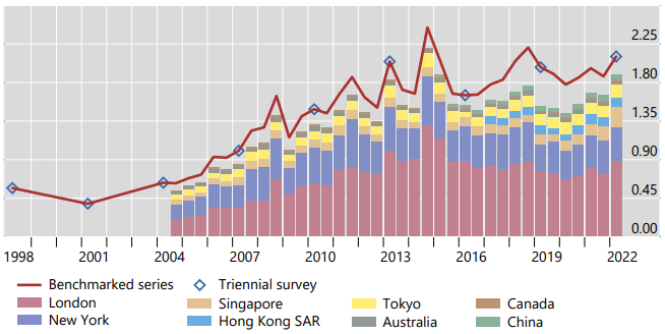
eFX "Explainers" Co-location, Tech and Strategies

The eFX "Explainers" series sheds light on how the electronic FX market operates. This issue focusses on co-location and technology involved in the fragmented FX market from a Liquidity Provider's perspective.

What is co-location?

- Since the advent of electronic trading in the late 90s, traders have recognized the importance of reducing latency and order execution time. Co-location enables firms to place their trading systems in the same building as the matching engine to gain an edge[1]
- Co-location initially gained importance in Equities where high-frequency trading firms started strategically placing their servers near to exchanges, improving trade execution speeds. CME was an early adopter offering co-lo services in the early 2000s
- In FX, EBS was the first major venue to move their matching engine to the Equinix[2] datacentre in New York, and later created a distributed CLOB structure extending to other co-lo centres in the UK and Tokyo. Reuters[3] and EBS both now provide access to their matching engines in London
- This opened up closer proximity to the primary CLOBs for Liquidity Providers (LPs) reducing latency of market data and enabling faster trade execution. Various multi-dealer platforms (MDPs) and ECNs now host their infrastructure in these co-lo datacentres
- FX Spot trading volume has historically been concentrated in a few trading hubs, with the main incentive being to be as close as possible to the liquidity source to minimise any uncertainty in price discovery and risk management



Note: The semi-annual FXC data used to create the benchmarked series are collected in April & October. Turnover from the China Foreign Exchange Trade System (CFETS) and from the Hong Kong Treasury Markets Association survey was added to the stacked bars beginning in April 2015 & April 2017, respectively.

Sources: BIS Triennial Central Bank Survey; Foreign Exchange Committee Surveys; CFETS

[1] The venue aims to equalise latency for all participants within the same datacentre

[2] Equinix is a multinational data center and interconnection company offering co-lo and connectivity solutions worldwide

[3] Reuters was rebranded as Refinitiv in 2018

Where are co-lo datacentres located?

- Major co-lo datacentres for FX trading are New York (NY4), London (LD4), Tokyo (TY3), and Singapore (SG1)
- NY4 and LD4 host the primary CLOBs for EBS Market and Reuters Matching, along with other main secondary venues (ECNs), MDPs and dark-pools
- During Asian trading hours, TY3 sees substantial trading volume, mainly facilitated by secondary ECNs and MDPs. More recently, Equinix has set up a FX co-lo centre in SG1 to reduce latency on orders originating from Asia
- In Chicago (CH1), CME has started to play a key role in providing liquidity where LPs are choosing to hedge spot risk using futures. Futures volume has been trending upwards, with NY4 volumes falling[4]

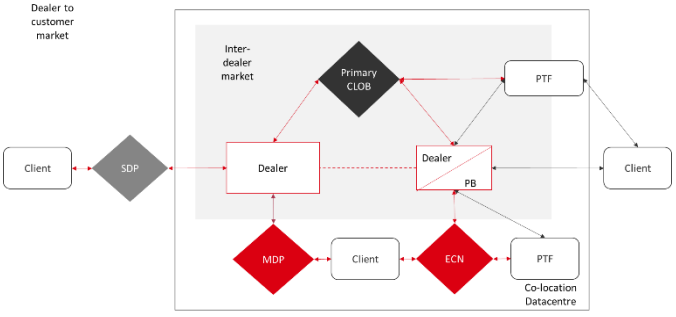
- HSBC provides liquidity in all major co-lo centres:

HSBC Presence

		CH1	NY4	LO4	TY3	SG1
Futures Exchanges	CME	X				
Primary CLOBs	EBS		X	X		
	MAPI			X		
Secondary ECNs	HotSpot		X	X		
	LMAX		X	X	X	X
	Fastmatch		X	X	X	X
	GTX		X	X	X	
	Currenex		X	X	X	
MDPs	FXSpotStream		X	X	X	
	FXAll		X	X	X	
	360T			X		
	BidFX		X	X	X	X
	EBS Direct		X	X	X	
Dark Pools	FXSpotStream		X			
	BGC			X		

