 and Y_1. Recall, sterilization requires in this case that the central bank reduces the amount of domestic assets (for instance government bonds) held by selling them in open market operations; for every foreign currency unit increase in foreign exchange reserves, the central bank must sell a foreign currency unit equivalent's worth of government bonds. This process can continue as long as the central bank has government bonds to sell. When the assets of the central bank are solely foreign exchange reserves, then sterilization has to cease.

Option 2 is selected by default if no action is taken (or if the central bank has no government bonds left to sell). As shown in Figure 16.2, in the absence of sterilization operations by the central bank, the increase in foreign exchange reserves drives upward the money supply, thereby shifting out the LM curve (white arrow). This process continues until the LM curve shifts out enough to set the interest rate equal to the one that restores external equilibrium. The monetary authority can also increase the money supply immediately so as to restore external equilibrium without delay.

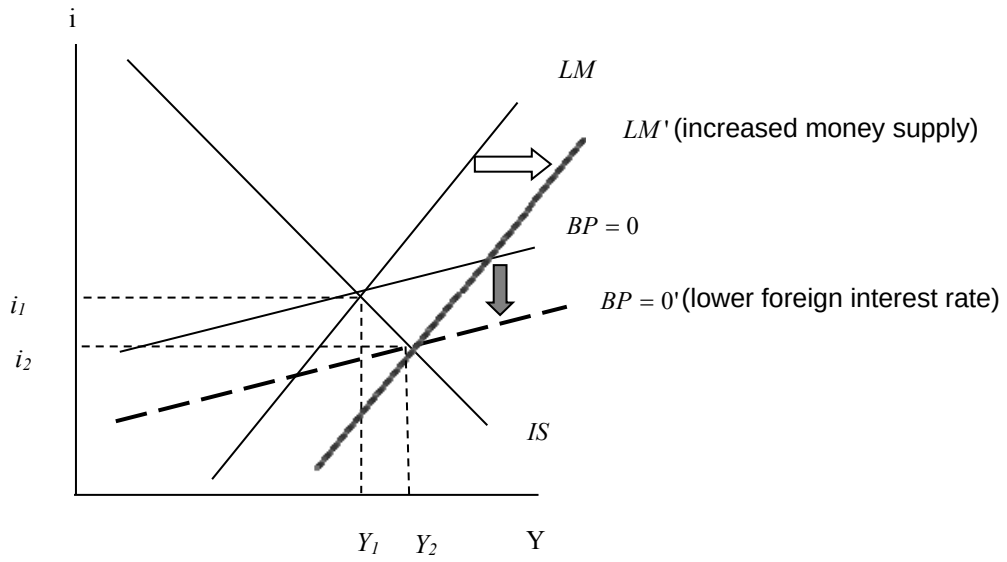


Figure 16.2: Responding to drop in rest-of-world interest rates by monetary expansion

This hardly seems like a dilemma, to the extent that output increases in response to the drop in rest-of-world interest rates. The problem arises if for instance full employment output is Y_1 (or less) so that the increase in money supply leads to overheating of the economy, so that a subsequent crash is unavoidable.

Another approach is to revalue the currency (or if the currency is on a managed float, allow a currency appreciation). The revaluation leads to a fall in q to q', so that the BP=0 curve shifts up, and the IS curve in (white arrows). In this case, the interest rate and income level are lower than to begin with.

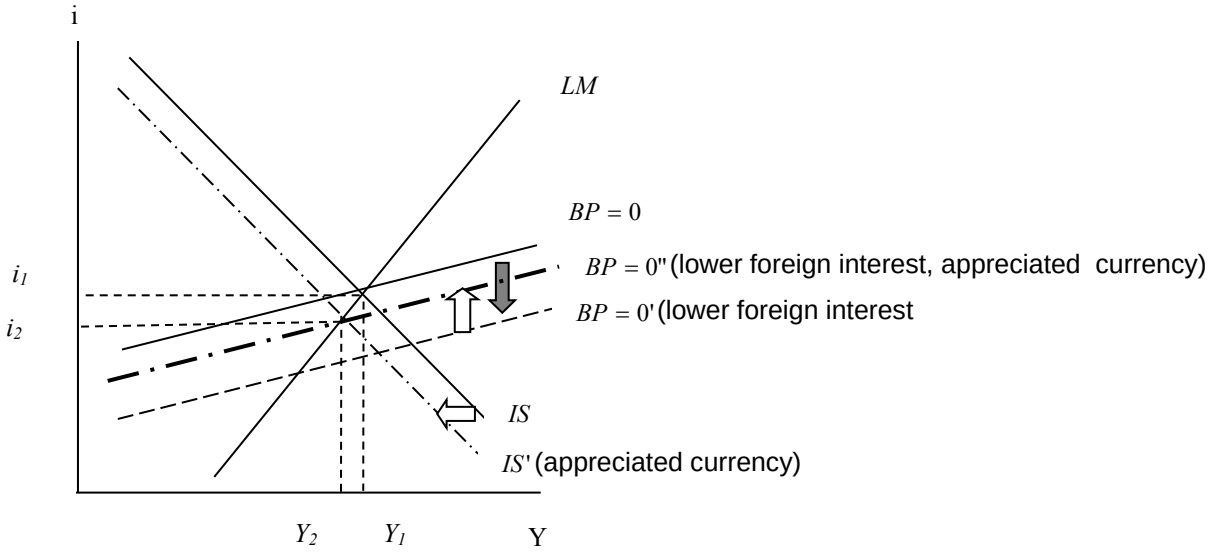


Figure 16.3: Responding to drop in rest-of-world interest rates by currency revaluation

It is also possible to respond to the inflows by imposing restrictions on cross-border financial flows, called capital controls. The controls can take the form of blocking certain types of financial transactions, or applying an explicit or implicit taxes on inflows. Such measures have the effect of decreasing κ in the BP=0 equation. Since the slope of the BP=0 curve is m/κ, a reduction in κ rotates the curve counter-clockwise, as shown in Figure 16.4.

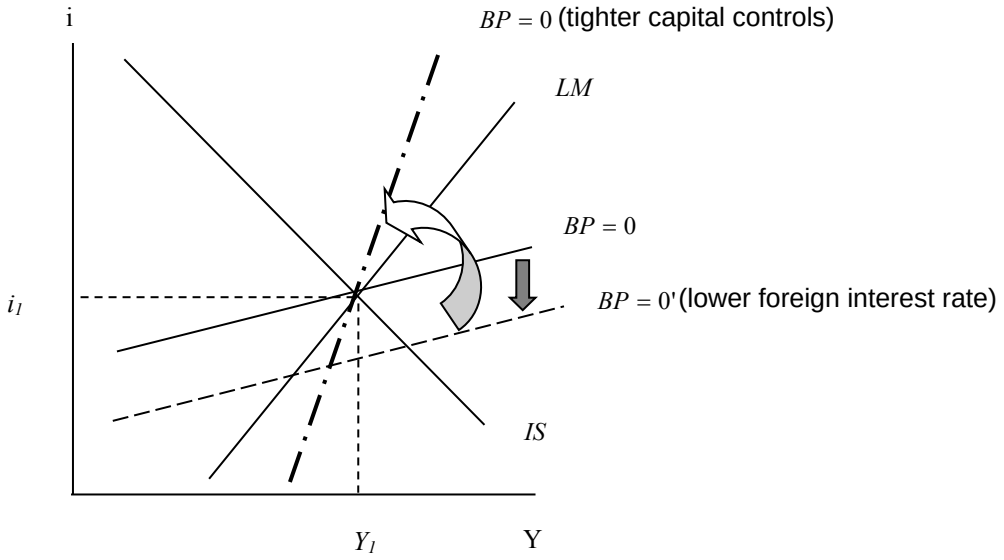


Figure 16.4: Responding to drop in rest-of-world interest rates by imposing capital controls

In Figure 16.4, the imposition of capital controls is calibrated so as to restore internal and external equilibrium at the original interest rate and income levels. In reality, there is no requirement that this outcome should result; rather, the only certainty is the counter-clockwise rotation of the BP=0 curve.

