

# Liquidity Monitoring Insights

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# Which market provides the best execution?

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## Definition of Liquidity?

- “Degree to which the quick sale or purchase of an asset affects the asset’s price”

## Important for all market participants

- Day traders face implementation shortfall when executing strategies
- Long-term investors have to sell assets when experiencing shocks

Market segmentation raises *choice of trading venue*

# We typically look at CoinMarketCap for price information

 Charts

 Markets

 Social

 Tools

 Historical Data

## Bitcoin Markets

Pair: USD ▾

Category: Spot ▾

Fee Type: All ▾

USD ▾

#	Source	Pair	Volume (24h)	Price	Volume (%)	Category	Fee Type	Updated
15	 Simex	BTC/USD	\$92,68 M	\$3.395,78	1,22%	Spot	Percentage	Recently
16	 RightBTC	BTC/USD	\$92,10 M	\$3.407,39	1,21%	Spot	Percentage	Recently
23	 Cryptonex	BTC/USD	\$77,19 M	\$3.474,21	1,02%	Spot	Percentage	Recently
28	 Coinsuper	BTC/USD	\$62,61 M	\$3.393,89	0,82%	Spot	Percentage	Recently
36	 Bitfinex	BTC/USD	\$40,89 M	\$3.471,10	0,54%	Spot	Percentage	Recently
42	 Coinbase Pro	BTC/USD	\$36,31 M	\$3.394,13	0,48%	Spot	Percentage	Recently
59	 Exrates	BTC/USD	\$26,27 M	\$3.464,34	0,35%	Spot	Percentage	Recently
62	 Bitstamp	BTC/USD	\$24,71 M	\$3.395,39	0,33%	Spot	Percentage	Recently
74	 Kraken	BTC/USD	\$21,62 M	\$3.394,10	0,28%	Spot	Percentage	Recently

# CoinMarketCap only provides very limited information

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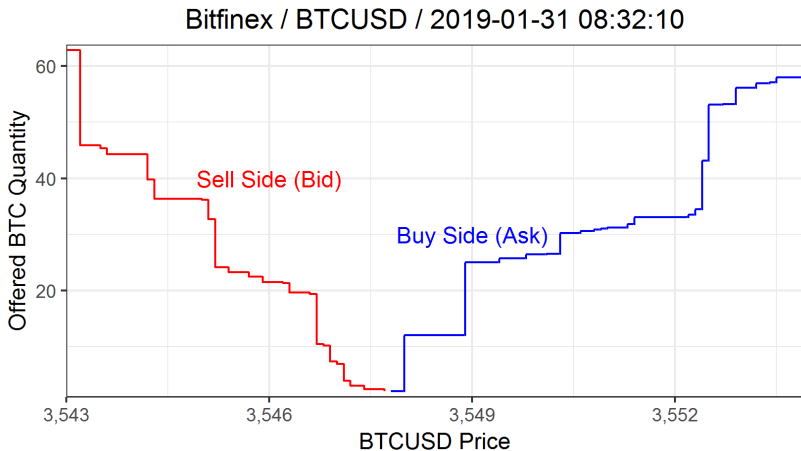
How much does my trade move the price?

- Traders & market makers offer price-quantity schedules (*orderbook*)
- I assume orderbooks show *true liquidity*

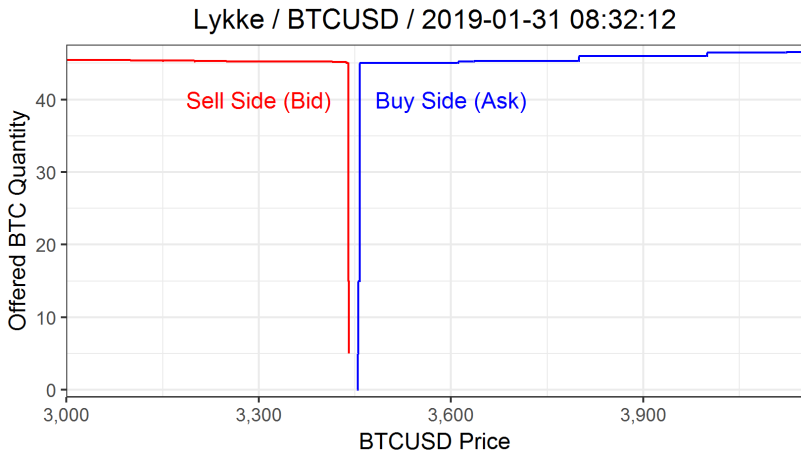
How much fees do I have to pay?

