Can Exchange Rate Dynamics in Krugman's Target-zone Model be Directly Tested?

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Summary

Despite Krugman's (1991) model being a benchmark for modelling target zones, empirical support has been sparse and empirical tests have often led to rejections of the model due to the subtle non-linear relationship between the observable exchange rate and underlying unobservable fundamental value. To overcome this deficiency of the basic Krugman model, this paper provides an alternative approach to derive explicit exchange rate dynamics under Krugman's model by approximating a quadratic relationship between the exchange rate and fundamental through a power-series method.

The explicit stochastic processes for the exchange rate dynamics and the associated probability density functions are derived accordingly for a parametric class of the drift terms in the fundamental dynamics, including zero-trend, symmetric and asymmetric mean-reverting stochastic fundamental, regarding how central banks intervene. The zero-trend fundamental in the Krugman model, assuming marginal intervention, is a case in the

framework. This analytical approach overcomes the difficulty of capturing the non-linear relationship in the Krugman model between the observable exchange rate and unobservable fundamental value empirically, such that the exchange rate dynamics can be tested directly.

The empirical results demonstrate that the stochastic exchange rate, following the square-root processes under the Krugman model (zero-trend fundamental), and asymmetric mean-reverting fundamental, adequately fits the exchange rate data on the Exchange Rate Mechanism (ERM) currencies in two-sided target zones and the Hong Kong dollar (HKD) in a one-sided target zone during the Asian financial crisis. Furthermore, the results show that the mean-reverting square-root process of the exchange rate dynamics associated with an asymmetric mean-reverting fundamental, assuming intra-marginal intervention at the weak side of a band, adequately fits the exchange rates of the ERM currencies and the HKD. Given that the exchange rate is quasi-bounded under this process, the measure for the probability leakage condition of the exchange rate breaching the weak-side limit surged before the realignment or abandoning the target-zone regimes for the ERM currencies and during the speculative attack on the HKD. The exchange rates dynamics under the asymmetric mean-reverting fundamental shock captures the realignment risk of the currencies' target-zone regimes.