



DECENTRALIZED EXCHANGES: THE FUTURE OF EXCHANGES?

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WHITE PAPER

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1.

WHAT ARE DECENTRALIZED EXCHANGES?

1.1. INTRODUCTION

The aim of this white paper is to give you a first grasp of what decentralized exchanges are and how they differ from centralized ones.

In decentralized markets/exchanges, buyers usually deal directly with sellers without the intervention of a central counterparty. Real estate is a good example of a decentralized market as buyers are usually in direct contact with the seller. In this article, we will focus on the digital decentralized exchanges that have been flourishing with the rise of the blockchain technology and cryptocurrencies.

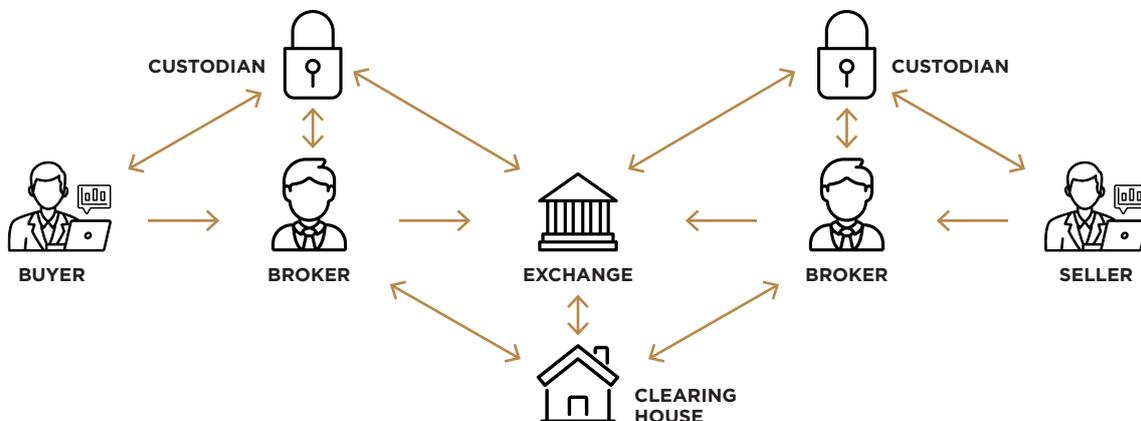
But first, we'll start by explaining how traditional centralized exchanges operate in order to highlight the main differences.

1.2. HOW DO TRADITIONAL CENTRALIZED EXCHANGES WORK?

Before explaining how decentralized exchanges operate, it is good to have a reminder about the traditional exchanges and how these work in practice as it is something that can be confusing. Classic exchanges typically work with order books. Buyers and sellers of securities send their requests to the exchange with the price they're ready to pay or they would like to receive. The exchange will match people who want to buy and sell something for something else.

The centralized exchange is the counterpart for both buyers and sellers and matches the requests between buyers and sellers. However, individual investors cannot trade directly with

Figure 1. Security trading on traditional exchanges



the exchange. They will need to go through a middleman, called broker that is able to transmit the investor's order to the exchange.

Each of these brokers will have links with Custodians that will take care of the bookkeeping and the custody of the assets. (Muthu, 2015)

There is yet one more actor which is the central clearing house. It will take care of the settlement part of the trade. It is important to note that the majority of traditional exchanges and clearing houses work with a T+2 model, meaning that it takes two days for the settlement to occur and the transaction to be effective. (Academy, 2021) The diagram presented in Figure 1. might help you to better picture how all these actors interact together in order for you to be able to actually buy or sell a security.

As it can clearly be seen, there are a lot of actors involved. Having lots of actors with different systems can make it more subject to potential technical and security issues.

Another point worth to note in our discussion is that these traditional exchanges are only open during trading hours, meaning they're operating on average 7 hours a day, 5 days a week (note there can be pre-market and after-hours trading). If some news happens during the weekend, the market can only react on the Monday morning. (DeSenne, 2021)

At the opposite of these traditional centralized exchanges, we've seen in the crypto world the rise of decentralized exchanges which appears to be lightyears ahead of the traditional ones. But what exactly are decentralized exchanges and how these could potentially become the future of exchanges? This is what we'll attempt to describe in the next sections of this article.

