Exchange Liquidity

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1 Introduction

1.0.1 Summary

- Coinbase is the most liquid exchange in terms of spread and price impact while Binance US is the least liquid exchange by the same measures.
- Kraken has a consistently low spread with large spikes in price impact that make liquidity harder to measure.
- All four exchanges are most similar in midpoint and price impact for asks with the largest differences in price impact for bids and spread.

Liquidity has been studied extensively in other financial markets. Rosu explores liquidity and information in limit order markets and focuses on the order choice problem of informed traders as well as how this choice affects market liquidity. Pani studies the effects of liquidity in high resolution markets and its subsequent explanatory power on the evolving transaction prices. He finds that explanatory power is satisfactory in short periods but weakens at longer periods.

1.1 Understanding Liquidity in Cryptocurrency Markets

Liquidity, a fundamental concept in financial markets, refers to the ease with which an asset can be bought or sold without causing significant price fluctuations. In the context of cryptocurrency markets, liquidity plays a crucial role in attracting traders and potentially commanding a "liquidity premium," where more liquid assets may trade at higher prices due to their enhanced tradability.

Two key metrics are commonly employed to quantify liquidity: spread and price impact. The spread represents the difference between the lowest asking price and the highest bidding price in the market. Conversely, price impact measures the degree to which the asset's price changes when a specific volume is traded. Both metrics offer valuable insights into different aspects of market liquidity. Markets characterized by narrow spreads are generally considered more liquid, as they offer lower transaction costs for traders. Similarly, exchanges demonstrating low price impact are indicative of higher liquidity, as large trades can be executed without causing significant price movements.

This study aims to assess the liquidity of Bitcoin across various U.S.-based cryptocurrency exchanges by analyzing both spread and price impact. Our analysis comprises a concise data overview followed by a comprehensive technical examination of these liquidity indicators.

2 Data Collection

We obtained data through RESTful API calls to the exchange's API at 6-second intervals. Due to server limitations, we were able to collect sufficiently detailed data for continuous segments of approximately 24 hours before being disconnected and requiring reconnection. A notable exception was a three-day period from June 1, 2024, to June 3, 2024. Data collection occurred at various times of day, with slight variations in duration. Tables 2-5 present summary statistics for each exchange across all time periods. The data collection periods were as follows:

Start Date	Start Time	End Date	End Time
Jun. 1	00:00:00	Jun. 3	21:00:00
Jun. 20	00:00:00	Jun. 21	00:00:00
Sept. 24	22:00:00	Sept. 25	22:00:00
Sept. 26	22:00:00	Sept. 27	18:00:00
Oct. 17	08:00:00	Oct. 17	18:00:00

Table 1: Regimes with Consistent Responses

	Price Impact (Bid)	Price Impact (Ask)	Spread
Mean	91.98	26.28	60.05
Std	82.16	37.94	19.38
Min	0.00	0.00	0.01
Max	1510.51	826.67	250.83

Table 2: Binance

	Price Impact (Bid)	Price Impact (Ask)	Spread
Mean	8.54	8.82	1.19
Std	4.33	4.66	1.94
Min	0.00	0.00	0.01
Max	42.80	33.16	16.77

Table 3: Coinbase

	Price Impact (Bid)	Price Impact (Ask)	Spread
Mean	17.69	15.02	8.39
Std	13.80	9.72	9.57
Min	0.00	0.00	0.01
Max	327.00	309.38	146.06

Table 4: Gemini

The analysis of liquidity across various cryptocurrency exchanges reveals consistent trends across different time periods. Notably, Coinbase exhibits the lowest mean Price Impact for bids, indicating a favorable environment for executing trades without significantly affecting prices. Additionally, Coinbase demonstrates the lowest standard deviation for Price Impact, suggesting greater stability in execution costs. Kraken also shows strong liquidity metrics, having the lowest mean for both Price Impact of bids and spread, along with the lowest standard deviation for spread. However, despite Kraken's overall liquidity, the considerable variation in Price Impact complicates the assessment of its liquidity.

