Technical Note on Crypto-Implied High-frequency Parallel FX Rates and Spreads from Binance

Max-Sebastian Dovi
mdovi@imf.org

1 Overview

Several approaches exist to infer parallel FX rates using crypto assets. These papers

1. Do not construct execution-consistent FX bid and ask prices,
2. Do not account for order size,
3. Do not provide high-frequency updates.[1]

However,

1. is important to monitor informal FX trading frictions.
2. is important because parallel FX rates can be sensitive to the amount of FX converted.
3. is important for real-time surveillance and high-frequency event studies.

The purpose of this exercise is to address all three shortcomings, and provide a continuously updated half-hourly data set that constructs crypto-implied parallel bid, ask, and mid rates for different order sizes (ranging from US$ 10 to US$ 25,000).

[1] von Luckner et al. (2024) provide a monthly data that is updated 'periodically'.

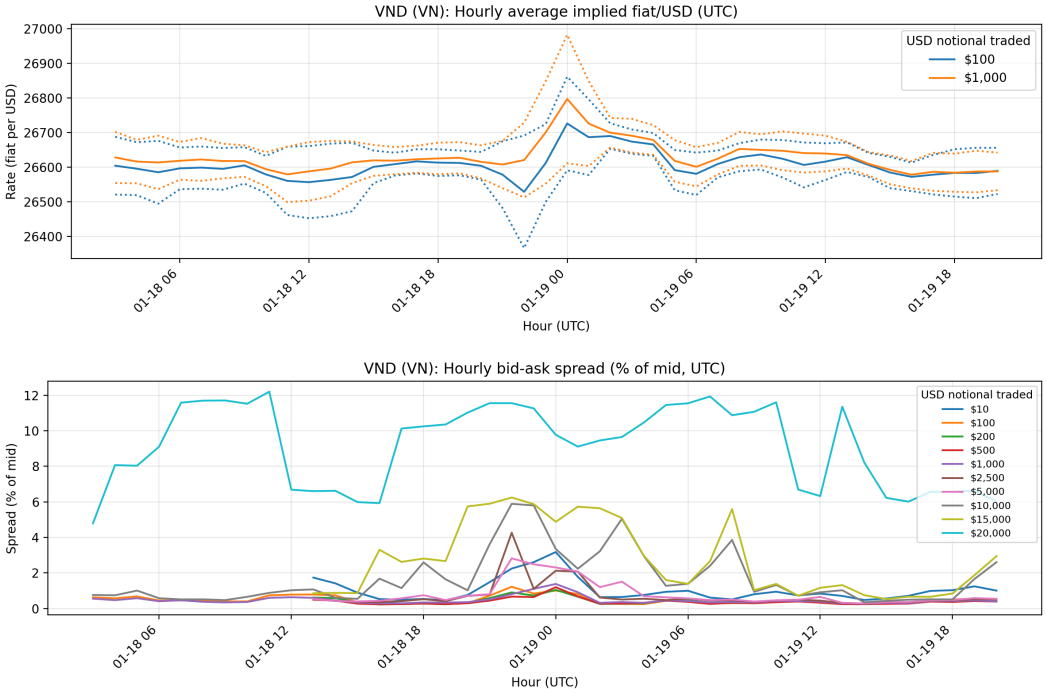

Figure 1: Vietnam

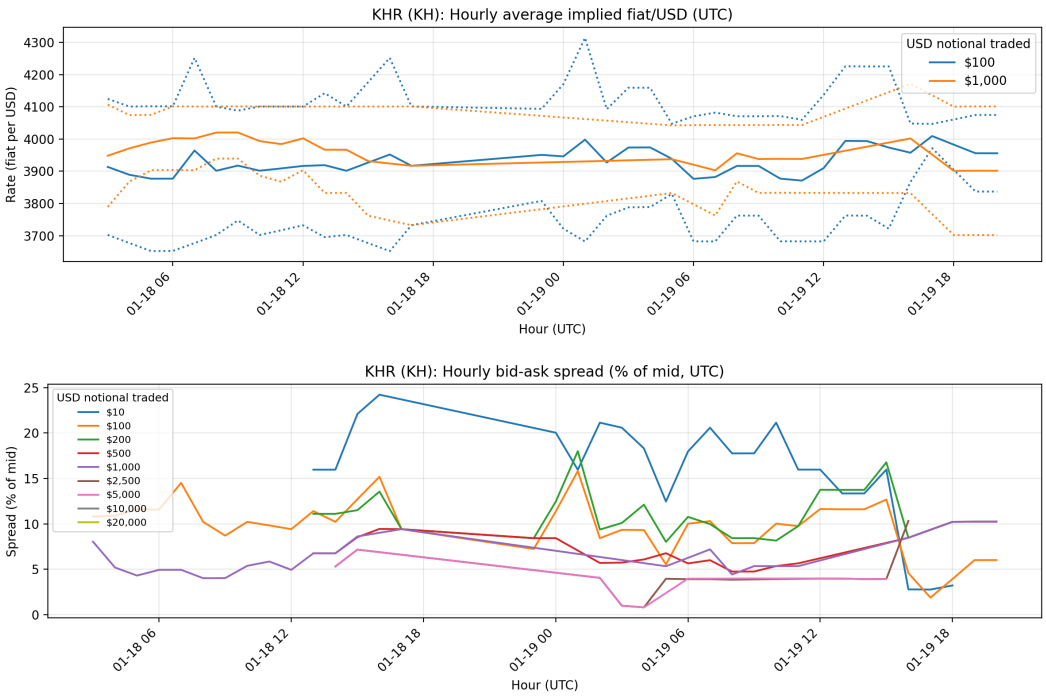

Figure 2: Cambodia

2 Implementation

2.1 Calculation of bid and ask prices

Fix a local currency, LCU, and let USD and $USDT$ denote the US dollar and the Tether stablecoin, respectively.

Let U_t be the US dollara amount to be exchanged.

At time t for currencies X and Y, $b_{t,U_t}^{X/Y} \leq a_{t,U_t}^{X/Y}$ are the bid and ask prices, i.e., $b_{t,U_t}^{X/Y}$ is the amount of currency X received when selling one unit of Y, $a_{t,U_t}^{X/Y}$ is the amount of X needed to buy one unit of Y.

Define the mid and the spread as

