

**Mystery #1: Bid/Ask Asymmetry**

In the past, it has generally been accepted that there is symmetry (up to statistical fluctuations) between the bid and the ask sides of the limit order book. Although a visual examination of empirical cdfs may appear to support this idea, it can be difficult to gain an accurate picture of such distributions by eye alone.

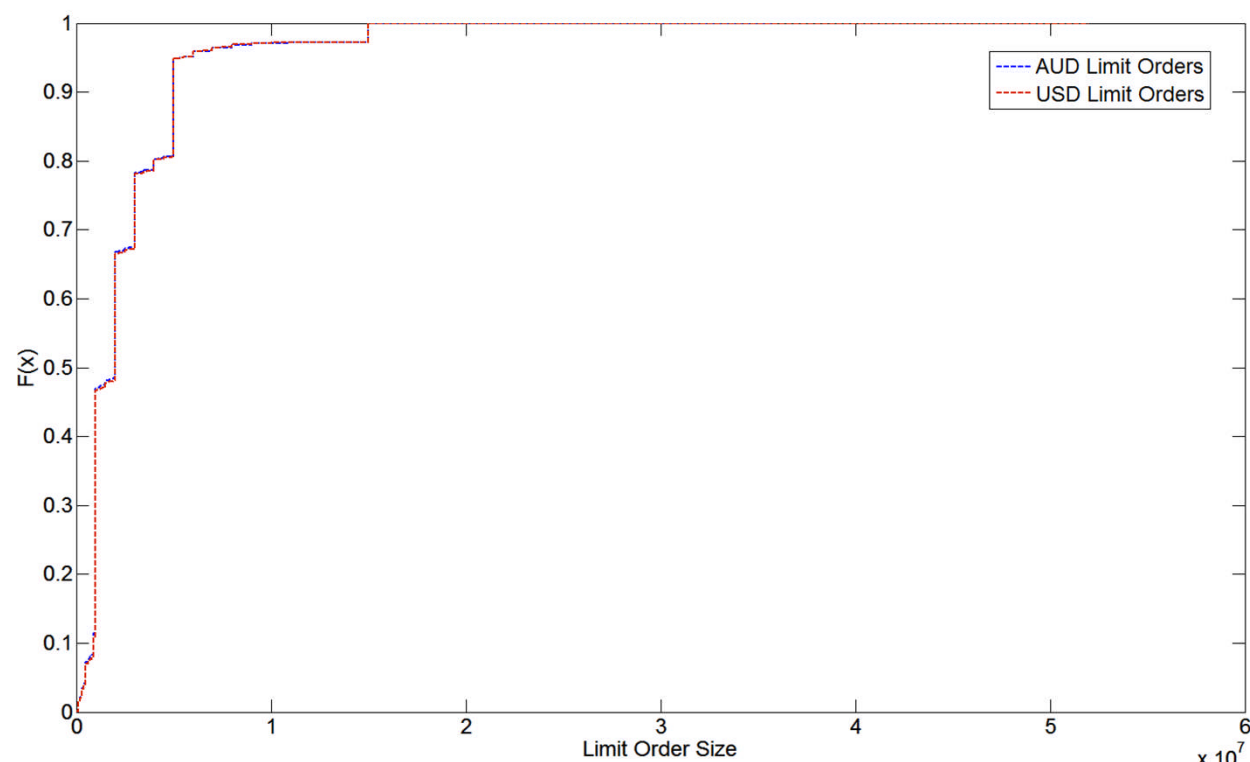


Figure 2: Empirical cdfs for size of incoming AUDUSD limit orders

**Formal Tests**

The problem with formally testing whether the behaviours observed on the bid and the ask sides of the limit order book are indeed drawn from the same distribution lies in the construction of a suitable test statistic. Although a Kolmogorov-Smirnov 2 sample test may seem like an ideal candidate, an examination of the time series of incoming limit order sizes reveals statistically significant autocorrelations over a wide range of lags, rendering such a test invalid.

