To introduce our study of exchange-rate regimes, we'll start by studying fixed exchange rates, and asking some questions about this regime for monetary policy.

What is their incidence and durability? As you will read in FT figure 2.4 and section 9.1, a number of countries have officially fixed exchange rates, but they don't seem to last very long. The Hong Kong dollar is the most durable. So why do we study this system? One reason is that it is regularly adopted in different countries. Another reason is that many countries that say they float in practice adopt unofficial exchange-rate policies that are a lot like a fixed or pegged system.

In this section we'll look at the narrow question of how fixed exchange rates work, and what guides or constrains monetary policy under this system. Then in sections 10 and 11 we'll look at what can go wrong (or how pegs meet their end) and at the broad issue of why this regime is adopted in the first place.

9.1.1 Monetary Reaction

Let us begin by considering a perfectly fixed exchange rate, and see what that implies for monetary policy, using the monetary model of the exchange rate.

Recall from the open-economy trilemma that adopting a fixed exchange rate requires devoting monetary policy to that goal (unless there are capital controls.) So the main lesson of managing a fixed exchange rate concerns how monetary policy has to react to shocks. FT 9.2 uses diagrams to explain the reactions. As a complement to that approach, I'll use some simple algebra.

Let us use the monetary model of the exchange rate to illustrate the reactions. Remember that:

\[ S = \frac{P}{P^*} = \frac{M}{M^*} \exp(-\alpha i^*) \frac{Y}{Y^*} \]

Let us write this in logs and also impose the fixed exchange rate: \( S = \bar{S} \) and so \( s = \bar{s} \):

\[ \bar{s} = (m - m^*) + (y^* - y) + \alpha(i - i^*). \]

Finally, we can invert or rearrange this to give a rule for domestic monetary policy:

\[ m = \bar{s} + m^* + (y - y^*) - \alpha(i - i^*). \]

Lesson 1: The level of the fixed exchange rate or peg determines the stance of domestic monetary policy. Choosing a value for \( \bar{s} \) implies a value for \( m \). That consideration is important for countries that are joining or adopting a fixed exchange rate.
Lesson 2: Domestic monetary policy has to shadow foreign monetary policy. You can see that $m$ moves 1:1 with $m^*$. If the foreign monetary authority tightens monetary policy then the domestic authority must do the same, to avoid a depreciation.

Lesson 3: Monetary policy also has to respond to shocks to domestic money demand. Notice that $m$ moves 1:1 with $y$. If there is a domestic recession then the currency will tend to depreciate, unless there is an offsetting contraction in monetary policy.

Lesson 4: Monetary policy may need to respond to a loss of credibility in the peg. To see this lesson, first suppose that the peg is completely credible, so that $E_t s_{t+1} = \bar{s}$. Then from UIP we know that $i = i^*$. As a result, the last term in the reaction function is zero.

But the peg may be imperfectly credible. As FT note, there can be an interest-rate premium either because of a lack of credibility in the peg (leading to a currency premium) or because of a lack of credibility in settlement or payment of debts (leading to a default premium). But if $i - i^* > 0$ then the currency value will be higher, so there must be an offsetting tightening of monetary policy to maintain the peg.

Another way to see this result is to combine UIP with the result so far:

$$m = \bar{s} + m^* + (y - y^*) - \alpha(E_t s_{t+1} - \bar{s})$$

You can read off directly that an expected depreciation — $E_t s_{t+1} > \bar{s}$ — necessitates an even tighter current stance for monetary policy.

Lesson 5: Reserves generally respond to shocks. Suppose that the central bank holds two assets, foreign exchange reserves $R$ and domestic bonds $B$ (sometimes called domestic credit). Its balance sheet then is:

$$M = B + R.$$ 

A sure-fire way to maintain a peg is to maintain sufficient reserves to allow buying and selling to make the market exchange rate equal to the official rate. In levels then:

$$\bar{s} = \frac{M}{M^*} \frac{Y^*}{Y} \exp[\alpha (i - i^*)]$$

$$= \frac{(B + R)}{M^*} \frac{Y^*}{Y} \exp[\alpha (i - i^*)]$$

which means that we can solve for the necessary reserves:

$$R = \frac{\bar{s} M^* Y}{Y^* \exp[\alpha (i - i^*)]} - B$$

We then can see how reserves need to respond to the variables on the right-hand side, just as in the previous lessons. (I have not written this in logs because the log of $B + R$ is not equal to the sum of their logs.)
Lesson 6: The central bank must sterilize changes in domestic credit. Suppose that the central bank increases $B$, to lend to the government or to assist the banking system. Then we can read off that it must decrease $R$ 1:1 with the increase in $B$ in order to maintain the fixed exchange rate. This transaction is called sterilization.

Lesson 7: The level of reserves needs to be sufficient for the central bank to respond to shocks without running out of reserves. You can see that if $R = 0$ that it cannot respond to shocks.

One way the central bank can make sure it has a large stock of reserves is by borrowing to finance them. It can issue domestic debt and use the proceeds to purchase reserves. FT pp 408–409 contain an example. One of the striking developments in international finance in the past decade has been the large-scale accumulation of reserves by central banks in emerging economies.