1.3. HOW DO DECENTRALIZED EXCHANGES WORK?

The idea of decentralized exchanges and its use is not new but has seen an exponential growth in the past few years as part of what is called decentralized finance (DeFi). In essence, a decentralized exchange is a peer-to-peer (P2P) marketplace that connects buyers and sellers. Decentralized exchanges are at the moment only used for cryptocurrency trading. (pramodAIML, 2020)

In contrast with centralized exchanges, DEXs do not have custody of the securities, meaning that they (the securities) remain under the control of the users. (Academy, 2021)

DEXs use blockchain technology and smart contracts to operate in the absence of a central authority. If you're not familiar with these terms, do not be afraid, those can be easily understood without digging into too much technical details. The logic behind smart contracts¹ is simply programs that self-execute when pre-determined conditions are met. A simple example of a smart contract is the case of insurance contracts. If the event that is insured occurs, the smart contract can be designed to automatically deliver the required payoff to the insured. As for the blockchain, it can be seen as a ledger where each transaction is recorded. Transactions executed by smart contracts and recorded on blockchains represent a fast-growing part of the digital assets market. (Cryptopedia s. , 2021)

In the crypto world, these peer-to-peer-transactions occur between two pre-existing digital wallets, from the buyer and the seller. Investors can safely keep their assets (limited to cryptocurrencies as of now) on these wallets and can send or receive assets using for example, decentralized exchanges. (JuanSC, 2021)

1. For more details: "smart contracts are simply programs stored on a blockchain that run when predetermined conditions are met. They typically are used to automate the execution of an agreement so that all participants can be immediately certain of the outcome, without any intermediary's involvement or time loss" (IBM, 2021)

1.4. NEW GENERATION OF DEXS: AUTOMATED MARKET MAKERS

Now, this does explain how the transactions are happening using decentralized exchanges but it does not explain how the exchange is able to perform its role and actually let investors buy and sell assets.

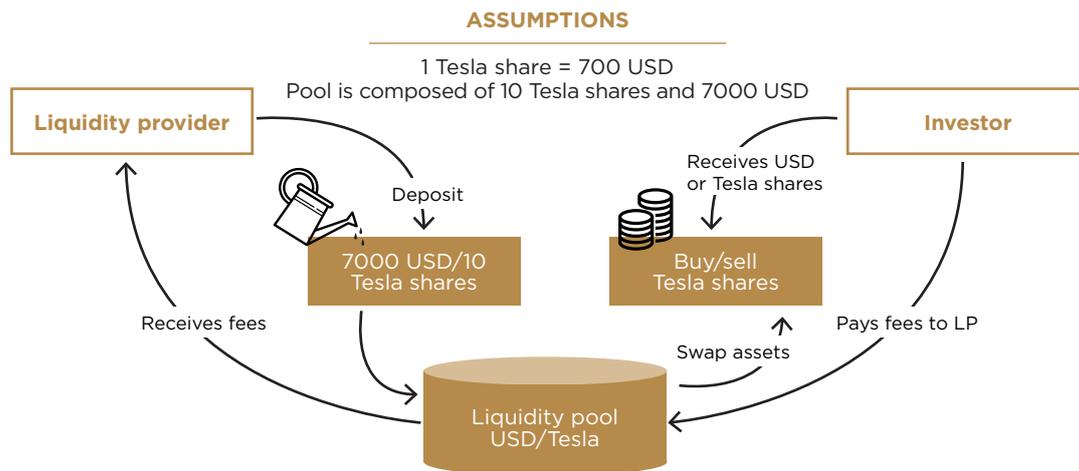
So how does it work? Well, instead of having a centralized entity that matches orders from both buyers and sellers, the newest type of decentralized exchanges are using a new type of order management model called automated market makers. Automated market makers

(AMMs) “allow digital assets to be traded without permission and automatically by using liquidity pools instead of a traditional market of buyers and sellers”. (Cryptopedia s. , What Are Automated Market Makers?, 2021)

This means that contrary to traditional exchanges, AMMs do not rely on the interaction between buyers and sellers and order books, but work with what is called liquidity pools. In essence, the buyer/sellers are trading against a smart contract and not another investor.

The below schema might help you better understand how this all fits together.

Figure 2. DEXs: Automated Market Makers



Some specificities of the liquidity pools are described here to help you better understand the concept:

- Liquidity pools are composed of pairs of assets that are traded. As it is only used in the crypto world for now, these are pairs of cryptocurrencies. But we could easily imagine a pair USD/Tesla for example.
- This liquidity pool can be used to instantly trade any assets at the current price which is dictated by the proportion of each asset in the pool. It is essentially the same as executing a market order.