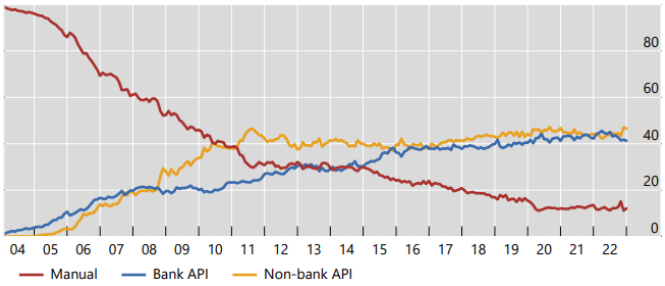
Navigating the co-lo maze

- Fragmentation of liquidity makes price discovery challenging for LPs due to information asymmetry and complexity in efficiently accessing / aggregating liquidity
- Co-lo datacentres cover both the inter-dealer and dealer-to-customer markets, where dealers' systems are co-located alongside primary CLOBs, secondary ECNs, MDPs and other distribution channels



Note: The figure builds on BIS paper 'The Foreign Exchange Market' Chaboud, Rime, Sushko (2023)

- A large number of FX LPs and liquidity consumers employ algorithms for trading, which may penalise mispricing by LPs and highlights the criticality of minimizing end-to-end latency



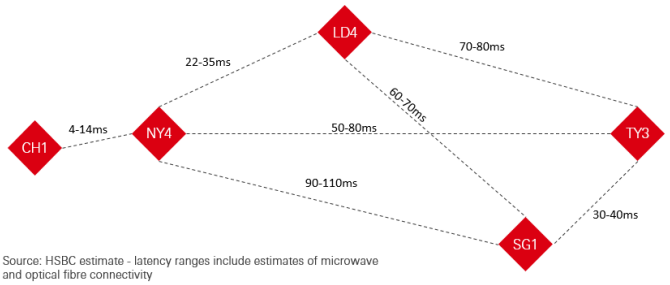
Note; The figure shows the proportion of trading volume on EBS Market executed manually versus algorithmically by banks & by non-banks.

Source; EBS

- This influences how LPs manage inventory and provide liquidity in various co-lo centres, in particular how quickly LPs can adapt pricing and risk parameters based on the relevant latency

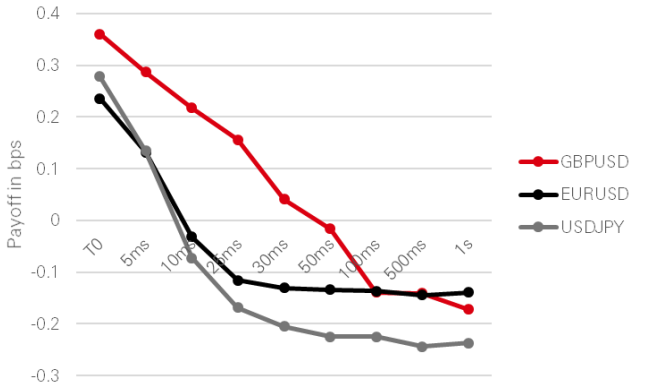
How fast is fast?

- Latency between an LP's server and the matching engines within co-lo is just a few microseconds[5], and latency between different co-lo centres is a few milliseconds[6]. Latency ranges in milliseconds between the major co-locations are:



Source: HSBC estimate - latency ranges include estimates of microwave and optical fibre connectivity

- To demonstrate market efficiency in low latency, for a strategy employed to capture the spread between primary CLOBs and CME, any positive pay-off at the time of a fill on the CLOB on average vanishes around the same time as the fastest-line latency between the co-lo's



Strategy assumes fill at paid/given on primary CLOB and being able to aggress CME straight-away on the same side at a profit. EURUSD and USDJPY CLOB is in NY4 and GBPUSD is in LD4. The quickest route over fibre between NY4 and CH1 is about 8ms and LD4 and NY4 is 30ms. Pay-off does not include any brokerage costs and analysis uses market data from June 2023.