9.1.2 Missing Volatility?

Obviously a fixed, nominal exchange rate is less volatile than a floating one. It is not quite as obvious that the fundamentals must be less volatile under a fixed exchange rate regime too. next, we work that out formally and then see whether that might help us learn what the fundamentals are.

Recall that

$$s_t = \frac{1}{1 + \alpha} x_t + \frac{\alpha}{1 + \alpha} E_t s_{t+1},$$

so if $\bar{s} = s_t = E_t s_{t+1}$ then

$$\bar{s} = x_t.$$

Let us contrast this with a float in which $x_t$ follows a random walk:

$$x_t = x_{t-1} + \eta_t.$$

In that case, our present-value model and forecasting rules give us:

$$s_t = x_t.$$

The variance of $s$ is lower under fixed exchange rates than under floating. Thus, if we have correctly understood the fundamentals, then $x$ also must be less volatile. For example, movements in $m_t$ might now offset movements in $y_t$ that formerly moved $x$ around. In other words, the volatility in $y$ should be transmitted to $m$ – under fixed exchange rates – rather than to $s$ – under floating exchange rates. That is the policy reaction we worked out in the previous section. But we there assumed that we know the correct model of the exchange rate. Since we don’t know that in practice, perhaps the change in volatility can help us learn about it. Can we find evidence of this missing volatility showing up somewhere? Do countries with fixed exchange rates have more volatile monetary policies?
9.1.3 Target Zones

Most fixed exchange rates are not really fixed but involve fluctuations within a band called a target zone. Examples include the Bretton Woods bands against the dollar and the ERM bands which ranged from $\pm 2.25$ percent to $\pm 15$ percent during the 1980s and 1990s. The authorities keep $s$ between bounds of $\bar{s}$ and $\underline{s}$ using monetary policy.

Most formal models of target zones use the simple monetary model of the exchange rate. They generally use some continuous-time mathematics with which you may be unfamiliar, so to avoid this entry barrier, we work with a simple, discrete-time example.

Imagine that the authorities can control the fundamental so that it is a constant plus some small variation:

$$x_t = \mu + \eta_t.$$

Suppose for example that $\eta_t$ has a uniform distribution between $\bar{\eta}$ and $\underline{\eta}$. That way it is bounded from above and below, unlike a normal density for example. Putting bounds on the fundamental will lead to bounds on the exchange rate.

The exchange rate, as always, follows the present-value model:

$$s_t = \frac{1}{1 + \alpha} [x_t + \frac{\alpha}{1 + \alpha} E_t x_{t+1} + \frac{\alpha^2}{1 + \alpha} E_t x_{t+2} + ...]
= \frac{1}{1 + \alpha} x_t + \frac{1}{1 + \alpha} \frac{\alpha}{1 + \alpha} (\mu + \frac{\alpha}{1 + \alpha} \mu + ...)
= \frac{x_t}{1 + \alpha} + \frac{\alpha \mu}{1 + \alpha}.$$

You can see that — perhaps surprisingly — the variance of $s$ is less than the variance of $x$. Paul Krugman called this property the ‘honeymoon effect’. Credibility in controlling the fundamentals pays off in a narrower range for $s$ than for $x$. The logic is that the authorities are credibly controlling all future fundamentals, and not just the current ones.

So have we now found a way to magically reduce the volatility of the exchange rate? No. The volatility goes into interest rates. This sounds like a bad thing, but another way to describe this outcome is that the central bank has some policy independence under a target zone, something which is not possible with a perfectly fixed exchange rate. Suppose that the band is $\pm 2$ percent wide. Then the maximum expected depreciation is 4 percent. But since that could occur rapidly, large, temporary interest-rate differentials are possible in short-term interest rates quoted at annual rates. For example, 3-month rates could display a 12 percent differential.

9.1.4 Testing the Predictions

Several ways of testing the credibility of target zones have been suggested. Since we don’t have much confidence in any specific model of the fundamental, most tests
of target zone models focus on the unconditional properties of the exchange rate or on the relation between the exchange rate and interest rates.

One way to test the model is to regard the forward exchange rate as the expected future spot rate, and see if:

$$\bar{s} \geq f_t^i \geq s$$

at any maturity $i$.

A second way is based on uncovered interest rate parity. At the top of the band, $s$ can only fall (appreciate), so the local interest rate should be below the foreign one. At the bottom of the band, $s$ can only rise (depreciate) so the local interest rate should be above the foreign one. Thus we can graph the interest differential against the exchange rate. We should see a negative slope.

In reality, the scatter plot of $i - i^*$ against $s$ is a cloud, not a downward sloping line, and forward rates often lie outside the band. This very negative evidence clearly refutes the simplest target zone model.

A realistic modification is to add the possibility of realignments. That is realistic for most target zones, like the Bretton Woods one. Realignment risk may explain why forward rates lie outside the band and why interest differentials don't match the position of the spot rate within the band. But realignment models are difficult to test because realignments are relatively infrequent. If we have time we'll set up an example and see how it works.

Of course, the forward rate might lie outside the target zone for the spot rate not because investors expect a discrete, one-time realignment but because they expect the fixed exchange rate to be abandoned and the currency to float and depreciate. One reason there is not much ongoing research on target zones is that most of them do not last long. The Danish peg to the Euro or the Hong Kong peg to the dollar are exceptions. In the next section, we'll study speculative attacks or crises in fixed rate systems.