- The funds in the liquidity pools are provided by users who are earning a passive fee on every trade based on the percentage of the liquidity pool they provide (Coinmarketcap, 2021). This means that the liquidity of an asset pair will be defined by the number of users ready to provide liquidity for this pair.
- There is some simple math involved in the way the liquidity pool works and how the trading pairs evolve based on the amount of each asset bought and sold. Liquidity pools use a constant product formula $X * Y = C$ where X & Y are the amount of each asset in

the pool and C is a constant. This formula will help to keep the value of the pool constant whenever a trade occurs².

As a simple example, we could imagine a trading pair USD and Tesla stock. If the current price of a share of Tesla is 700, the liquidity pool will be composed of 700 USD for each Tesla stock. Whenever a trade occurs, for example we buy some shares of Tesla, there will be USD added to the pool and Tesla stock removed. This will modify the relative price of the pair Tesla/USD within the pool. It is important to understand that, the less liquidity is provided to a pool and the largest a trade is, the larger will be the relative price slippage between the two assets traded in the pool (Shrimpy, 2021). If the price in the liquidity pool is different than the market price, arbitrageurs will intervene to take

advantage of it. In the crypto world, these arbitrageurs are mostly automated bots that take advantage of the price discrepancies between the different cryptocurrency exchanges.

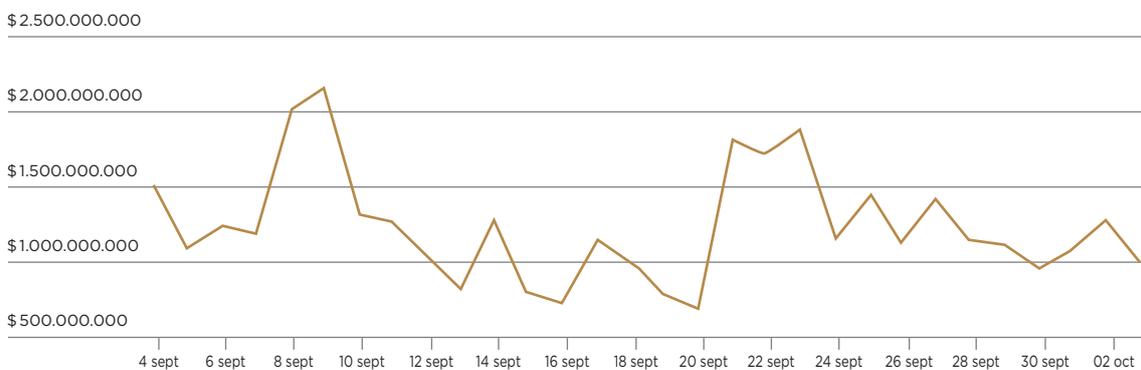
1.5. GROWTH OF DECENTRALIZED EXCHANGES

You might wonder if this new technology is actually working and if it's being used?

In fact, decentralized exchanges, especially the new generation working with an automated market maker have seen a substantial growth in the last years.

The total traded volume on decentralized exchanges varies a lot depending on the activity on the crypto markets but has seen in the past months an average daily volume around USD 3-4 Billions³.

Figure 3. Uniswap trading volume in September 2021, source : <https://www.coingecko.com/en/exchanges/uniswap#statistics>



Uniswap, the biggest DEX in terms of volume, is currently seeing daily volume of transactions above USD 1 Billion.

This (not so) light introduction on decentralized exchanges might already give you a sense of the

possible advantages it could bring to traditional finance and how those could be great to investigate. In the next section of this short paper, we discuss the advantages and disadvantages of DEXs compared to traditional exchanges.

2. If you want to dig deeper in the math and the technical aspects of the liquidity pool concept, a good explanation can be found here: <https://www.theancientbabylonians.com/what-is-liquidity-pool-lp-in-defi/>

3. More information on the current volume of DEXs can be accessed here: <https://coinmarketcap.com/rankings/exchanges/dex/>

2.

WHAT ARE THE ADVANTAGES?

If you've followed the explanation in the previous section, you can already spot a few advantages of decentralized exchanges compared to centralized ones.

