Are crypto currencies cryptic or a source for arbitrage: A genetic algorithm approach

Oluwasegun Bewaji, Sania Hamid, Shaun Byck (Payments Canada)
Timothy Aerts, Ronald Heijmans, Ellen van der Woerd (DNB)
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Crypto arbitrage

Research question:
Can we find arbitrage opportunities on crypto platforms by trading different cryptocurrencies? How large is this arbitrage opportunity?

USD -> Bitcoin -> Ethereum -> Monero -> USD

Method: We find the most profitable trade order using an AI algorithm called Genetic Algorithm.

Conclusion: You can become rich doing crypto arbitrage.
Outline

- Crypto arbitrage
- Genetic algorithms
- Results
Crypto arbitrage

We compare:
- Cryptocurrency
- Stablecoins
- Cryptocurrency & stablecoins
- Fiat currency

How price efficient are these markets?
Crypto arbitrage

How can we find the most profitable combination of crypto currency trades?

USD -> Bitcoin -> Ethereum -> Monero -> USD
USD -> Monero -> Bitcoin -> Ethereum -> USD
...

Using 31 cryptocurrencies (market value > 2 billion) and three intermediate trades = 26970 possibilities!
Genetic algorithms

Solution: Genetic algorithms (GA) [Goldberg and Holland – 1988]
Most profitable combination is found using the theory of evolution:

- We start with a small random population of trade orders (500)
  Example: USD -> Bitcoin -> Ethereum -> Monero -> USD

- Population evolves due to:
  - Survival of most profitable trade orders. (250)
  - Mutation. (30%)  Example: USD -> Dogecoin -> Ethereum -> Monero -> USD
  - Crossover (reproduction of profitable trade orders). (250)
    Example: USD -> Bitcoin -> Monero -> Dogecoin -> USD
Genetic algorithms

Generation = 1 iteration.
Training lasts until the profit of the best trade order stabilizes.

All this takes less than a minute to calculate.
Results

Optimal trade order length:

- Longer means more arbitrage opportunities.
- Too long means high transaction costs and little variance in the population.

Crypto: 10
Stablecoins: 7
Crypto + Stable: 20
Fiat: 3 (with a loss)
Results – January 2020

Cryptocurrency = $5
Stablecoins = $2
Mixed = $11
Fiat = $0.98 (loss)
More and more extreme outliers. What is going on?

- COVID-19 leads to extreme volatility.
- Results don’t take into account order book depth and therefore the profit becomes unrealistic.
Results – Arbitrage on one platform

- Less profit on individual platforms.
- The larger the platform the smaller the profit.
- Larger fragmentation, in which case different currency pairs cannot be exchanged into one another, on a platform leads to larger profits and less price efficiency.
Conclusion

- If you want to become rich, you should go into crypto arbitrage.
- In ‘normal’ periods it is possible to earn $5 on average with crypto currencies and $11 with a mix of stablecoins and crypto. This indicates price inefficiency.
- This inefficiency is mainly caused by differences between exchanges and smaller more fragmented exchanges.
Conclusion – why isn’t everyone doing this?

- It does happen, but not on a large enough scale to eliminate the arbitrage opportunities.

- To use this algorithm in practice one should do further research into:
  - Orderbook depth.
  - How long does a solution remains profitable.