- Exchanges provide fee menu depending on trading quantity
- I do *not* consider fees in my presentation

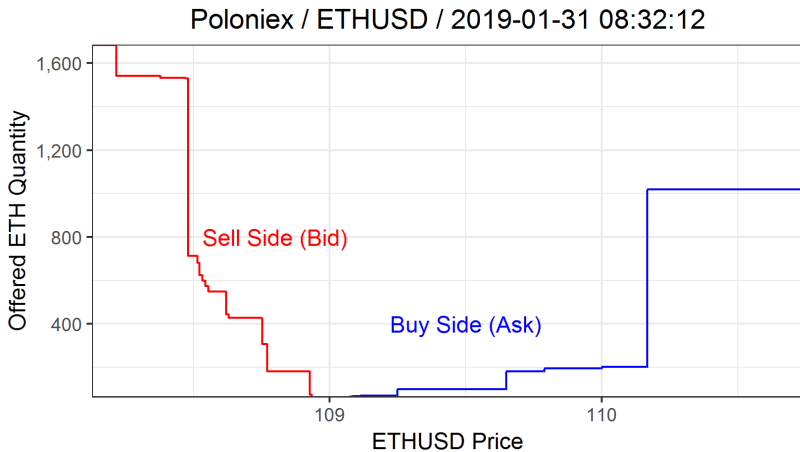
## Example of a typical orderbook



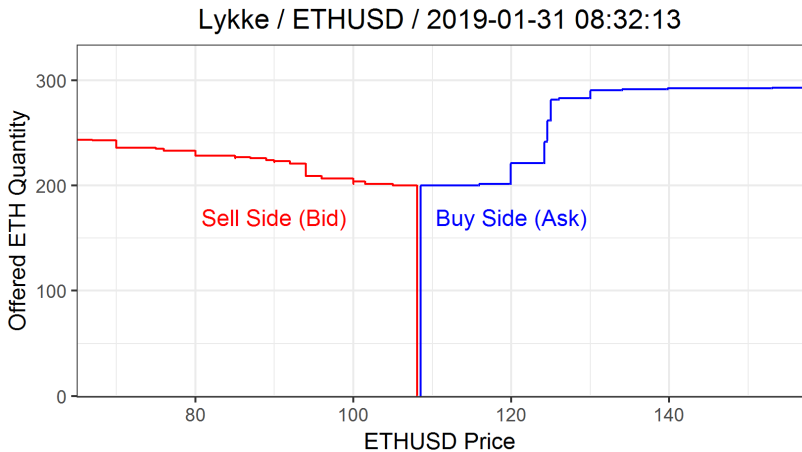
# Lykke orderbook at the same time



## Another example of an orderbook



## Again Lykke at the same time





# Overview of my talk

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1. Data collection
2. Descriptive statistics
3. Liquidity measurement
4. Outlook & potential questions

# How do we collect data?

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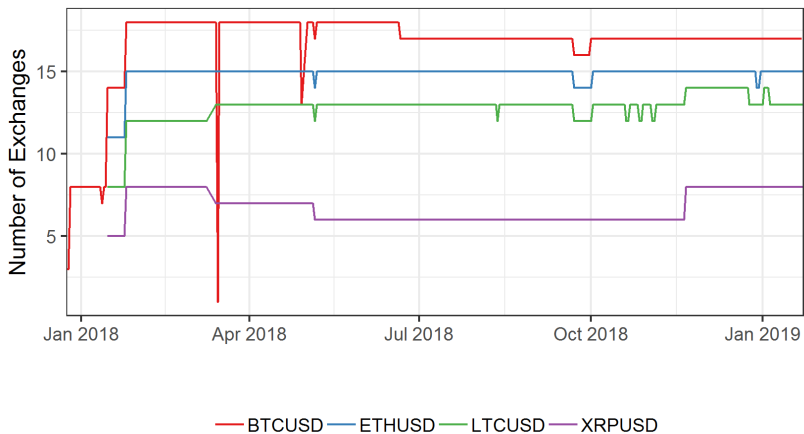
We run several servers & use our own code

- DigitalOcean (free credit: <https://education.github.com/pack>)
- CryptoX R Package (<https://github.com/ckscheuch/CryptoX>)

