UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

MASTER'S THESIS

APPROACHES TO CRYPTO ASSETS VALUATION

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LIST OF ABBREVIATIONS

CDO	Credit Debt Obligations
CDS	Credit Default Swaps
DAO	Decentralized Autonomous Organization
DCF	Discounted Cash Flow
EUR	Euro
GDP	Gross Domestic Product
ICO	Initial Coin Offering
IPO	Initial Public Offering
NVT	Network Value-to-Transaction Ratio
PBoC	People's Bank of China
SEC	Securities and Exchange Commission
TARP	Troubled Asset Relief Program
TTP	Trusted Third Party
USD	U. S. Dollar
VC	Venture Capitalist

INTRODUCTION

The world of crypto assets, with Bitcoin as its pacesetter, is bursting with growth and we are witnessing it giving rise to many innovations with promising technologies building expertise in different fields. The new crypto projects are unique and distinct in nature from the things we knew before, but they still come with a taste of familiarity. We are familiar with market/trade exchange, venture capitalism, crowd funding and other elements from our existing lives that can be seen adopted by the crypto markets. The only truly new and exciting element is the blockchain technology. Blockchain, however, is a big deal in and on itself. And this big deal has led to the development of the new crypto world, which we are now a part of.

We are noticing countless crypto projects looking for funding through the initial coin offering (hereinafter: ICO), which essentially resembles an initial public offering (hereinafter: IPO). Likewise, compared to an IPO, crypto projects issue coins or tokens, which can represent part ownership. However, they can also be used as currency to buy services and products, they can be utilized as a means of transaction or store of value, and they can even have no goal whatsoever. This leads to a comprehensive new area of business models for crypto projects. Since tokens are bought and sold publicly on crypto exchanges, they can be used by anyone for investment purposes, speculation, or just as a means for something, the token is intended for. Tokens represent the blockchain-derived equivalent of “value” in the crypto world and can take many different functional values. Therefore, we will call the collective uses and values of tokens, crypto assets.

The crypto market as a whole represents a small share of the global market capitalization. The lack of regulation and rules make it a perfect destination for frauds and scams. Small market caps also make it susceptible to market manipulation. Many projects do not even offer anything innovative related to blockchain, but used the crypto hype as a means of gaining funding. Since we are dealing with a public exchange, that is open to anyone’s access, anyone can become an investor in a project which could reward its investors handsomely, as it already happened in the past. First however, we need to ask ourselves, is the project worth investing in and if it is, at what price? Thus, it is clear that crypto valuation models are both necessary and beneficial, yet their development is currently lacking.

Investors usually invest to profit and grow their portfolio. They decide what portfolio of assets to hold, which would best achieve their vision of growth. However, not all investors have the same idea and same goals. Assets’ price, which an investor is looking to buy, should then equal the expected discounted value of the assets’ payoff, using the investor’s discount to the payoff (Cochrane, 2005). To help us calculate and achieve these investment goals we use different evaluations models.

Our main question was, how to assess the value of crypto assets, especially since these assets offer no claim on an underlying business, generate no operating cash flow, and promise to pay nothing out to its owners (Winton, 2017). Our first sub-question was to look at different crypto asset valuation methods that are emerging from the traditional ones. Since there are no academically recognized valuation models, we looked throughout the crypto community to find the first pioneers that attempted to create a model for valuing crypto assets and had received support from the academia that gives an emphasis on the same matter. We focused on Crypto Valuation Frameworks, that several leading cryptocurrency investors and thinkers proposed. We present a few different crypto asset valuation models, which are based on acknowledged financial models such as Discounted Cash Flow model, Velocity of Money Theory and Black-Scholes model. As each valuation methodology takes in account different factors, this lead us to our next sub-question. Which among all factors affect the value of crypto assets most? Our third sub-question was to look at differences from different valuation models and compare them.

Our research was mainly carried out through data analysis. Most of data was obtained from secondary sources. The research is of qualitative and quantitative nature. Qualitative since we are extensively looking on how to successfully assess the value of crypto assets and quantitative, since we are also dealing with pricing models and variables.

The research was part theoretical, part empirical. In the theoretical part, we focused our research and analyses on the application of valuation models to a token, a crypto asset. First we introduce the reader to the basics of blockchain, just to equip the reader with some fundamental mechanisms for understanding the workings of tokens. We look at different tokens and establish distinct crypto assets categories, because there are substantial differences in technology, structure and incentive alignment between various coins. Naming just about everything cryptocurrency can be misleading (Glazer, 2018). Field-relevant regulations and a short history of financial bubbles are analyzed, as well. We also dwell into Initial Coin Offerings, how launching an ICO looks like, criticisms of the ICO model and check if an ICO is actually a Security (Burniske & Tatar, 2018). A traditional valuation method, the Quantity Theory of Money, is presented, since it is the basis for most crypto valuation models. Later we introduce other crypto valuation models, which are used to assess the value of our fictitious token. The models analyzed include the following: the INET model (Burniske, 2017), the VOLT model (Evans, 2018), the A Model (Winton, 2018) and the Black-Scholes Option Theory (Antos & McCreanor, 2018). We also benchmark results from evaluations to compare them for differences. Lastly, we also introduce a few other valuation models which focus on one aspect of crypto assets and the idea of looking at long-term fundamentals of the underlying cryptocurrencies to help with their evaluation, which were presented by Tomaino (2018) and Moore and Moore (2018).

