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The Computer Assisted Trading System (CATS) launched by the Toronto Stock Exchange in 1977, was one of the first blows to trading floors. As electronic systems took over stock exchanges worldwide in various forms, they have morphed into the global hive we see today.

A turning point of analog to digitization of stock exchanges happened in the 1987 stock market crash. The Nasdaq had faced challenges for thinly traded securities due to lack of liquidity as market volatility peaked.

Enter the small-order-execution system (SOES), one of the earliest forms of liquidity provision that began in the early 1980s. Introduced then for low volume stocks and orders equal to or less than 1000 shares and less than \$250. Although this system's use became mandatory following the 1987 crash; it was short-lived. The method required market-makers to quote prices in advance, the same reason for its eventual demise, as price exploitation and manipulation from participants became common practice.

90s traditional mms

In the 1990s many global exchanges began digitizing the various components of the trading processes. Aiming to offer more seamless operations with less human involvement. During that decade of the new electronic exchanges trading costs were 32.5% lower for NASDAQ listed stocks and 28.2% lower for NYSE listed stocks. Furthermore, they estimate that every 10% drop in trading costs produces an 8% increase in share turnover and an 1.5% decline in the cost of capital.

00/10s electronic mms

Further digitization enhancements were implemented in global exchange infrastructures. These enhancements also contributed to lesser transaction costs and thus better returns overall. Additionally, faster connectivity also provided noticeable improvements and cost benefits. Lower latency reduced adverse selection costs and enhanced inventory management abilities, allowing for improved market depth and bid-ask spreads. There are two types of liquidity provision in stock market exchanges depending if it's an auction market (e.g. NYSE) or dealership market (e.g. NASDAQ). Both compete for narrow quote spreads, market depth, and price stability.

Auction markets, deploy DMMs for each security to exclusively function as an order execution apparatus. Given it's a centralised trading floor, brokers are responsible for inflows of orders. Following the 08' crisis, a new method called the Supplementary Liquidity Provider was introduced to the NYSE. This Rebate based role added quotes to the market and rewarded for executing quotes against incoming orders.

Dealership markets, on the other hand, work with large liquidity providers that hold a basket of stocks. These market makers provide bid and ask orders at different price points. Orders are all executed electronically so there is no central order execution body.

Algos

High frequency trading (HFT) is the umbrella term for algorithmic trading and AMM/liquidity provision, among other arbitrage strategies deployed by HFT market makers.

Shifting from tradfi to defi. Algorithmic trading is prevalent in crypto under a variety of strategies. Among them arbitrage, mean reversion, coin lending, and momentum trading. Leading these categories is arbitrage, since many different strategies fall under it. Estimates show that 70-80% of crypto trading occurs algorithmically.

Some of the more controversial ones are Maximal Extractable Values (MEV's). Essentially frontrunning strategies including but not limited to, sandwich trading, DEX arbitrage, and lending protocol liquidations.

Defi - CEX to DEX

Thus far majority of trading occurs through CEXs via the continuous-limit order book structure, similar to tradfi. The method is commonly known as quotation matching of bid-ask order books. DEXs also use the continuous-limit order book mechanism. However, orders are executed from decentralized wallets and then traded through the DEX's private servers. Private servers being off chain and thus semi-decentralized.

As the case was in the tradfi involving low volume obstacles, industry wide attempts aimed to solve that in the DEX space. The catalytic shift happened when Uniswap repurposed the AMM structure of the stock market with a swap function in its UX. This allowed for token listing and liquidity provision without the need for gatekeepers. This also created an immediate method of order execution, without the need to wait for an order match. The radical breakthrough being the entirety occurring on chain, including the order match.

The constant product market maker function used was initially proposed by Alan Lu of Gnosis [link](#). The shift also furthered decentralization since both order matching and execution occurs on chain via miners.

Since, many AMM based DEXs popped up with different approaches. Curve launched the hybrid constant product market maker (CPMM) and constant sum market maker (CSMM), or CFMM (Constant function MM). In this scenario, a balanced portfolio trades on a constant sum curve and switches to a constant product curve when imbalanced.

Bancor's AMM bonding curve uses the native token BNT as an intermediary for orders and uses separate pools for non-native currencies.

AMM Outlook

As the case was for developments and the growth of AMM based swap exchanges, there will undoubtedly be new improvements to come. One of the recent pivots is virtual AMM (vAMM), a similar concept to AMMs but with virtual liquidity instead of a real asset pool. Thus, real assets are held as collateral for the virtual assets that provide liquidity.

As several L1s gain momentum, exchanges are emerging with swap methods via an internal bridge function. This type of mechanism is able to provide chain agnostic swaps. Yet, the next need several projects, on different chains, are working on is cross-chain liquidity provision (e.g. Synapse protocol).