In theory, then, capital controls can be quite effective at restoring internal and external equilibrium. However, two large questions arise. The first is whether capital controls, if implemented, are actually effective in stemming the inflow of financial capital. If the returns to saving in the home country are sufficiently high, then individuals will work hard to circumvent those controls. The second relates to the costs of imposing controls on economic efficiency. When capital is not allowed to move to the countries and industries where it is most productive, then economic efficiency might be lower than it otherwise would be.

16.4 The Bust: Currency Crises Interpreted in the Mundell-Fleming Framework

Crises can occur for a variety of reasons. One is that foreign interest rates rise drawing away capital. Another is that, because of fears that the government will not be able to pay its debt, the interest rate required to draw in sufficient financial capital rises. In the first case, the i^* term rises in the BP=0 equation:

(16.1) $$i = -\left(\frac{1}{\kappa}\right)[(\overline{EXP} - \overline{IMP} + \overline{FA}) + (n+v)q] + \bar{\imath}^* + \left(\frac{m}{\kappa}\right)Y$$ <BP=0 curve>

Notice that if the foreign interest rate goes up, the BP=0 curve moves up percentage point for percentage point.

In the second case, the financial account equation is written:

(16.2) $$FA = \overline{FA} + \kappa(i - \rho - \bar{\imath}^*)$$

Where ρ is the premium necessary to induce investors to hold the country's government bonds. If investors feel there is some likelihood the government will default (i.e., not pay interest on the bonds, or pay back the loans), ρ increases. Then:

(16.3) $$i = -\left(\frac{1}{\kappa}\right)[(\overline{EXP} - \overline{IMP} + \overline{FA}) + (n + v)q] + \rho + \bar{\imath}^* + \left(\frac{m}{\kappa}\right)Y$$ <BP=0 curve>

In both of these cases, the BP=0 schedule rises. In Figure 16.5, the first case is shown.

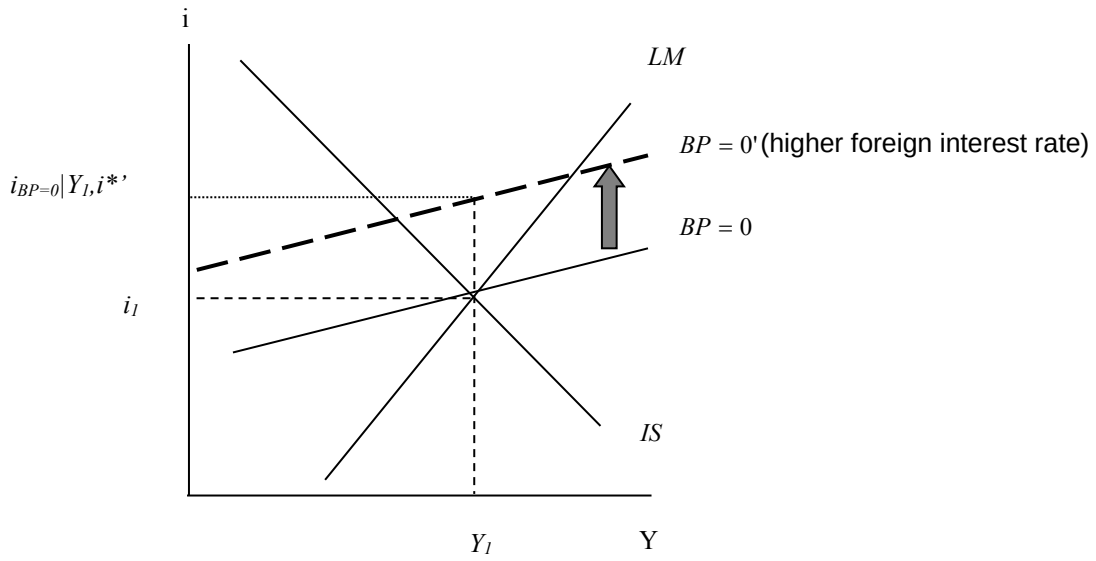


Figure 16.5: Prelude to a currency crisis: A balance of payments deficit

It's easiest to think of the crisis arising if the country is on a fixed exchange rate regime. Starting from a point of initial internal and external equilibrium, when the BP=0 shifts upward, the balance of payments goes into deficit, and foreign exchange reserves are falling. This situation can be accommodated as long as the central bank can sterilize capital outflows by purchasing net domestic assets, such as government bonds *and* foreign reserves are positive. However, eventually, reserves are exhausted, so that the exchange rate peg is unsustainable; a crisis occurs, and the country is forced to float the currency.

The fixed exchange rate assumption is just an approximation – as long as the country manages the exchange rate so that it's not freely floating, and is held stronger rate than would occur in the absence of central bank intervention, the previous analysis holds. As shown in Chart 16.1, Thailand and Korea did not maintain hard, fixed, pegged exchange rates against the US dollar, and yet suffered the balance of payments pressures that led to currency crises.

In the real world, an exchange rate peg will likely collapse even before the last unit of foreign exchange is exhausted. That's because as foreign exchange participants recognize the eventual collapse of the peg, speculators will try to withdraw their funds earlier to ensure they can obtain before the currency collapse in order to avoid capital losses. Sometimes, this mass attempt to withdraw funds before the bank runs out of funds is called "a run". The central bank, recognizing this fact, accedes to the inevitable even before the exhaustion of reserves.[2]

This interpretation is often characterized as a "first generation" model of currency crises, and was developed by Paul Krugman (1979). In contrast, third generation crises focus on the revelation of additional government liabilities – so called contingent liabilities -- that make prospects of the government successfully servicing its debt highly unlikely, so that ρ rises. The mechanics that follow are the same as above – speculators run on the central bank, trying to withdraw their foreign currency before the inevitable devaluation. The difference from the first generation models is that it's not required that the government be running explicit deficits in order to run into trouble. The fact that the government is undertaking policies that might bankrupt it in certain states of the world is sufficient. One example is if it is suddenly perceived that the government will have to bail out the private banks, but in so doing it will go into so much debt that it might have to default on its own debt. That fear drives a run on the central bank, just like in the first generation model. This is one interpretation of the Thai crisis of 1997.

Why are currency crises costly? Mostly, it is because of the disruptive nature of cutoff of imports and access to foreign capital. Let's consider the first channel. Typically, countries that encounter balance of payments difficulties are countries that are running trade deficits. When foreign exchange reserves are exhausted, then imports can no long exceed exports, and a sharp reduction in imports results (it's hard to increase exports overnight).

Now, it might seem surprising that the currency devaluation does not improve the external situation, as discussed in Chapter 12. The logic is that a weaker currency encourages exports and discourages imports, thereby improving the trade balance, and hence aggregate demand. The logic is not in question; it's that in the midst of the crisis, these adjustments cannot occur instantaneously.