In comparison, Gemini is slightly less liquid than both Coinbase and Kraken but remains competitive in terms of overall liquidity. On the other hand, BinanceUS stands out as significantly less liquid than its counterparts, exhibiting the lowest liquidity metrics by a considerable margin. These findings establish a clear hierarchy among the examined exchanges: Coinbase and Kraken emerge as the most liquid platforms, with Coinbase excelling in Price Impact stability and Kraken leading in spread metrics.

The implications of these findings are important for traders and investors. Coinbase's low variability in Price Impact suggests more predictable execution costs for large orders, while Kraken's low spread indicates potentially lower transaction costs for smaller trades. However, the high variability in Price Impact on Kraken could pose challenges for executing larger orders effectively. Meanwhile, the substantial liquidity gap between BinanceUS and other exchanges may lead to higher trading costs and increased slippage for users of this platform. Overall, these liquidity patterns provide valuable insights for market participants when selecting trading venues and developing execution strategies in the cryptocurrency market.

	Price Impact (Bid)	Price Impact (Ask)	Spread
Mean	10.18	6.46	0.18
Std	20.65	12.15	0.63
Min	0.00	0.00	0.10
Max	166.20	93.50	24.30

Table 5: Kraken

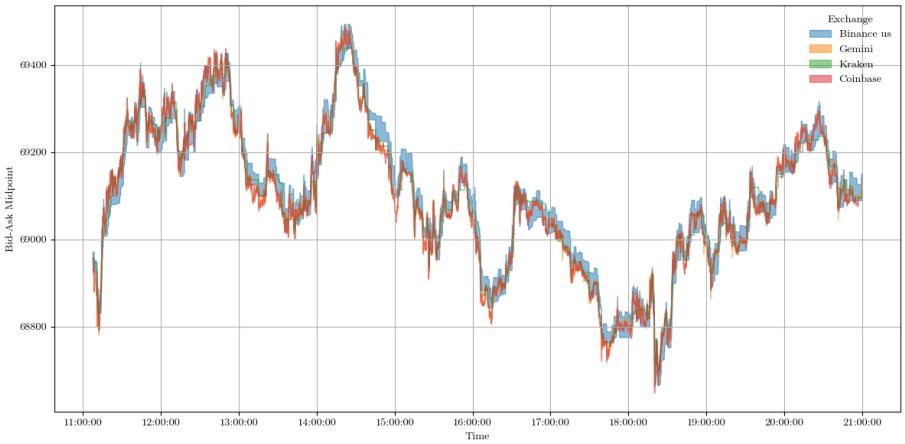

Figure 1: Spread over time 06/01 - 06/03

The trends hold in general across each regime that we sampled. Figure 1 shows the spread of each exchange from 06/03/24 - 06/03/24.

From Figure 1 we see that the price of Bitcoin on each market moves roughly together. Also of note, Figure 1 shows that the spread and midpoint price for BinanceUS is much higher over this time period. Tables 6-8 show the correlation between exchanges for each liquidity measure.

Binance	Coinbase	Gemini	Kraken
1.00	-0.02	0.10	-0.00
	1.00	-0.04	0.00
		1.00	0.03
			1.00

Table 6: Spread Correlation Matrix

Binance	Coinbase	Gemini	Kraken
1.00	-0.04	0.06	0.11
	1.00	-0.01	-0.05
		1.00	0.01
			1.00

Table 7: Price Impact (Bid) Correlation Matrix

Binance	Coinbase	Gemini	Kraken
1.00	0.05	0.02	0.08
	1.00	0.06	0.08
		1.00	0.03
			1.00

Table 8: Price Impact (Ask) Correlation Matrix

Based on our sampling the correlation between any exchanges is spurious and inconsistent. We also plot the Cumulative Distribution Functions for the same time period. These plots reinforce the lack of liquidity in the BinanceUS exchange. Interestingly the price impact for asks is fairly similar across exchanges. This trend holds across all regimes sampled.

