

# **Exchange rate solutions with currency crashes**

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## **Summary**

We present an exchange rate model in which a currency's exchange rate is confined in a wide moving band and a currency crash occurs when the rate breaches the lower boundary. A solution is derived from the standard log exchange rate equation for the model with a smooth-pasting condition at the lower boundary. Using an asymmetric mean-reverting fundamental shock, the solution shows the exchange rate follows a mean-reverting square-root process, which is quasi-bounded at the boundary, and generates left-skewed exchange rate distributions consistent with empirical observations. The probability leakage for the exchange rate across the boundary increases with a weakened mean-reverting force for the exchange rate, suggesting an increase in currency crash risk. The empirical results show that the exchange rates of nine major currencies against the US dollar can be calibrated according to the model, where the mean reversion is negatively cointegrated with the risk reversals in currency option markets, as expected by the model, and are consistent with the positive

relationship between currency crash risk and risk reversals. The leakage condition for breaching the lower boundaries was met during the 2008 global financial crisis when most of the currencies were under the disaster shock.