In the crisis story discussed above, we are assuming that the responsiveness of net exports to the real exchange rate (n+v) is essentially zero, in the very short run. This results in the trade balance

[2] In the Krugman model of speculative crises, the central bank is committed to monetizing the government's debt, and defending the exchange rate peg. The central bank cannot simultaneously accomplish both objectives at all times. At certain junctures, the two become inconsistent; then a crisis is inevitable.

worsening to begin with, reducing output. Working through the traditional multiplier process, output declines.[3] This is represented as an inward shift of the IS curve.

Next, the second channel. When a crisis occurs, typically expected depreciation rises, so that expected returns for the foreign investor declines. If the increase in expected depreciation rises so much that foreign investors do not believe the government can honor its (foreign currency denominated) debt, then lenders might refuse to lend at any interest rate. This extreme situation has been characterized as a "sudden stop", and is depicted in Figure 16.6. The IS curve shifts far inward (white arrow) so that the financial account is zero, i.e., no lending from abroad occurs; the LM curve is shifted up by the monetary authorities, in order to avoid too much of a currency depreciation (white arrow). The BP=0 curve rotates to a vertical position, representing the fact that the lenders are completely insensitive to interest rates (white/gray curved arrow).

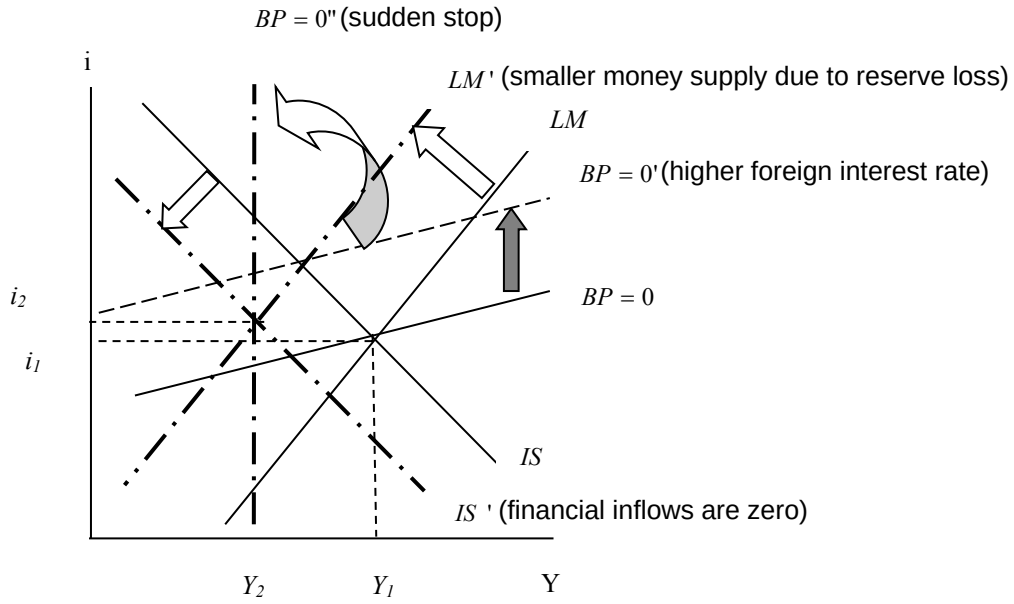


Figure 16.6: A Currency Crisis/Sudden Stop

Notice the vertical slope of the BP=0 schedule means that there is a limit on the amount of lending that occurs (in this example, it's zero). The trade balance has to be zero, and income and output must adjust to achieve this constraint.

Notice that output has fallen from Y_1 to Y_2, as the IS curve shifts back. As depicted in the figure, the LM curve is shifted upward in order to stem the decline in the real exchange rate, but in the absence of the monetary policy, the IS curve would have to shift back enough meet the constraint of no financial inflows.

Figure 16.6 also illustrates the role of the IMF during financial crises. In a full blown financial crisis, the economy can operate at a point to the right of the BP=0 curve (i.e., BP < 0) for some

[3] Another channel could come from the supply side. The reduction in imports crimps production, since many goods use imported inputs in the production process. A concrete example of this point is oil; without any oil imports, some countries' economies would grind to a halt.

period of time if the IMF provides a temporary loan of foreign exchange reserves. The loan can also reduce the likelihood of government debt default, thereby reducing ρ. The existence of an IMF loan program might also heighten confidence sufficiently that $\kappa > 0$, thereby rotating the BP=0 clockwise.

In principle it's possible to forestall the full blown currency crisis, such as the one described above. In the previous example, the reason the economy faces this dilemma is because, in some sense, the monetary policy is overly loose. Hence, a more feasible policy option is to tighten monetary policy; shifting back the LM curve would restore external equilibrium, at the cost of reduced economic activity.

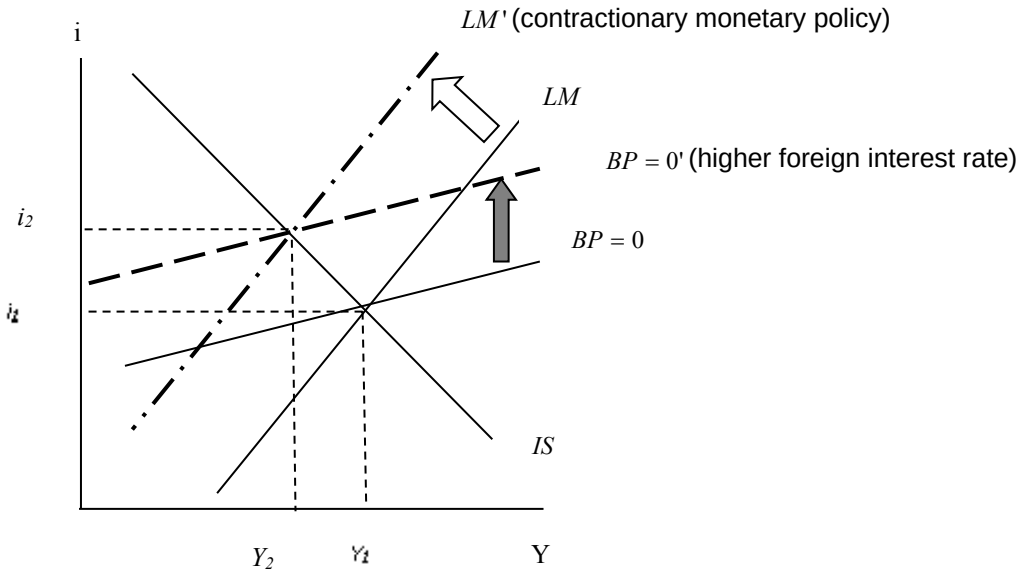


Figure 16.7: Responding to a Balance of payments deficit with contractionary monetary policy

As the LM shifts back, the interest rate rises sufficiently to draw in enough financial capital so reserves are not depleted. If this policy works so well, why isn't it implemented? The reason is that output declines from Y_1 to Y_2; in other words the economy goes through a recession.[4]

While mechanically, the policy combination shown in Figure 16.7 should solve the balance of payments problem, in practice, there is no guarantee of success. That is because international creditors might not believe in the government's commitment to maintaining high interest rates, even at the cost of a recession. Fears that the government will not persevere can lead to a heightened probability of devaluation, and a further upward shift of the BP=0 curve. That could in turn precipitate the exact eventuality the heightened interest rates were aimed at avoiding. In this case, the expectations were self-fulfilling. If the speculators had believed in the government's commitment to the defense of the currency, on the other hand, then the policy

[4] In principle, increasing government spending or reducing taxes could shift out the IS curve until interest rates are sufficiently high to restore balance of payments equilibrium. However, typically concerns about the government's ability to service its debt are exacerbated by the larger budget deficits that would occur; hence, when the BP=0 schedule rises because of an increases in ρ, this option is unlikely to be pursued, as it would tend to further shift up the BP=0 schedule.