3 Welfare Analysis

4 Conclusion

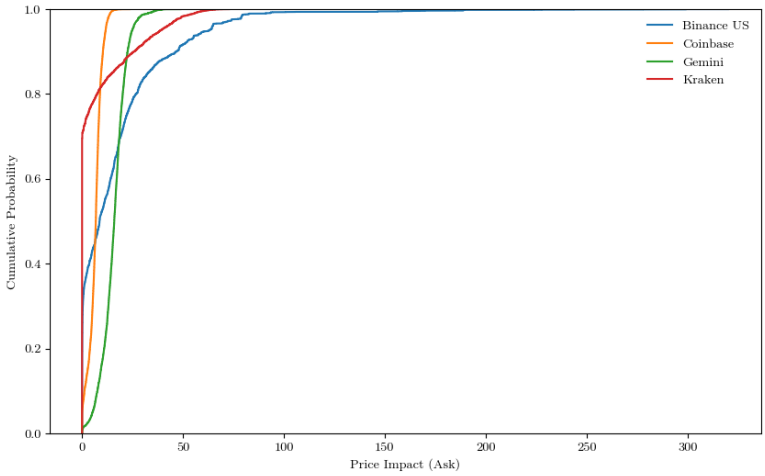

Figure 2: Price Impact (Ask) CDF 06/01 - 06/03

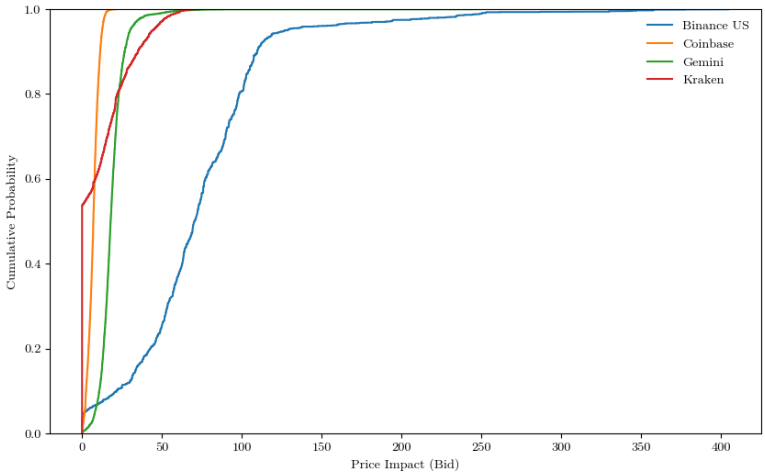

Figure 3: Price Impact (Bid) CDF 06/01 - 06/03

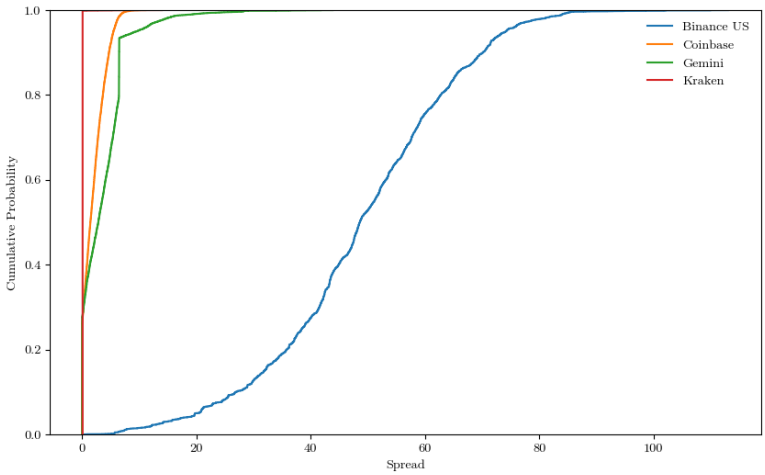

Figure 4: Spread CDF 06/01 - 06/03