Every minute we simultaneously ping 17 exchanges

Every day we create a backup on Google drive

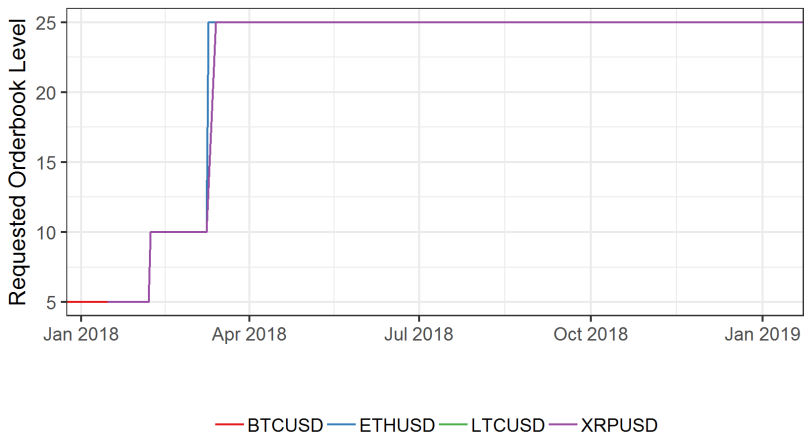
# Number of exchanges in our sample



## We currently track these exchanges

	BTC	ETH	XRP	LTC	Tether	Company Location
Binance	✓	✓	✓	✓	✓	Tokyo, Japan
Bitfinex	✓	✓	✓	✗	✗	Central, Hong Kong
bitFlyer	✓	✗	✗	✗	✗	Tokyo, Japan
Bitstamp	✓	✓	✓	✓	✗	London, UK
Bittrex	✓	✓	✓	✓	✓	Las Vegas NV, USA
BTCC	✓	✗	✗	✗	✗	Shanghai, China
CEX.IO	✓	✓	✓	✓	✗	London, UK
Gate	✓	✓	✓	✓	✗	Sparta NJ, USA
Gatecoin	✓	✓	✗	✓	✓	Wanchai, Hong Kong
Coinbase Pro	✓	✓	✗	✓	✗	San Francisco CA, USA
Gemini	✓	✓	✗	✓	✗	New York NY, USA
HitBTC	✓	✓	✗	✓	✓	Hong Kong
Kraken	✓	✓	✓	✓	✗	San Francisco CA, USA
Liqui	✓	✓	✗	✓	✓	Kiev, Ukraine
Lykke	✓	✓	✓	✓	✗	Zug, Switzerland
Poloniex	✓	✓	✓	✓	✓	Wilmington DE, USA
xBTCe	✓	✓	✗	✓	✗	Charlestown, Nevis

# Requested orderbook levels



# How does our data look like?

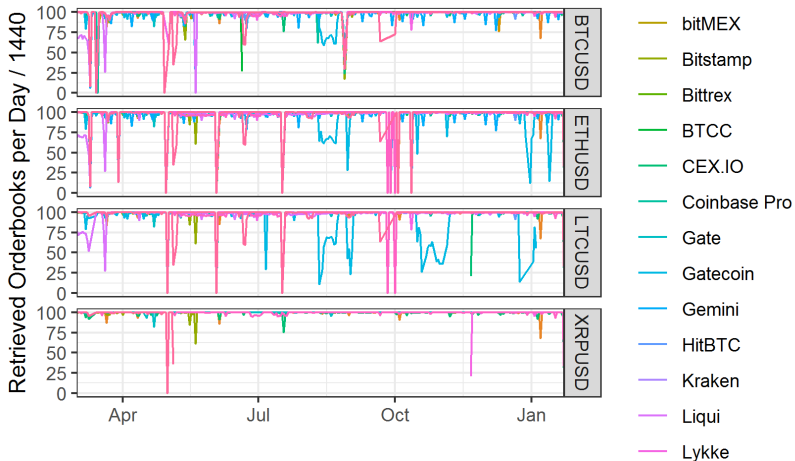
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asset_pair	exchange	ts	ts_received	ts_exchange	requested_level	side	level	price	size
<chr>	<chr>	<dbl>	<dbl>	<dbl>	<int>	<chr>	<int>	<dbl>	<dbl>
1 XRPUSD	cex	1521504063.	1521504064.	1521504063	25	ask	1	0.728	100
2 XRPUSD	cex	1521504063.	1521504064.	1521504063	25	bid	1	0.723	2000
3 XRPUSD	bitfinex	1521504063.	1521504064.	1521504061	25	ask	1	0.713	12000
4 XRPUSD	bitfinex	1521504063.	1521504064.	1521504061	25	bid	1	0.711	26987.
5 XRPUSD	bitstamp	1521504063.	1521504064.	1521504059	25	ask	1	0.714	3594.
6 XRPUSD	bitstamp	1521504063.	1521504064.	1521504059	25	bid	1	0.712	992.
7 XRPUSD	bitstamp	1521504123.	1521504137.	1521504117	25	ask	1	0.714	13959.