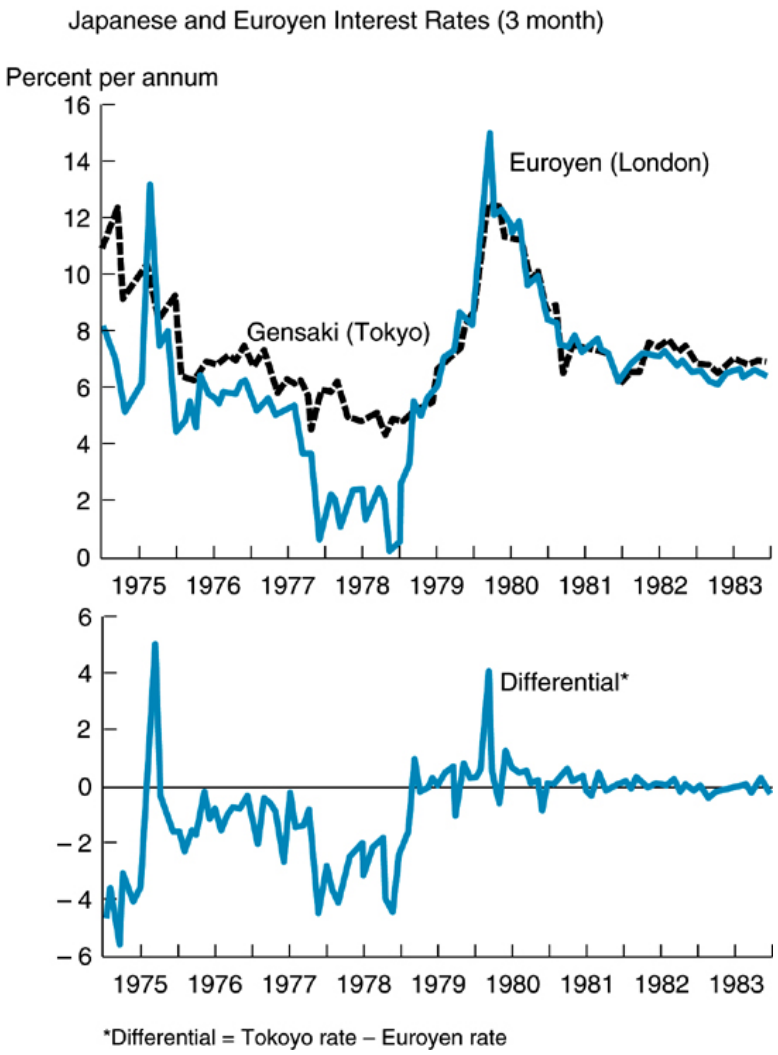
might have been successful. The fact that each outcome was equally plausible is the hallmark of what have come to be known as "Second generation models" of currency crises.[5]

Box 16.1: How Well Do Capital Controls Work?

At one level, this question seems an easy one to answer: with sufficient determination, the answer is "yes". North Korea is a case in point where the government is able to stringently control financial capital inflows and outflows so that essentially no private funds get in or out. Of course, that country is remarkable along many dimensions, and it's not clear that that experience is relevant for countries even more generally.

In order to answer the question in a way relevant for most countries, one has to define what the word "work" means. If it's to mean that the controls make it more difficult to conduct cross-border financial transactions, so that returns are not equalized, then controls probably do work. For instance, consider Japan. Prior to liberalization of the financial account (what was then called the capital account), a substantial interest rate differential existed between yen-denominated securities traded on shore, in Japan, and off shore, in the UK. As shown in Box Chart 16.1 from Frankel (2006), once the controls were lifted, the differential shrank to zero.

[5] See Obstfeld (1995, 1996).



Box Chart 16.1: Source: Caves, Jones and Frankel (2006)

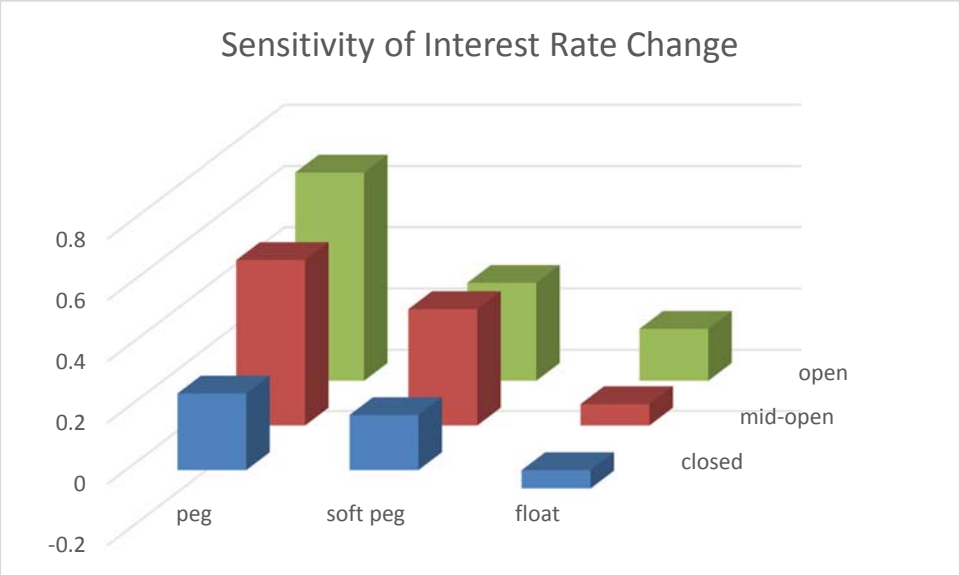
The answer is slightly more complicated, if by “work”, one means that capital controls provide -- at specific times -- noticeably greater latitude for an independent monetary policy, or that they are able to deter financial inflows or outflows. In Figure 16.4, a policy response of tightening capital controls is shown; it is a response that is so precisely implemented that a new equilibrium is established; that presupposes effective capital controls.

Before discussing effectiveness further, it’s also useful to define what constitutes capital controls. While there is no formal definition, they are usually understood to encompass measures that restrict capital transactions by defined by the residency of the parties to the transaction. These controls can apply to the economy overall, or merely specific sectors. The measures could apply to all types of financial capital flows, or could be specific to types (equity vs. debt vs. direct investment) or duration (short vs. long).

Some of these measures can take the form of explicit controls (e.g., no more than a certain amount of bank loans can be made across border), sometimes

they take the form of implicit taxes (e.g., some proportion of an inflow has to be placed on deposit with the central bank where it gets zero interest).

The general consensus is that capital controls, particularly comprehensive and durable ones, can somewhat insulate an economy. When the controls are largely permanent and extensive, the interest rate linkages are much weaker. Box Chart 16.2 shows the sensitivity of a given interest rate change to the interest change in the country to which the currency is pegged to, or managed against. The higher the bar, the greater the sensitivity. The bars are differentiated by combinations of exchange rate regime and by financial openness (or absence of capital controls).



Box Chart 16.2: Sensitivity of change in interest rate to change in interest rate in base country. Peg, soft peg, and float refer to exchange rate regime; open, mid-open, closed refer to financial openness according to Chinn-Ito index. Source: Klein and Shambaugh (2015).

Notice that the co-movement of interest rate changes is highest when the financial account is open[6], and the exchange rate regime is rigidly pegged. As the country's financial account is more closed, or the exchange rate regime becomes less rigid, the extent of co-movement declines.