[4] HSBC estimate
[5] One millionth of a second
[6] One thousandth of a second

The Tech Stack

LPs continuously invest in powerful technology solutions:

- **Hardware**: High-performance servers, efficient cooling systems, prioritizing reliability and speed, eliminating single points of failure with automatic failovers
- **Network**: Trading in microbursts (high-intensity network traffic measured in nanoseconds), optimizing settings to enable low latency, high-throughput communication
- **Software**: Robust order management, smart order routing and risk management systems. Low latency market data feeds and advanced analytics including machine learning to optimise pricing and risk management decisions
- **Colocation services**: Use of specialist service providers and in-house engineering teams to build and manage infrastructure in co-lo, maintaining and monitoring resilient infrastructure
- **Compliance and Regulation:** Technological solutions must also consider multiple regulatory aspects including pre-trade controls, trade surveillance and monitoring

What goes into an LPs pricing?

- Aggregated liquidity from fragmented markets, taking into account volatility, costs of accessing liquidity, quality of execution (execution speed, fill ratio and potential impact)
- Inventory-based skew incentivizes clients to trade, benefiting both clients and LPs by reducing their risk. Internalization of risk among major dealers has grown to over 80%[7]. The HSBC eFX Desk internalizes a large proportion of risk resulting from client transactions, benefiting clients with competitive pricing and lower post-trade impact
- Pricing may be adjusted further based on expectation of future moves, during macroeconomic data releases or when unusual jumps in market prices are observed. This enables LPs to show competitive prices but also exposes them to 'skew leakage' that could increase hedging costs
- The HSBC eFX Desk offers price improvement to clients where refreshed pricing in client favour is available

How do LPs manage risk?

- **Risk Management Strategies:**
  - **Pre-Trade Risk Controls:** To assess credit with counterparties, monitor exposure limits, and evaluate market conditions prior to execution
  - **Real-Time Risk Monitoring:** To manage risk positions, analysing market data, liquidity conditions, and positions in real-time to quickly identify and respond to emerging risks
  - **Hedging:** Employing strategies that skew pricing to clients or clear the risk in external markets
  - **Liquidity Risk Management:** Using models that estimate liquidity risk and adjusting pricing / trading strategies so LPs can meet client demands and maintain market stability
- **Risk Models:**
  - **Execution Models:** To optimize trade execution and minimize market impact, considering factors including trade size, market depth, and price slippage to determine the most efficient execution strategy
  - **Market Impact Models**: To estimate the potential impact of trading activities on market prices, helping LPs understand impact to market liquidity and enabling adjustments to pricing and trading strategies
  - **Skewing Models:** To show good prices to clients that can aid in LP's risk management and to identify patterns, detect potential risks, and make informed decisions about order execution and risk management
  - **Statistical / Machine Learning Models:** To analyse historical data, identify correlations, and predict future market moves. This supports risk assessment, volatility forecasting, and portfolio optimization to enhance risk management strategies

What challenges do LPs face?

- **De-Fragmentation**: LPs must aggregate fragmented liquidity across various venues to provide competitive prices and execute trades
- **Tech Complexity:** LPs must constantly adapt pricing and trading strategies to keep up with complex technology and changing liquidity. Innovation and investment to optimize trading systems are key to remaining competitive in a low latency environment
- **Risk Management:** LPs continuously manage various risk (e.g. market, credit, operational) in line with regulatory, compliance and trade surveillance requirements
- **Competition and Profitability:** Liquidity provision in institutional trading is highly competitive, with many market participants competing for the same order flow. LPs must price competitively to attract order flow while maintaining profitability, continually assessing pricing models, transaction costs, and execution quality

What lies ahead for FX trading in co-lo?

- **Tech Advancements:** Continuous advancement of ultra-low latency solutions including innovation in hardware, networking and data transmission. AI and machine learning algos playing a larger role in trading strategies, especially in predicting market movements, and optimising trading algos to improve efficiency
- **Increased Competition:** As the co-lo environment becomes more accessible, competition in the FX co-lo space may intensify resulting in higher trading volume but more fragmentation
- **Regulatory Considerations:** Regulators will continue to monitor co-lo practices to ensure fair market access. This may lead to guidelines addressing low-latency trading and pre-trade risk controls
- **Alternative Venues:** Alternative exchange venues, dark pools and peer-to-peer networks may gain popularity, prompting LPs to explore co-lo options on these platforms

The HSBC eFX Desk has vast experience operating on all platform types therefore is uniquely positioned to provide the best liquidity to clients through a variety of innovative trading mechanisms working with venues and other partners

[7] Alain Chaboud & Dagfinn Rime & Vladyslav Sushko, 2023. "The foreign exchange market," Chapters, in: Refet S. Gürkaynak & Jonathan H. Wright (ed.), Research Handbook of Financial Markets, chapter 12, pages 253-275, Edward Elgar Publishing

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