## How often do we successfully retrieve data (% of all minutes)?

	BTCUSD	ETHUSD	LTCUSD	XRPUSD
Binance	97.39	95.58	96.62	97.20
Bitfinex	97.05	95.16	96.10	97.35
bitFlyer	97.26			
bitMEX	97.68			
Bitstamp	96.94	95.26	96.24	97.42
Bittrex	97.32	95.49	96.52	97.69
BTCC	81.98			
CEX.IO	97.05	95.03	96.52	97.18
Gate	97.62	95.63	96.70	97.86
Gatecoin	95.98	92.48	90.76	
Coinbase Pro	97.27	95.48	96.45	
Gemini	96.46	94.60		
HitBTC	97.47	95.42	96.40	
Kraken	97.13	95.49	96.50	88.32
Liqui	93.71	91.50	93.04	
Lykke	97.32	95.29	97.92	97.09
Poloniex	96.93	94.72	95.93	97.78
xBTCe	96.35	95.29	96.32	92.67

# Coverage ratio by exchange and asset pair





## Percentage spread as a simple measure of liquidity

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$A$  = best ask (price if you want to *buy*)

$B$  = best bid (price if you want to *sell*)

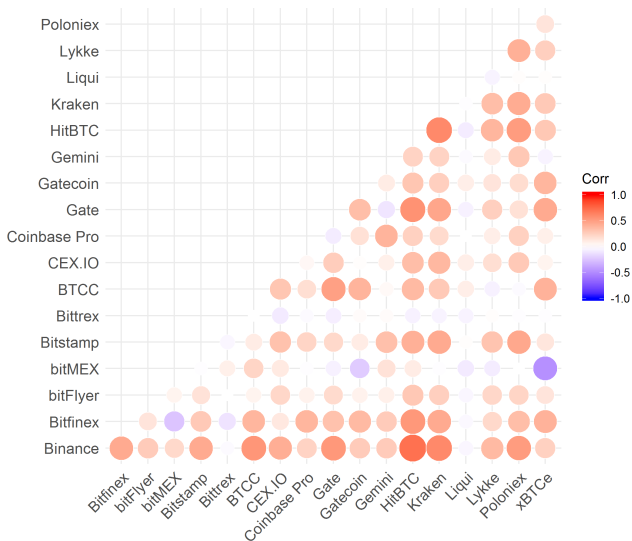
Definition of *percentage spread*

$$\text{Spread} = \frac{A - B}{A} \cdot 100$$

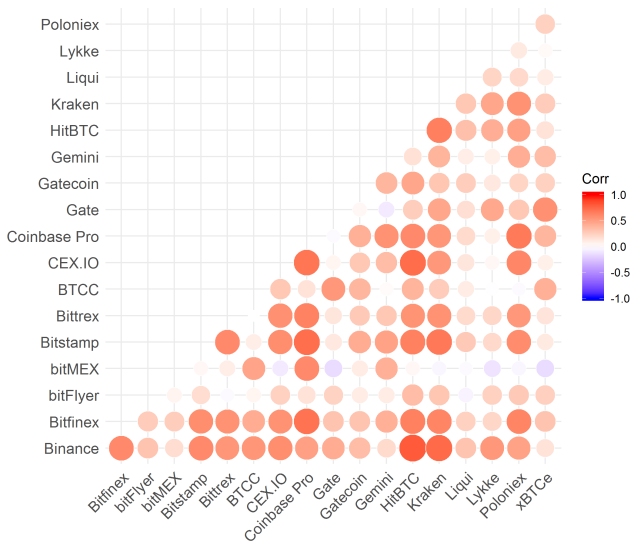
## Median percentage spreads by asset pair & exchange