**Q-Q Plots**

Q-Q plots are an effective tool for identifying whether there are certain parts of the distributions that do not match each other. Producing Q-Q plots for a range of currency pairs reveals that although some seem to have good bid-ask symmetry, others certainly do not.

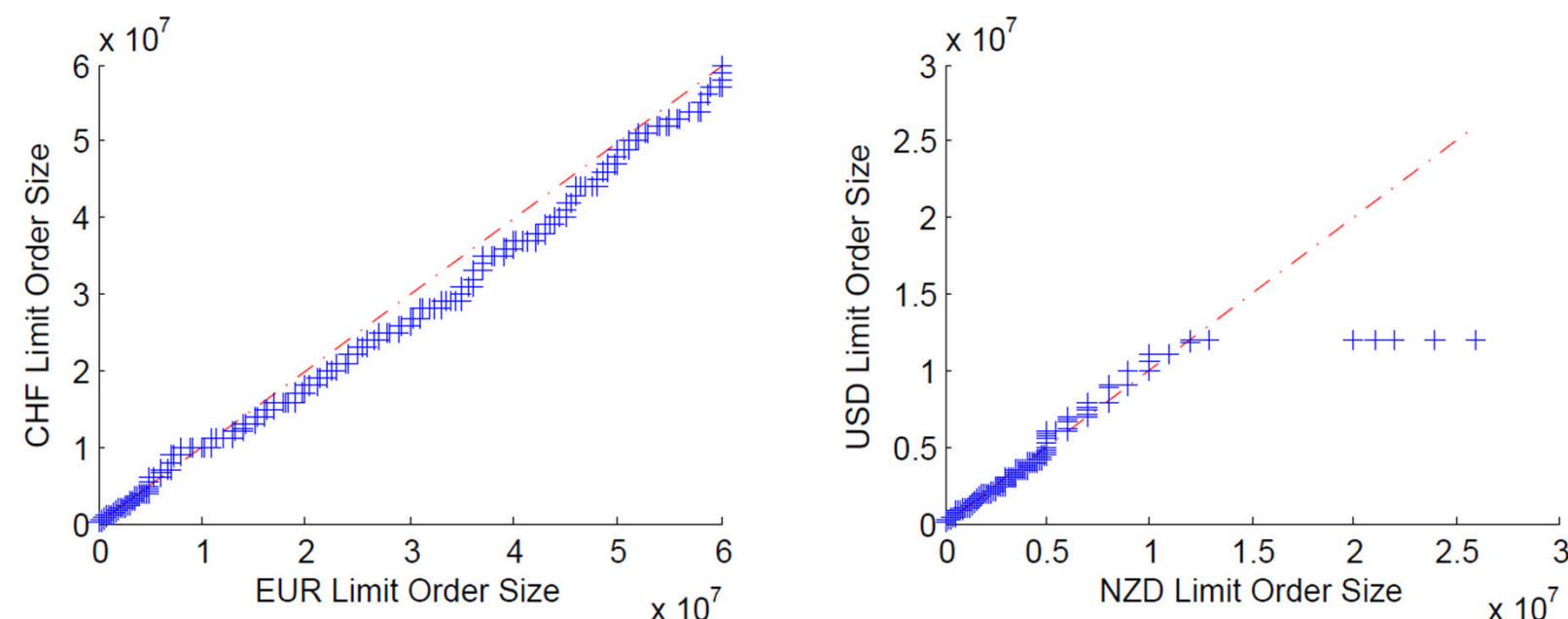


Figure 3: Q-Q plots for size of incoming EURCHF and NZDUSD limit orders

**Other Asymmetries**

There are other asymmetries between the bid and the ask sides of limit order books. A key example is the distribution of limit order prices – limit orders placed on the ask side tend to have a larger distance from the best price than do those on the bid side. Why should this be the case? Could perhaps human error play a statistically significant role? If so, what implications does this have for other aspects of limit order book modelling?

***Mystery #1: What drives such asymmetry in limit order books for some currency pairs?***