- A first main advantage of DEXs is that it does not require any manual intervention or control in order to operate and they are open and operational on a 24/7 basis.
- Decentralized exchanges cannot be closed and are not in the hands of a centralized authority that can halt or limit trading. In a previous article of my colleagues Maxime Liénart and Laurens Verelst, we mentioned the frenzy that occurred last year with the stocks of AMC & Gamestop and how the trading platform Robinhood decided to halt trading due to the skyrocketing volumes. This was done at the expense of some investors that could not execute their orders (Liénart & Verelst, 2021). This is a typical situation that would be avoided with decentralized exchanges as no one controls them and can decide to halt trading. On the other hand, as we will mention in the disadvantages, in periods of high volumes, we can see some delays and some higher fees for the transactions to be executed on DEXs.
- In addition, as they do not have order books but are working with liquidity pools and are based on smart contracts, the trades, called swaps, are done instantly. The assets can be traded and be transferred into the investor's wallets in a matter of seconds. This is to be compared with traditional exchanges where we usually only have a T+2 settlement.
- It remains to be seen how this could be adapted to all types of securities, but another advantage of DEXs in the crypto world is that the investors keep control of their assets. As explained earlier, the assets are held in and directly transferred between digital wallets based on the execution of smart contracts. This greatly reduce the counterparty risk, the security risk as well as the risk of having technical issues, under the hypothesis that the smart contract is correctly built.
- DEXs are trustless, meaning "users' funds, privacy, and limited personal data are well preserved". (Cordero, 2021) There is currently no need for KYC on decentralized exchanges, which allows investors to maintain a degree of anonymity.

Of course, all is not perfect and there are not only advantages but as well some disadvantages to DEXs compared to traditional exchanges. These disadvantages are listed in the next section. It is worth noting that some of those could soon be solved as the technology progresses and becomes more and more mainstream.

3.

WHAT ARE THE DISADVANTAGES?

- A first disadvantage is that the new type of DEXs using automated market makers as explained in the introduction are only able to do swaps, which are equivalent to market orders. There is, for instance, no possibility to make limit orders, stop-loss limits or trade with margin. These DEXs currently do not offer the same possibilities and tools as traditional exchanges. This might of course change in the future as the technology evolves.
 - As mentioned above, we currently have no fiat currency or stocks trading on DEXs but only crypto currencies. We're still far away from having the same offer in decentralized exchanges as we have in classic exchanges. Moreover, regulators are on top of the subject and are currently having a close look at the decentralized finance world (DeFi) of which DEXs are a central part of. (Catalini, 2021)
 - Although the volume is increasing day by day on DEXs, liquidity can currently still be an issue. As explained in the section on liquidity pools, the less there is liquidity in a pool, the more the relative price of the two assets will be impacted by a trade. If the liquidity pools are not deep enough, there can be large price slippage which would cause the investor to realize the trade in worst terms than he could have done on centralized exchanges working with order books. This issue can be solved by attracting more liquidity providers. Uniswap, the largest DEXs in terms of volume at the moment, is for example offering 3 types of fees for liquidity provider depending on the trading pair. The most stable trading pair have the lowest fee, whereas the more exotic pairs will have a higher fee to attract liquidity providers. (Sommelier, 2021)
 - The absence of KYC and the large degree of anonymity compared to traditional exchanges might expose DEXs to lots of pressure from regulators. The way they're built and operate might need to change for them to become mainstream and attract more investors⁴.
 - There have been some congestion issues on decentralized exchanges during peaks of high volume causing some delays in trading as well as high fees (Madeira, 2021)⁵. Although there has been some progress and new solutions have been found to reduce the delays and the fees, it is yet to be seen if the technology can be scaled to be offered to a wider base of investor and to handle high volume peaks. (Cordero, 2021)
- Now that we have laid down what DEXs are and what their advantages/disadvantages are compared to traditional exchanges, we would like to discuss how they could evolve in the future.

4. It is worth noting that the KYC process could be done in an efficient way using smart contracts and blockchains. The technology is already being developed. Some actors such as KYC-chain (<https://kyc-chain.com/>) already offer many KYC services such as the AML feature which analyzes transactions on blockchains for forensic evidence and to identify bad actors.

5. Fees on the blockchains are positively correlated to the network congestion. The Ethereum network, on which Uniswap (DEX) is operating, could only process around 30 transactions per second until recently. A higher demand of transaction bandwidth with a fixed supply causes the fees to skyrocket. A new version, Ethereum 2.0 has been implemented a few months ago and is aiming at improving the processing speed. (Berkowitz, 2021)

4.