The general conclusion is that it is much more difficult for temporary and selective capital controls to insulate the economy from capital flows, and in particular from interest rate linkages. Klein and Shambaugh (2015) document how capital partial controls do not seem to break the linkages between the interest rates in two countries, one of which has a currency pegged to the other.

However, effective can also be defined in other ways, besides providing some room for greater exchange rate and monetary autonomy. Perhaps capital

[6] Typically, capital controls are "measured" by some tabulation of written regulations pertaining to cross-border transactions reported to the IMF, and published in the *Annual Report on Exchange Arrangements and Exchange Restrictions* (*AREAER*). The specific measure used in Box Chart 16.2 is the Chinn-Ito index (Chinn and Ito, 2006).

controls alter the composition of financial capital inflows, so that less "fickle" capital flows in. There is a widespread presumption that longer term capital, such as foreign direct investment, is less likely to leave the country abruptly. Qureshi et al. (2011) find that the combined effect of capital controls and prudential measures is to tilt the composition of external liabilities away from debt, and to other forms of borrowing.

Capital controls can insulate an economy from the rest-of-the-world, but policymakers' ability to carefully calibrate changes in capital controls in order to hit exactly the right degree of insulation during a specific time interval is probably limited. That doesn't mean that capital controls are not useful – countries might wish to insulate their economies from international financial markets for extended periods, or to alter the composition or duration of external liabilities.

16.5 Why Is Devaluation So Contractionary?

One policy option for avoiding a balance of payments crisis is devaluation – at least in principle. A devaluation would reverse the upward shift in the BP=0 curve in Figure 16.5. If implemented with sufficient lead time, a devaluation could restore external equilibrium. In Figure 16.8, the devaluation shifts down the BP=0 curve, and out the IS curve (black arrows). Eventually, income rises to Y_3, and interest rates to i_3.

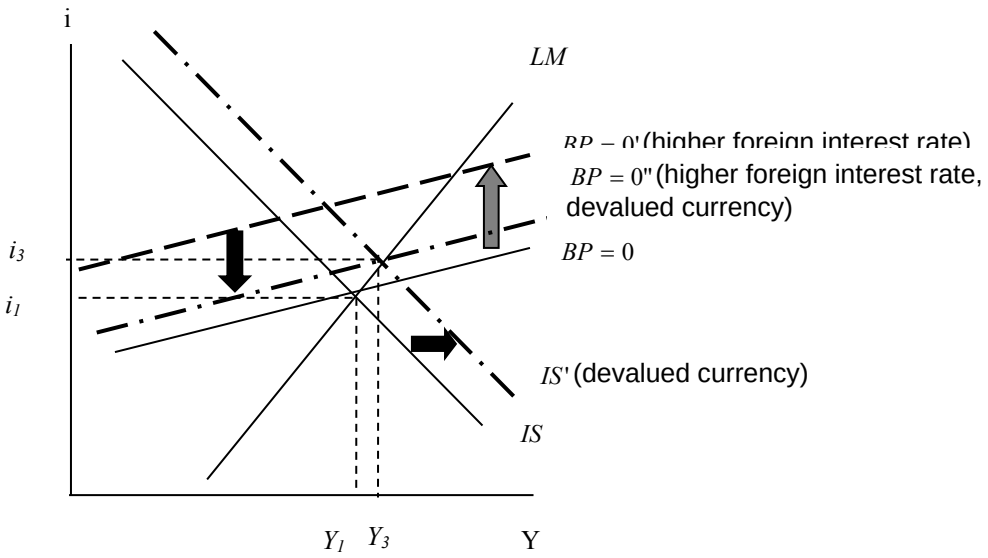


Figure 16.8: Responding to a Balance of payments deficit with a devaluation

There are at least three reasons why devaluations do not prove expansionary in crisis conditions: (1) low trade elasticities in the short term; (2) currency mismatch in balance sheets, and; (3) the inflationary impact on the price level.

The first issue – low trade elasticities – was mentioned in Section 16.4. In the immediate to short run, prices of imports and exports are all higher, so if there is a trade deficit to begin with, the

nominal value of the trade deficit is likely to increase. It's only over time – time that the country might not have – that the trade balance improves sufficiently to shift the BP=0 schedule up.

The fact that the quantity response of exports and imports are zero or small in the beginning means that the impact on aggregate demand might be negative to begin with. In that case the IS shifts in and output declines.

The second channel by which devaluation exerts a contractionary effect relates to the composition of the country's balance sheet – specifically the currency composition of assets versus liabilities. If countries borrowed in their home currency and loaned in their home currencies, then the balance sheet would not be such a big concern. But it is exactly the different nature of the items on the asset side and the liability side of the balance sheet that means a depreciation can have a negative effect on firms, and even governments.

Most less developed countries firms and governments borrow in foreign currency; thus their liabilities are in currencies such as US dollars or euros. Their assets, might be in dollars as well (for instance foreign exchange reserves). But many of the assets – for instance factories – are denominated in domestic currency. When the currency are devalued, the value of debt (in US dollars) goes up. If the value of the liabilities goes up enough, firms are rendered bankrupt. The government's debt (in terms of the taxing capacity of the government, which is in domestic currency) goes up as well, casting in doubt the government's ability to make good on its debt service. This second channel is discussed at further length in Section 16.6.

The third channel is by way of prices. A devaluation raises the prices of imported and exported goods. Less developed countries tend to be very open to international trade, with a high share of consumption and production reliant on imports. Higher import prices feed into the overall price level, just like a supply shock. This reduces the real money supply, pushing up the interest rate, and hence crowding out investment.

To see this process in play, consider Figure 16.9, which shows the aggregate demand-aggregate supply graph developed in Chapter 15. Assume that the initial income level Y_0 is equal to potential GDP, Y^{FE}. A higher price level means that in the short term, the price level shifts up (white arrow). The higher price level shrinks the real money supply, inducing a higher interest rate. The higher rate results in a stronger currency and reduced output, at Y_1. The AD curve shifts in because it's assumed that the trade balance is initially in deficit and trade elasticities are low in the short run (the gray arrow), so that the trade deficit initially worsens.

Overall, output falls from Y_0 to Y_2 as the price level rises. The economy falls into recession.

Eventually, the AD curve will return towards its initial position as import and export flows respond positively to the exchange rate depreciation. Even when that occurs, however, output will remain lower than full employment, in the absence of further adjustment in the price level. Over time, with a negative output gap, the price level will fall restoring output to full employment, at Y^{FE}. However, this process is likely to be quite prolonged, as it requires downward adjustment in nominal wages and prices.