In the empirical part we present to you a fictitious ICO project, which we then evaluate with the models presented and explain the results. Our fictitious token is derived from the idea of providing a platform, where users can book a mooring spot in bays and marinas. In addition, the idea is to provide an effective and efficient marina system, which optimizes the data flow and the control of all processes that need to be maintained. Whilst producing a higher turnover and a new revenue stream.

Our research was structured as a desktop research on the use of the before mentioned methods. It was based on both primary and secondary data, with a deeper focus on secondary data. Primary data for our fictitious ICO project was derived from our own original research, calculations and assumptions, since we are working to make this project a future reality. All the calculations, assumptions, facts and variables referred to in the thesis are interpreted to more easily guide the reader behind the assumptions and possible conclusions The derived values are explained and justified. We performed a synthesis and critical evaluation of the existing literature. However, since there is still no academically recognized sources for information regarding crypto asset valuation or even the overall crypto assets topic for that matter, we made use of articles, blogs and other publications from researchers who are pioneering within the area of crypto asset valuation and whose ideas are supported from the crypto community.

1 GENERAL INTRODUCTION TO BITCOIN AND BLOCKCHAIN

The market capitalization of all crypto assets together, presented in the figure 1, was almost 254 billion USD in July 2018, but just six months earlier, on 8 January, it was around 828 billion USD (CoinMarketCap, 2018). Such a massive volatility is and was not be expected. If we look at the figures representing the market state two years ago, we can find a value of a bit over 12 billion USD and interestingly a market capitalization value of almost 1,1 billion USD just five years ago. But what are crypto-assets and what are they based on? How can we evaluate them? This chapter elaborates all mentioned questions and more, in order to lay the foundations of clear understanding of this master's thesis's core, which differs from the classic evaluation approaches applied to a future crypto-asset i.e. token.

The year was 2008 and the world financial crisis reached its peak with the declaration of bankruptcy from the Lehman Brothers. This unfolded a series of events, among which was the acquisition of another major bank, Merrill Lynch, by the Bank of America. The United States of America also formed Troubled Asset Relief Program (hereinafter: TARP) for 700 billion USD and the famous Satoshi Nakamoto published a document, which resulted later in the foundation paper for Bitcoin (Burniske, 2018). The fast unfolding of several events deserves a more scrupulous look

To understand what led to the downfall of some of the biggest banks in history, we must take a look at the banks' financial instruments and activities, which played a major role in the crisis. Banks as institutions are primarily loaners as well as the institutions that assure all loans are paid back with profitable interests. What happens when the loaners become reckless can be seen in the 2008 crisis. By issuing Credit Debt Obligations (hereinafter: CDO) and Credit Default Swaps (hereinafter: CDS) the banks poured more water on the Subprime mortgage crisis mill. CDOs are made out of many *mortgage bonds*, where each mortgage bond is made out of a thousands of individual mortgages bundled up (Wang, 2014). Thus, each CDO is like an organization or corporation made from tranches with different risks incorporated. The logic behind risk bundling is due to the fact that if you combine many risky securities together, the risk level of the newly formed unity decreases. In order to show a healthy financial position, banks maneuvered their debt off the balance sheet by converting a loan into a marketable security such as CDOs. In other words, banks sold their issued subprime loans to investors after grouping them into a new diversified financial instrument. On top of everything mentioned, some financial institutions introduced on the market the Credit Default Swaps. CDSs are in a way similar to insurance contracts. They let the buyer bet on CDOs or bonds. The bizarre thing was, that the financial institutions such as AIG so profoundly believed in the CDOs as an instrument, that they did not post any reserve capital as insurance against its malfunctioning (Wang, 2014).

Figure 1: Total crypto assets market capitalization in USD

Source: CoinMarketCap (2018).

Mortgages, which originated from loans for housing based on asset-backed securities, defaulted. As a response, Emergency Economic Stabilization Act in October 2008 initiated the TARP. TARP gave authority to the Secretary of the Treasury to insure or buy suspicious and possibly toxic assets possessed by banks and other financial institutions for USD for a period of two years (Webel, 2013). Accordingly, the U.S. government spent up to 550 billion USD and acquired Freddie Mac and Fannie Mae, a portion of General

Motors, and Chrysler. All this was followed by the already mentioned bankruptcy of Lehman Brothers and the near downfall of AIG, which was barely saved by a big loan from the U.S. state (Burniske, 2018). At that point, faith in the financial markets was at a record low, since there was a plague of so-called toxic assets spreading among firms. These firms were blocked from obtaining the needed credits because they did not meet the necessary liquidity conditions.

