

## Frequently Asked Questions

Supplementary information to the SQBM+ demo

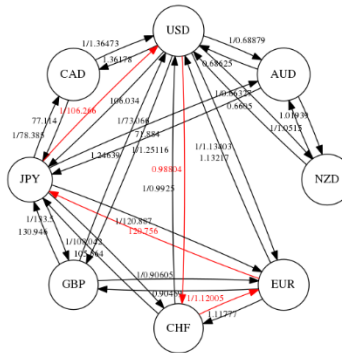
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### 1. What is currency arbitrage High Frequency Trading (HFT)?

Currency arbitrage is a trading (buy and sell) strategy aiming to profit by taking advantage of price discrepancies in different currency markets. In HFT, traders use automated algorithms and systems to execute large numbers of trading within milliseconds.

### 2. What does the mathematical model look like for currency arbitrage?

The objective of currency arbitrage is to find profitable currency exchange paths, as illustrated in below:



Mathematically, it is a **combinatorial optimization** model to maximize the profits of below cost function:

$$Profit = \prod_{i,j \in path} r_{i,j}$$

One constraint is that the target path should be a closed loop, for example, EUR→JPY→USD→CHF→EUR.

### 3. How long are profitable currency arbitrage HFT opportunities lived?

Those opportunities typically occur in milliseconds to seconds [1] in the real market environment. Sub-millisecond trading speed is desired to capture more opportunities, an industry-wide challenge.

[1] Robert *et al.*, 2019

#### **4. Apart from speed, why does trading accuracy matter?**

Accuracy refers to the percentage of algorithmic identified (predicted) trading opportunities that are proven profitable, directly indicating how trustworthy an HFT system is. This is a critical factor in determining the profitability of a HFT system.

Maintaining a consistently high trading accuracy is a common challenge in the industry. For example, a 50-70% accuracy [2] can be regarded as a good performance for a HFT system.

[2] [Dakota et al., 2022](#)

#### **5. Why SQBM+ powered HFT system can break the speed & accuracy limits?**

SQBM+ technology emulates the quantum bifurcation phenomenon and leverage the parallel computing power of FPGAs or GPUs, which, as a result, improves the computing speed by 10-100 times compared to traditional algorithms.

This was the world's first time that such game-changing quantum-simulated technologies (e.g. quantum/digital/CMOS annealers, optical Ising machines) have been demonstrated on currency arbitrage HFT use case.

#### **6. Does SQBM+ technology rely on specific quantum hardware?**

No. This demonstration was carried out on an FPGA, and SQBM+ algorithms can also be run on GPUs and cloud instances/virtual machines provided by AWS and Azure.

#### **7. Was the SQBM+ powered HFT system demonstrated on real market data?**

Yes, but not in live environment. We used real historical FX exchange rates emulated as live market input data in the demonstration.

#### **8. What should I do if I want to build a similar HFT system powered by SQBM+?**

The quickest way is to formulate and evaluate your trading strategy into one of the following optimization models, QUBO, QPLIB or PUBO, and test it with SQBM+ cloud products on AWS or Azure.

Alternatively, please contact Toshiba team for on-premise GPU and FPGA version setups.

#### **9. Has SQBM+ technology been applied to other industries and use cases?**

Absolutely, it's capability has been proven in wide industrial applications such as drug discovery, logistics, and AI enhancement.