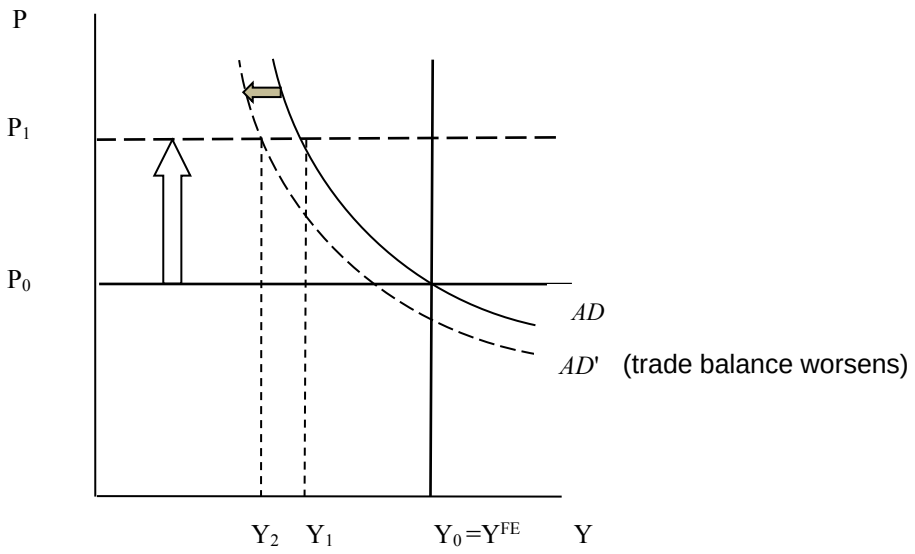


Figure 16.9: Contractionary Devaluation and Exchange Rate Induced Inflation

Notice that there is a temptation to mitigate the negative impact of the devaluation and price increase using a combination of expansionary monetary and fiscal policies. That outcome would result in higher output without the prolonged process of eroding the price level through running a slack economy. The key shortcoming of this policy is that it entrenches inflation, particularly if inflationary expectations are adaptive – for instance if this period's inflation rate equals last period's inflation rate.[7]

16.6 Complications: Balance Sheet Effects

The previous explanations for balance of payments crises rely upon the behavior of flows – flows of goods and services, and of financial capital. However, another source of instability has been introduced by the increasingly integrated nature of global financial markets. One way of thinking about this channel of international effects can be thought of in terms of increased cross-border holdings of assets and liabilities. As a consequence, the net international investment position – the difference between assets and liabilities –does not convey fully the exposure of a country to changes in the international environment.

This increasing cross-border exposure is shown for two countries – Thailand and Korea – in Charts 16.5 and 16.6 below. In order to account for the increasing size of the economies, both

[7] The standard formulation of potential output involves capital and labor. If imported inputs are critical to the production process, and the currency crisis entails a cutoff of those inputs, then potential output might additionally be reduced. This event would be represented as an inward shift of the long run aggregate supply curve. Such an event would not necessarily be long-term. Eventually, such curtailments would end, and long run aggregate supply curve should return to its original position. In the meantime, output is much lower than it otherwise would be.

asset and liability series are normalized by GDP in each country. Notice that before the crises in 1997, gross positions were increasing, while the *net* position looked stable, particularly in Korea.

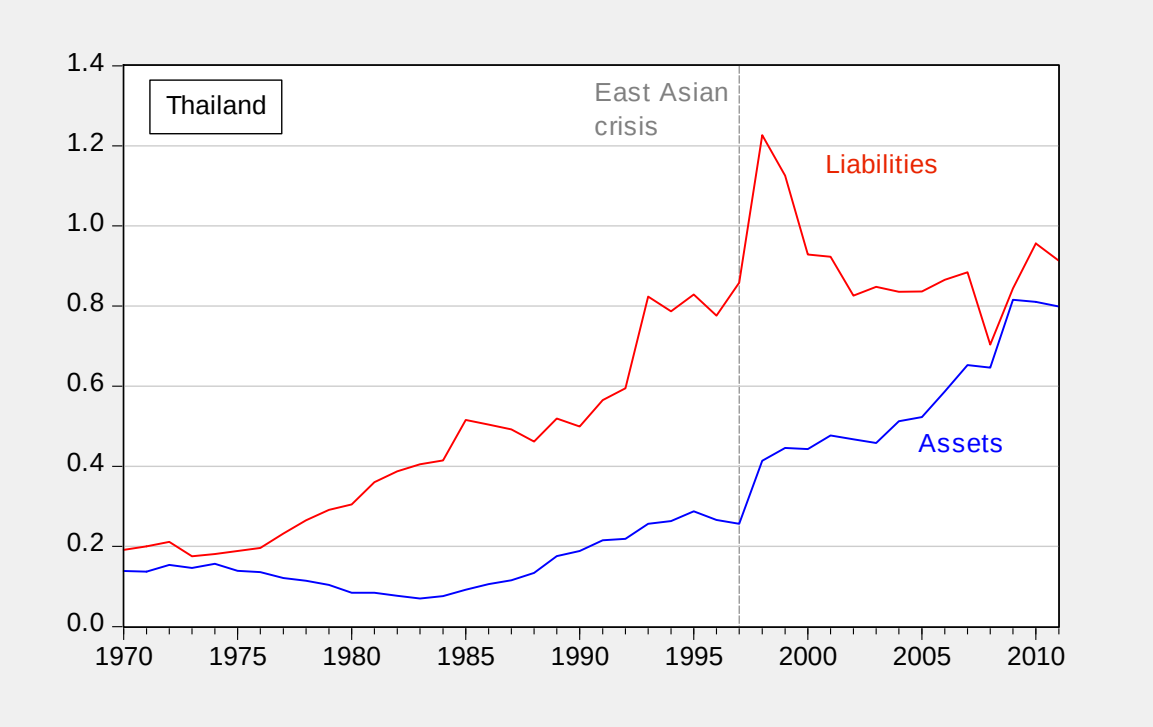


Chart 16.5: Thai Cross border assets and liabilities as a ratio to GDP. Source: Lane and Milesi-Ferretti and World Bank World Development Indicators.

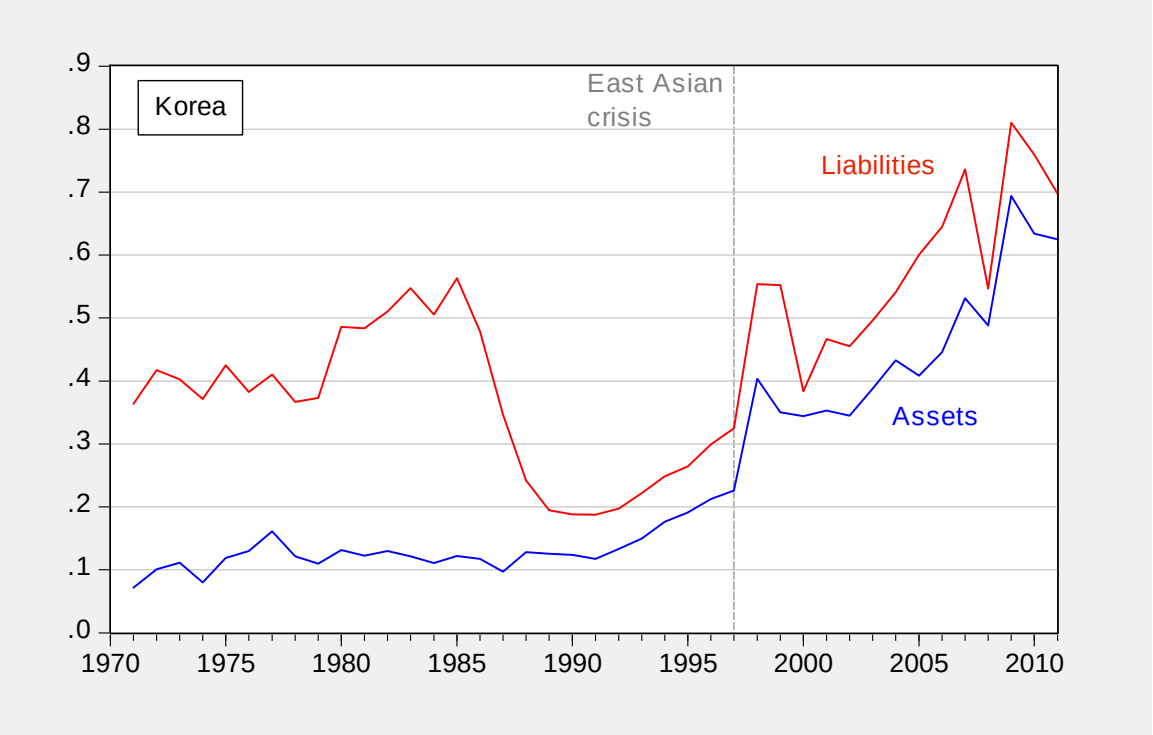


Chart 16.5: Korean Cross border assets and liabilities as a ratio to GDP. Source: Lane and Milesi-Ferretti and World Bank World Development Indicators.