$$m_{t,U_t}^{LCU/USD} = \frac{b_{t,U_t}^{LCU/USD} + a_{t,U_t}^{LCU/USD}}{2}, \qquad s_{t,U_t}^{LCU/USD} = \frac{a_{t,U_t}^{LCU/USD} - b_{t,U_t}^{LCU/USD}}{m_{t,U_t}^{LCU/USD}}.$$

Execution-consistent spreads (suppress dependence on U_t for convenience)

- $LCU \to USD$

  LCU buys $USDT$ at $a_t^{LCU/USDT}$, then USDT is sold for USD on spot at $b_t^{USD/USDT}$. The implied ask is

  $$a_t^{LCU/USD} = \frac{a_t^{LCU/USDT}}{b_t^{USD/USDT}}.$$

- $USD \to LCU$

  USD buys USDT at $a_t^{USD/USDT}$, then USDT is sold for LCU at $b_t^{LCU/USDT}$. The implied bid

  $$b_t^{LCU/USD} = \frac{b_t^{LCU/USDT}}{a_t^{USD/USDT}}.$$

2.2 Data

For every t, I request the first page of Binance P2P listings with 8 rows and take the median advertised price across those returned ads, separately for buying and selling. If fewer than 8 ads are returned, I take the median over the available subset. This provides $b_{t,U_t}^{LCU/USDT}$, $a_{t,U_t}^{LCU/USDT}$, $b_{t,U_t}^{USD/USDT}$, $a_{t,U_t}^{USD/USDT}$.

I consider $U_t \in \mathcal{U} := \{10, 100, 200, 500, 1000, 2500, 5000, 10000, 20000\}$. In the $LCU \to USD$ leg, the amount of local currency to be converted is given by the median of the elements of $\{m_{t-1,U_t}\}_{U_t \in \mathcal{U}}$.

I run the code every half hour ($t = 2026/01/20 - 00 : 00, 2026/01/20 - 00 : 30, \dots$) and automatically save the results on github.

References

von Luckner, C., R. Koepke, and S. Sgherri (2024, 7). Crypto as a marketplace for capital flight. IMF Working Paper 2024/133, International Monetary Fund.