HOW WILL THE FUTURE OF EXCHANGES LOOK LIKE?

4.1. TECHNOLOGICAL PROGRESS

A first point that was mentioned in the advantages & disadvantages of DEXs is that the technology is still in its infancy and is improving day by day. In the next years, we might see the DEXs offering more and more functionalities similar to traditional exchanges. If they're able to solve the scalability issues and improve the liquidity, these exchanges might become really efficient and could be a good substitute to traditional exchanges.

However, before making it possible to offer trading of other assets than cryptocurrencies, such as stocks, we can expect a large regulatory impact that might force DEXs to modify the way they operate.

4.2. REGULATORY FRAMEWORK

In fact, changes in the Decentralized Finance (DeFi) industry might be coming really soon.

Regulators are currently looking at decentralized finance and at DEXs to try to understand how regulations could be adapted to suit it better. The current existing regulations that apply to DeFi are based on the presence of centralized intermediaries, which as we explained above, do not exist in DEXs. The regulations are applied on

these intermediaries, such as brokers, in order to regulate the entire market. This therefore means that regulatory requirement such as KYC and AML are currently not applicable to DEXs (Meijer, 2021).

Regulators are actively trying to figure out how to deal with the decentralized and multiple nature of DeFi as it does not fit within any existing or historical models used to perform financial transactions⁶. In order to promote the development of this new technologies in DeFi, regulators should take a balanced approach and not overregulated the sector. Regulation could be implemented to have a sound and safe DeFi market and at the same time leave space for innovation and healthy competition in this new segment of the financial world (Meijer, 2021).

We should soon see some announcement and news on this topic. We will then be able to judge if the regulators are indeed taking a balanced approach as suggested here.

4.3. STOCK TOKENIZATION

On another note, that could be a potential lead for how securities could be traded on decentralized exchanges, Binance the largest centralized cryptocurrencies exchange recently started

6. The world economic forum recently (in June) published a Policy-Maker toolkit for decentralized finance. This toolkit gives a range of potential policy actions that could be taken by the different regulators in the coming months as well as indication on the policy tools that could be used. More information can be found here: http://www3.weforum.org/docs/WEF_DeFi_Policy_Maker_Toolkit_2021.pdf

the tokenization of some stocks. This means that Binance issued digital tokens that represent the equity shares for the following companies: Apple, Tesla, Coinbase, Microsoft and Microstrategy. These stocks could be traded as tokens on the Binance exchange. The tokens, such as any other cryptocurrency tokens, could be traded on a 24/7 basis on the platform and were backed by a depository portfolio of the underlying securities (Crawley, 2021).

Binance had to quickly shut down its tokenized stocks' offer due to pressure from the regulators and does not support any stock tokens anymore since the 14th October 2021. But this doesn't mean the idea of stock tokenization should be abandoned as it might give more flexibility to the industry.

In fact, some new businesses and start-ups are actually already doing their fundraising through initial coin offering (ICO) that distributes digital tokens to the investors. These tokens are equivalent to equity shares but with the ownership being recorded on a blockchain. These digital stocks offer a low cost and flexible way to raise funds and can be traded on DEXs on a 24/7 basis (FRANKENFIELD, 2021). We could see more and more of these ICO and tokenized stocks appearing in the next years and with it, an increase of the trading volume and the importance of decentralized exchanges in the financial markets (Bhandarkar, Bhandarkar, & Shiva, 2019).

5.

CONCLUSION

In Conclusion, decentralized exchanges are an interesting technology that is growing along with decentralized finance. It is attracting more and more investors day by day and at the same time caught the attention of the regulators.

Some regulation is expected in the very near future and might have a large impact on the way DeFi and decentralized exchanges will evolve. We should soon have more information on the regulatory response, which should hopefully not be too constraining in order to promote the development of this new technologies.

DEXs should not be neglected by the large players of the financial markets as the technology has some clear advantages compared to traditional exchanges. It is for instance worth having a look at the automated market maker technology which is a new kind of order management model

that is completely different from the current way traditional exchanges operate. The implementation of peer-to-peer trading between financial institution using smart contracts and blockchain technology could be a good path to investigate to improve the efficiency of transactions.

Decentralized exchanges are however still in their infancy and do not yet offer the same range of services as traditional exchanges. It will be interesting to follow the development of this technology and see how the current regulatory and technological challenges will be overcome... or not.

6.

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