The composition of the gross asset and liability positions are key; in particular, when the composition of assets and liabilities differ substantially, then changes in the economic environment that affect assets and liabilities differently can have big effects on the state of the economy.

Composition can differ along several dimensions: terms of maturity, currency of denomination, and capital structure. For instance, a country might have borrowed extensively short term, and loaned long term. Should foreign lending sources decide not to roll over short term debt, the mismatch in assets and liabilities can come to the fore; in essence, a "run" occurs on the country. Capital structure mismatch – say the liabilities are in the form of debt, while assets in equity – can mean that when economic conditions deteriorate, a default might be forced on the country.

The most salient of concerns is currency mismatch. Suppose liabilities are mostly denominated in foreign currency, while assets are in domestic currency. Then a depreciation of the currency might not yield a net positive impact on the economy, as implied by the standard model covered in Chapters 12 and 13. Rather, the depreciation will exert a contractionary impact on the economy by increasing the value of the liabilities (defined in terms of domestic currency) while leaving the value of assets unchanged. If the mismatch applies to the government, then the government's net liabilities increase. If it applies to the private sector (firms, households), then they will see their net liabilities increase, perhaps forcing some firms into insolvency. Firm closures reduce aggregate supply. Even if firms do not go bankrupt, the reduced net worth of firms make them poorer credit risks (at least from the banks' perspective), thereby reducing their ability to borrow and investment in plant and equipment. This effect further depresses the economy.

Box 2. How Balance Sheet Risks Apply to Different Sectors

Risk Sector	Maturity Mismatch	Currency Mismatch	Capital Structure Mismatch	Solvency (Liabilities v. Assets)
Government	Government's short-term hard currency debt (domestic and external) v. government's liquid assets (reserves)* Short-term domestic currency denominated government debts v. liquid domestic currency assets of the government **not all central bank reserves are available for government debt service; some may be pledged to back currency, lent to banks, etc*	Government's debt denominated in foreign currency (domestic and external) v. government's hard currency assets (reserves)	N/A	Liabilities of government and central bank v. their assets. Assets include discounted value of future primary surpluses (including seignorage revenue) and the financial assets of the government and central bank, including privatizable state owned enterprises Liabilities may include implicit liabilities from pension plans as well as contingent liabilities stemming from government guarantees
Banks	Short-term hard currency debts (domestic and external) v. banks' liquid hard currency assets (and ability to borrow from central bank) Short-term domestic currency debts (often deposits) v. liquid assets	Difference between foreign currency assets (loans) v. foreign currency liabilities (deposits/ interbank lines)	Deposits to capital ratio (closely related to capital to assets ratio)	Bank liabilities v. bank assets and capital
Firms	Short-term debts v. firms' liquid assets	Debts denominated in foreign currency (domestic and external) v. hard currency generating assets.	Debt to equity ratio	Firms liabilities v. present value of firms' assets
Households	Short-term debt v. liquid household assets	Difference between Foreign currency assets (deposits) v. foreign currency liabilities (often mortgages)	N/A	Liabilities v. future earnings (on wages and assets)

Box 2 (concluded). How Balance Sheet Risks Apply to Different Sectors

Risk Sector	Maturity Mismatch	Currency Mismatch	Capital Structure Mismatch	Solvency (Liabilities v. Assets)
Country as a whole	Short-term external debt (residual maturity) v. liquid hard currency reserves of government and private sector * **foreign exchange reserves of the central bank/government plus liquid foreign currency reserves of banks and firms*	Net hard currency denominated external debt **External debt denominated in hard currency minus external assets denominated in hard currency*	Net external debt stock (external debt minus external assets) relative to net stock of FDI. **Flow analogue: Heavy current dependence on debt rather than FDI to finance current account deficit*	Stock of external debt relative to both external financial assets held by residents and the discounted value of future trade surpluses, (resources for future external debt service)* **A more complex analysis would need to include remittance of profits on FDI as well. While such remittances are variable, they are another claim on the external earnings of the country as a whole*

Source: Allen et al. (2002).

The differential responses highlights the fact that different sectors of the economy are exposed to these shocks in different ways. Box 2 identifies the vulnerabilities of the government, the private financial sector (banks), private nonfinancial sector (firms and households) and the economy overall. What this means is that trouble, in the form of mismatches, can show up almost anywhere in the economy, and in many forms.

Many of the recent financial crises were characterized by currency mismatches, either in government debt (Mexico, Brazil, Turkey, Argentina and Russia), in the banking sector (Korea, Thailand, Indonesia, Turkey, Russia and Brazil), or the nonfinancial corporate sector (Korea, Thailand, Indonesia, Turkey, Argentina, and Brazil). Notice for instance in Charts 16.4 and 16.5 the level of liabilities increases sharply in the wake of the currency crises. That pattern is a natural outcome of the sharp exchange rate devaluations shown in Chart 16.1.

How do these currency mismatches arise? One big contributing factor appears to be the presence of pegged or highly managed exchange rate regimes. Chart 16.1 highlights the relative stability of the Thai and Korean rates prior to their respective crises. These fixed exchange rate regimes reduced the uncertainty associated with foreign currency denominated debt, and thus encouraged the accumulation of debt in foreign currency. In some cases, the real appreciation associated with the pegs provided additional impetus for accumulation.

Notice that mismatches in the private sector can have spillover effects on the government sector. If for instance the government has to bail out the banking system, then private firm insolvency due to currency mismatch can be transferred to the public sector. The fact that private sector liabilities sometimes become public sector liabilities, thereby triggering a deeper crisis, is one manifestation of the phenomenon of "contingent liabilities", which underpin the "third generation" models of currency crises.[8] In the midst of a crisis, the government cannot credibly commit to not bailing out key players (such as the banking system) in the economy. These liabilities are "contingent" upon the state of the economy (say an economic downturn, or a currency devaluation). But by bailing out the banks, the government endangers its own solvency.

The policy implications are relatively straightforward, albeit difficult to implement. For instance, they suggest that currency mismatches in debt, either by the public sector or the private, should be avoided. Achieving this objective is difficult; governments are often unable to borrow on international markets in their own currency – this phenomenon has been termed "original sin" by Eichengreen and Hausmann and Panizza (2007).

Finally, the importance of balance sheet effects introduces a new set of tradeoffs during crises. Consider the case where a country has both a currency mismatch on public sector debts (borrowing in dollars, tax revenues in local currency) and private sector debts with a maturity mismatch (short term borrowing, long term lending). An interest rate defense of the currency will mitigate a deterioration in the government's position while exacerbating interest rate risk (short term interest rates will typically rise relative to long). This tension in policy effects is layered on top of the obviously counterproductive effect higher interest rates have on aggregate demand. Hence, the presence of balance sheet mismatches greatly complicates the problems of managing a currency crisis.

[8] See Krugman (1998), and Corsetti, Pesenti, and Roubini (1998). Dooley (2000) provides a related model which interprets the buildup of contingent liabilities as endogenous to the insurance provided by international agencies.