	BTCUSD	ETHUSD	LTCUSD	XRPUSD
Binance	0.03	0.05	0.12	0.08
Bitfinex	0.00	0.01	0.04	0.05
bitFlyer	0.17			
bitMEX	0.19			
Bitstamp	0.06	0.15	0.21	0.17
Bittrex	0.16	0.28	0.51	0.42
BTCC	1.37			
CEX.IO	0.15	0.29	1.16	0.39
Gate	0.33	0.33	1.21	1.16
Gatecoin	0.73	9.20	24.34	
Coinbase Pro	0.00	0.01	0.02	
Gemini	0.02	0.06		
HitBTC	0.03	0.05	0.22	
Kraken	0.03	0.07	0.13	0.20
Liqui	0.46	0.50	0.64	
Lykke	0.31	0.49	0.60	0.46
Poloniex	0.09	0.18	0.30	0.25
xBTCe	0.05	0.46	0.93	17.97

# Correlation matrix of spreads for BTCUSD



# Correlation matrix of spreads for all asset pairs



## Change in marginal prices for given trading quantities

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$$\text{Ask Impact}(q) := \left( \frac{A(q)}{A} - 1 \right) \cdot 100,$$

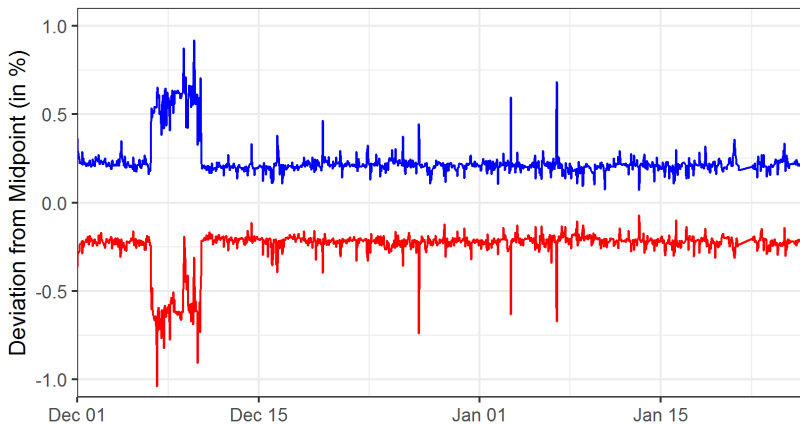
$$\text{Bid Impact}(q) := \left( 1 - \frac{B(q)}{B} \right) \cdot 100$$

where  $A(q)$  ( $B(q)$ ) is price of buying (selling)  $q$  USD of asset  $j$  on market  $i$  at time  $t$

*Alternative* definition:  $q$  in terms of units of the asset

- Caveat: hard to compare across assets!

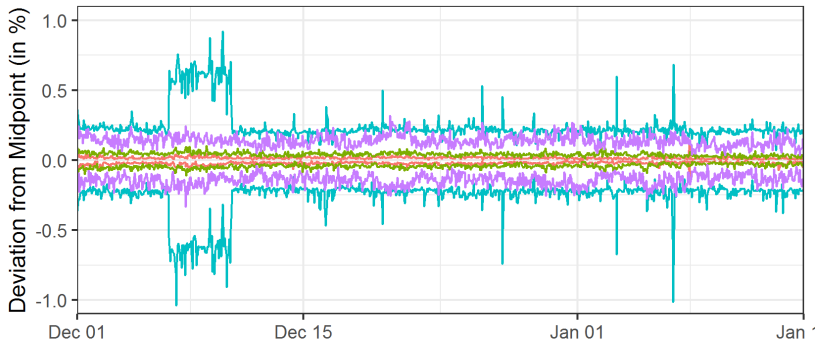
## Market impact measure of trading 1k USD on Lykke



# Trading different quantities on Lykke



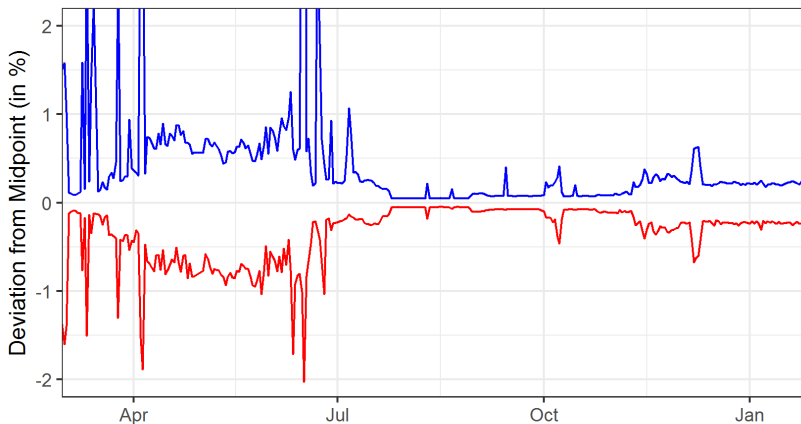
# Illustration of trading 10k USD on different exchanges



