Exchange Rate Target Zones

Abstract

A target zone attempts to limit the movement of an exchange rate, avoiding the pitfalls of both a pegged rate and a freely floating rate. The European Monetary System was the prime example. An elegant model of Paul Krugman demonstrates that in theory a target zone does indeed stabilise an exchange rate. But in practise it has been substantially rejected empirically. Williamson’s ‘crawling bands’ around a ‘fundamental equilibrium exchange rate’ develop the concept. Target zones survive among candidates for membership of the Euro zone who take part in the Exchange Rate Mechanism mark II.

Exchange Rate Target Zones

An Exchange Rate Target Zone is a scheme intended to limit the flexibility of an exchange rate without going as far as fixing or pegging the value of one currency against another. It is a band, or zone, of values for the exchange rate, around a central or target rate. Within the zone, the exchange rate is allowed to fluctuate freely without any intervention from the authorities; or, at least, with less intervention than there is elsewhere. At the edge of the band, and outside, if the rate strays there, there is more vigorous intervention to keep the rate within, or return it to, the band. There are many varieties of Target Zone. The edges may be hard or soft. It may be defined in terms of nominal or real exchange rates. The central rate – the target – may be either constant over time, possibly with provision for occasional discrete changes; or it may be adjusted continuously. The bands may be narrow or wide.

The most celebrated and ambitious target zones were those introduced in 1979 by the European Monetary System (the EMS). They operated until the end of 1998. Under the EMS, member states were initially required to keep their bilateral exchange rates within a band of ±2.25 percent around a grid of central parities. (Giavazzi and Giovannini, 1989) They were required to use unlimited intervention in the foreign exchange markets to defend the bands if an exchange rate strayed to the edge. Member countries could adjust central parities occasionally by mutual agreement when perceived misalignments had built up. The system evolved over time. As capital controls were progressively removed, orderly realignments became more difficult to manage. The system became less flexible, notably after 1987. The gradual movement towards complete fixity of exchange rates, intended to prevail under Economic and Monetary Union, was thrown off course by a massive speculative attack in September 1992. The system was unable to withstand it and the bands were widened to 15 percent. But they were subsequently narrowed again and the EMS gave way to the Euro on the 1st January 1999.

The use of Target Zones sprang from a desire to avoid the pitfalls of fixed rates and free floating. Under the fixed exchange rates of the Bretton Woods System (1944 - 1973), exchange rate misalignments had become progressively worse as inflation rates diverged, and weak currency countries put off devaluation, deterred by costly speculation. Under floating exchange rates during the 1970s, exchange rates fluctuated excessively, unrelated
to fundamentals like relative price levels and current accounts. The ‘disconnect’ between exchange rates and economic fundamentals has been confirmed by widespread experience and has become a central tenet of international macroeconomics.

The EMS was intended to allow exchange rates to offset inflation differentials among members. Realignments were to be sufficiently timely to avoid giving the markets a one-way bet. The bands were intended to enable markets to determine exchange rate movements without official intervention for most of the time, at the same as discouraging destabilizing speculation.

The questions of how target zones might work in theory, whether they worked in practice as the theory predicted, and whether they did indeed cut exchange fluctuations, have generated enormous amounts of research.

The key theoretical contribution is that of Krugman (1991). He showed that a fully credible target zone would reduce the volatility of an exchange rate and reduce its sensitivity to fundamentals. His theoretical model assumes a monetary theory of the exchange rate for a small open economy in a world of perfectly flexible prices and perfect capital mobility, in which purchasing power parity and uncovered interest parity hold good. Then the log of the exchange rate \( e \) can be expressed as a function of its own anticipated rate of change over time \( E_r(de)/dt \) and a driving fundamental \( f \)

\[
e = f + \alpha E_r(de)/dt
\]

The parameter \( \alpha \) denotes the semi-elasticity of money demand with respect to the interest rate. The fundamental reflects money supply and demand. He considers a stochastic model in continuous time, in which the fundamental \( f \) follows Brownian motion, the continuous-time analogue of a random walk. That is

\[
df = \sigma dz
\]

where \( dz \) is the innovation in a standard Wiener process, and \( \sigma \) is the variance of the innovation in the fundamental per unit time. \( dz \) has mean zero and variance \( E(dz^2) = dt \).

When the exchange rate is allowed to float freely, the exchange rate will be a linear function of the fundamental

\[
e = f
\]

But, when a target zone limits movements of the exchange rate, this solution does not apply. Assume for simplicity that under the target zone the central parity for the logarithm of the exchange rate is equal to zero and the limits of the zone are \( \bar{e} \) and \( e \).