Box 16.2: Can We Predict Emerging Market Crises?

Given that currency crises in emerging markets are so costly, shouldn't we seek to avoid them? A minimal requirement for successfully avoiding such events is that one can identify when a crisis is imminent. A large literature has arisen attempting to achieve this goal, without much luck. In order to see why, it's useful to go through the problems involved in predicting such events.

The first is defining what a crisis is. As shown in Section 16.4, when the bust arrives, the pressure can be manifested in either a depletion of reserves, and increase in the interest rate, a devaluation of the currency, or a combination of all three. The typical approach is to take a weighted average of all three of these variables, and when the index composed of these measures exceeds the average amount, that's defined as a crisis.

The empirical determinants of currency crises have been identified as currency overvaluation, a lending boom, a large stock of short term debt relative to foreign exchange reserves, a large current account deficit (as a share of GDP), and slow economic growth. All of these turn out to be statistically significant determinants of crises. And they can be linked to the theoretical determinants examined before. When the currency is overvalued, the interest rate has to be higher, holding everything else constant, in order to sustain enough financial capital inflows to maintain the balance of payments. If short term debt is large, or reserves small, then the likelihood of being unable to pay interest in foreign currency is lower, and foreign investors more likely to leave. If a current account deficit is large, then sustainability of the balance of payments equilibrium is much more vulnerable to changes in the private financial account. Finally, when economic growth is slow, policymakers' ability to credibly commit to a high interest rate defense is reduced.[9] Of these factors, the most important – in terms of raising the probability of a crisis when the variables rise to crisis levels – are exchange rate overvaluation and credit booms.

Using this model estimated over the entire sample, they correctly predict 66% of the crises, which sounds like a pretty good record. On the other hand, 58% of the alarms sounded failed to turn out to be a crisis. That's using the following rule – if the probability of a crisis is predicted at greater than 20%, then a crisis is called. If the threshold was lowered to 15%, the proportion of correctly predicted crises would rise, but at the cost of a higher proportion of false alarms.

More importantly, there's a big difference between finding significant correlations in the sample. It's much more difficult to *predict* a crisis in the future, based on the data you have today. Bussiere and Fratzscher (2006) use a model based upon these determinants and estimated on data up to the end of 1996 to predict the crises that took place in 1997. The model predicts crises in Colombia, Czech Republic, the Philippines, Poland, and Russia. Of these, only the Czech Republic and the Philippines suffered crises over the next year. On the other hand, the model fails to predict the crises that did occur in Indonesia, Korea, Malaysia, Singapore and Thailand (although the model comes close for the last country).

[9] A financial contagion variable, which is measured as the correlation in stock returns during tranquil periods, accounts for the fact that financial turmoil in one country can be transmitted to another through financial markets.

This outcome demonstrates that in general, it is easy to find factors that are associated with currency crises, but difficult to use that information to identify when and where the crises will occur, before the fact.

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Appendix

In this section, the aggregate demand curve is derived. Recall, the aggregate demand curve shows how different price levels are consistent with different levels of output and interest rates, *holding constant the levels of autonomous spending and the nominal money supply*.

With price level P_0, the equilibrating interest rate is i_0, and the output level is Y_0. A lower price level (P_1), given a fixed nominal money supply M, means an outward shifted LM curve, resulting in a lower interest rate i_1, weaker real exchange rate q_1, and higher output level Y_1. Yet a lower price level P_2 results in a yet weaker real exchange rate and higher output level (q_2, Y_2, respectively, due to the lower interest rate i_2. These combinations are shown below.

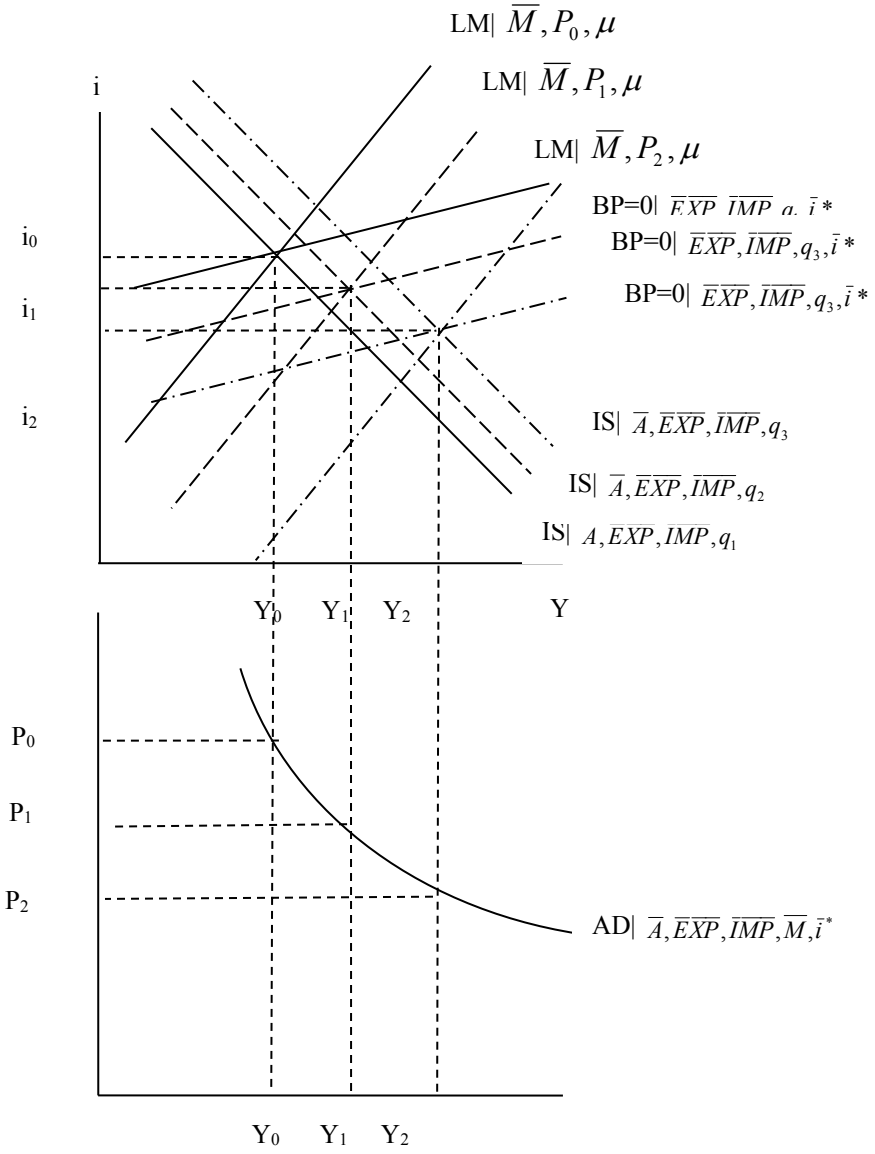

Figure 16.A1: IS-LM-BP=0 and Aggregate Demand and Aggregate Supply

Notice that the AD curve is drawn conditional on a given level of domestic autonomous spending, autonomous exports and autonomous imports, and the foreign interest rate (assumed exogenous). This means that an increase in government spending, for instance, will shift out the aggregate demand curve – as will an increase in autonomous exports.

Notice that the endogenous response of the trade balance and hence aggregate demand due to the endogenous appreciation of the exchange rate as the price level rises is built into the slope of the aggregate demand curve. Exogenous changes in the real exchange rate due to changes in the foreign interest rate (or changes in the autonomous component of financial capital flows) will result in shifts in the aggregate demand curve.