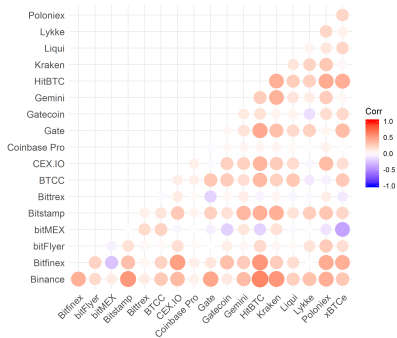
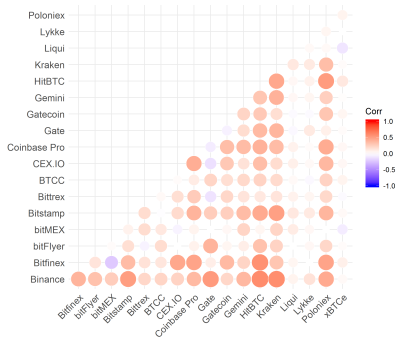
— Coinbase Pro — Kraken — Lykke — Poloniex



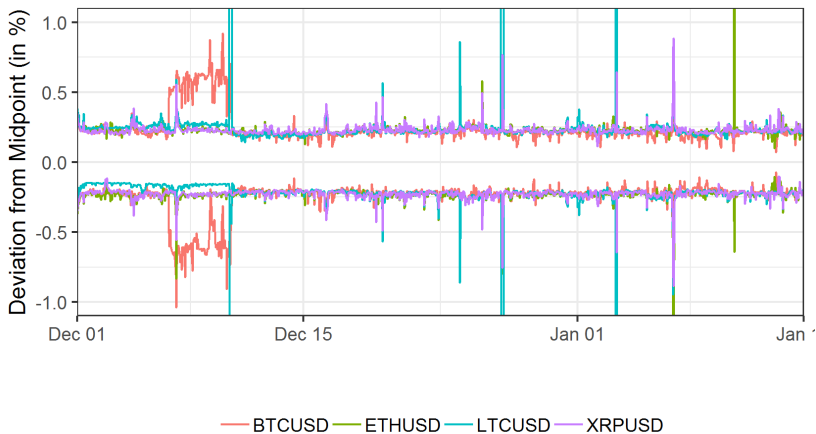
## Average daily price impacts for 10k USD on Lykke



# Correlation of trading 10k USD on different exchanges



# Trading 10k USD in different assets on Lykke



## Tool for live monitoring of price differences?

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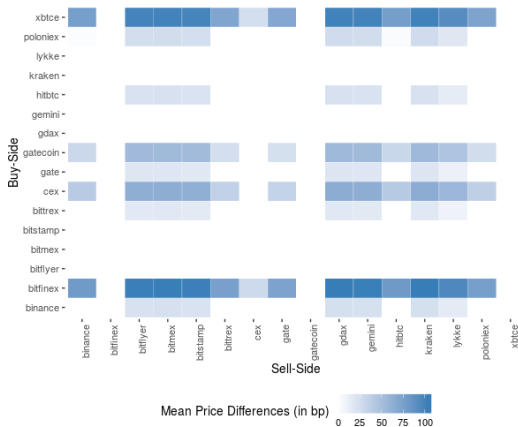
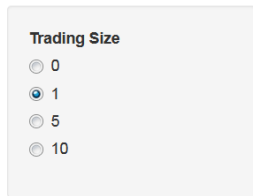
Can we exploit price differences across exchanges?

<https://ckscheuch.shinyapps.io/arbitrage>

App downloads orderbooks from all exchanges & computes potential arbitrage opportunities

# Example of very simple app to look for arbitrage

## Arbitrage Possibilities



# Some suggestions for further exploration

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## Technological perspective

- What is the most efficient way to retrieve & store orderbook data?
- How often / fast can we ping exchanges?
- Which exchanges provide the stablest connection?

## Applied finance perspective

- How much do fees shift prices?
- How much can we trust orderbooks (*fake liquidity*)?
- How stable are liquidity relations over time?

## Academic finance perspective

- How are cryptos / blockchains different from current financial system & what can we learn from them?

Thank you!

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