Further assume that the zone is symmetrical and \( \bar{e} = -e \). Using stochastic calculus and methods widely used in the theory of options pricing, Krugman shows that the exchange rate is related to the driving fundamental by the relationship

\[
e = f + A(\exp(\xi f) - \exp(-\xi f))
\]

where

\[
\xi = \sqrt{\frac{2}{\sigma^2 \alpha}}
\]

The constant \( A \) is such that at the top and bottom of the band, the value-matching conditions
\[ \bar{e} = f + A \left( \exp(\xi f) - \exp(-\xi f) \right) \]
and
\[ e = f + A \left( \exp(\xi f) - \exp(-\xi f) \right) \]
hold, and also the smooth pasting conditions hold. These require that the derivative of the exchange rate with respect to the fundamental at the edges of the band is equal to zero. Viz.
\[ 1 + A \left( \xi \exp(\xi f) + \xi \exp(-\xi f) \right) = 0 \]
and
\[ 1 + A \left( \xi \exp(\xi f) + \xi \exp(-\xi f) \right) = 0 \]
From these conditions the value of the constant \( A \), and the value of the fundamental at the limits of the band (\( f = -f \)), can be determined. The value of the parameter \( A \) that emerges from this analysis is negative. Thus the value of the exchange rate, corresponding to any particular value of the fundamental, is closer to the parity rate under a target zone than it would be under a free float.

Krugman’s analysis establishes that the exchange rate within the target zone enjoys the ‘bias in the band’ or the ‘honeymoon effect’. The relationship between the fundamental and the exchange rate in the target zone is an S-shaped curve. It is flatter everywhere than the relationship under a free float, which is a 45 degree line. The perfectly credible commitment of the authorities to intervene, should the exchange rate ever reach the edge of the band, so as to prevent any movement beyond it, discourages deviations from the central parity even without any actual intervention. It is illustrated in Figure 1.

This elegant theory has very strong empirical predictions. Three predictions that do not rely on any assumptions about the value of the unobserved fundamentals are follows. Firstly, the exchange rate should spend a lot of time near the edges of the band, and relatively little near the centre. The unconditional distribution of the fundamental within the band is uniform, and the distribution of the exchange rate is u-shaped. Secondly, the uncovered interest parity condition implies that when the exchange rate is strong (\( e \) is close to \( e \)) and thus likely to weaken the domestic interest rate should exceed the foreign rate, while when the exchange rate is weak the domestic interest rate should be relatively low. And thirdly, the converse of the second prediction, at any point in time the expected future exchange rate implied by the uncovered interest parity condition
\[ E_t(e_{t+dt}) = e_t + (r_t - r_t^*) dt \]
(\( r_t \) is the domestic instantaneous nominal interest rate and \( r_t^* \) the foreign one) should lie within the band.

Unfortunately, all three of these predictions are comprehensively rejected by empirical evidence, of which a great deal has been accumulated. The work of Flood, Rose and Mathieson (1991) led the way in this. They and many subsequent studies found that
exchange rates had tended to be concentrated near the middle of the band, not at the edges, as predicted. They also found that when the exchange rate was weak, there was no tendency for the interest rate to be relatively low. The expected future exchange rate implied by uncovered interest parity was found to spend a great deal of time outside the band, suggesting a lack of credibility of the Target Zone.

Direct tests of the relationship between the exchange rate and the fundamental driving variable have generally found very little evidence of non-linearity or S-shaped-ness. There appears to be little evidence of any ‘honeymoon effect’. Svensson (1992) remarks that the comprehensive rejection of this theory looks like what T. H. Huxley called ‘the great tragedy of science – the slaying of a beautiful hypothesis by an ugly fact’. But in fact, while descriptively unrealistic, Krugman’s model of target zones maintains its conceptual grip. A number of minor amendments to the theory have gone some way to reconciling it with the evidence while leaving its central ideas intact. The theory makes many clearly unrealistic assumptions. Two changes that have been particularly important are allowing for imperfect credibility of the target zone and allowing for intra-marginal intervention. Intra-marginal intervention in particular alters the process driving the fundamentals and can cause the theoretically predicted distribution of the exchange rate within the zone to have the empirical humped shape. Expectations that a zone is not fully credible, and that the authorities might adjust the central parity rather than defend the zone also have the effect of reducing the curvature of the s-shaped curve and bringing it closer to the 45-degree line that would prevail under free floating.

With the empirical failure of the theory, and the disappearance of the most prominent practical example when the Euro replaced the EMS in 1999, interest in target zones has subsided. Nevertheless, John Williamson (1998) emphasizes the empirical observation that within a target zone, the forward rate responds less than one-for-one with a change in the spot rate, whereas the same is not true of a floating exchange rate, as an indication that even an imperfectly credible target zone exerts a stabilizing influence on exchange rates. He has proposed looser arrangements for exchange rates, such as ‘crawling bands’ and ‘monitoring bands’, in which the band is defined around an equilibrium real exchange rate (his concept of the Fundamental Equilibrium Exchange Rate), which naturally implies a central nominal exchange rate that crawls over time. While a crawling band involves a commitment to keep the exchange rate within a wide announced band, a monitoring band involves a weaker commitment. A number of countries used crawling bands during the 1990s, including Chile, Colombia, Israel, Indonesia, Ecuador, and Russia. The IMF reports that by the end of 2005 there were no countries using crawling bands. Several countries were using ‘pegged exchange rates within horizontal bands, mostly countries in ERM II, the revised form of the Exchange Rate Mechanism of the former EMS: Cyprus, Denmark, the Slovak Republic, Slovenia, and Hungary; with Tonga alone outside ERM II.

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References


Figure 1