Motivated by the disillusion in the financial markets and the promises of new technologies, cryptocurrencies entered the market. On October 31 2008, a white paper describing an entirely new concept called Bitcoin was published. A white paper is just a paper that points out and explains the main properties and differences of a foundation's product or service. In addition, it is a way of advertising and gaining more visibility and publicity. Bitcoin's white paper set the first milestone in a big and influential digital wave that altered our perception on centralized systems as we are used to. The seed of the new era was sown by a still today unknown person or group of people under the name Satoshi Nakamoto. Nakamoto suggested a digital transaction system that does not lean on the trust, i.e. banks, but rather on a group consensus. The first Bitcoin transaction happened nine days after the publishing. On July of the next year, the first exchange rate occurred at 1,309 Bitcoin to a dollar. Each Bitcoin investment at that time had a prospective return of one million dollars at the beginning of 2017 (Burniske, 2018).

The Bitcoin "money" is not based or related to any fiat currency, but rather made via mining, a process that will be explained later (Low & Teo, 2017). Bitcoin is an electronic currency built by computer experts, created with a prearranged and distinct speed in order to propel a defined volume of capabilities. The Bitcoin's value is obtained from the belief, certitude and investing of its community. It is assured and validated by its restricted amount of resources and the cryptographical underlying mechanisms. The latter opened doors for all cryptocurrencies with Bitcoin in the foreground, followed by the rest of cryptography derivatives (Low & Teo, 2017). It became known, for its usage and popularity increased especially because of illicit acquisitions and the advancement of criminal activities (Turpin, 2018). This is due to the fact, that the transactions are totally anonymous and can be completed by traversing state borders seamlessly. Additionally, it is also a riskier asset, than assets derived by a governmental institution, which are backed by a state or a bank. However, Bitcoin gained popularity in the programming world, reflected within the developers' efforts to popularize and use the new digital currency. Bitcoin's code is publicly available, but only accessible by five IT experts. To change or adapt the code, it would take an absolute majority, i.e. 51% of the community, to alter it. (Turpin, 2018).

Bitcoin is founded on cryptography, which is the process of transforming a plain text into cipher text (i.e., replacing natural language text with strings of random-looking numbers and characters), and with that, making a normally understandable text indecipherable. Cryptography's four principal goals are:

1. Confidentiality - An information can be comprehensible only to the person to whom it is addressed (Rouse, 2009),
2. Integrity – securing that the information stays intact (Rouse, 2009),
3. Non-repudiation - the sending time is secured and can not be altered (Rouse, 2009),
4. Authentication - information on the transaction, such as who is the sender and receiver, can be controlled and verified by both parties (Doran, 2015).

Bitcoin's backbone is based on an innovative technology by the name blockchain that holds the history of all transactions within itself. A main function of containing the history is to verify the legitimacy of each transacted asset as well as its ownership. It is a cryptographic chain maintained by miners, the network's members that validate the transactions by solving mathematical problems. The system is fundamentally decentralized and assembled by ledgers. A ledger is a book of records of all creations and made transactions of Bitcoins. The blockchain is maintained by a community of millions of connected computers with the same software. Each time a user wants to transfer Bitcoins, the network receives a command where the computers need to validate the transaction, before it is joined with the blockchain. The validation is done by Nodes, by solving a complicated mathematical equation. A legitimate validation sets the status of the transaction made as permanent, meaning that nothing can be done to change it – and it is therefore immutable (Low & Teo, 2017). In return, the miners who solve the mathematical problems within the Nodes get a compensation from the transaction fees in form of Bitcoins or part of Bitcoins. Bitcoin users can hold their coins on a crypto exchange, on a digital online wallet, offline wallet or even on a hard-drive, which appears to be the safest way. For those who hold their coins online, they need an online address and a public key, where the bought coins are send to and a private key, that permits a Bitcoin's holder to transfer the coins to other address. Turpin expresses a fine analogy regarding this with the public key being the same as your home address, where people can send mails to you and the private key, as the key of your front home's door that only you keep privately safe. The latter is paramount, so the miners can let only the legitimate owners to receive or send their Bitcoins (Eyal & Sirer, 2013). As Turpin writes, it "is simply a chain of digital signatures (i.e., a string of numbers) saved in a "wallet" file". Each wallet consists of a private and already mentioned public key.

Nakamoto wanted to cut out the third trusted party with its payments processing and consequently avoid the trusted institution inflicting expenses. That is why, Nakamoto introduced a distributed and decentralized network possibility that is dependent on private machines of common people. It is a system built with both transparency and obscurity simultaneously. As an analogy, all information regarding the stock market is publicly available, but the investors remain unknown. Of course, a user's key can be traceable to a certain extent, but there are some ways of laundering the crypto assets (Turpin, 2018).

The Bitcoin's dollar value is mostly influenced by pure speculations. Its value increases whether there is a trend or just a common belief that its value will reach higher levels. Thus, the history's value shows unpredictable appreciations as well as devaluations. Bitcoin is peculiar because of the possibility of immediate transaction from one part of the world to another with comparably insignificant costs. Besides, the transactions are permanent, hence irrevocable (Zohar, 2015). Nakamoto claimed that the transaction within our banking systems could be altered, even retroactively when they are past transaction. Because of that, banks have higher transaction costs derived from various conciliation efforts and cannot execute the usual smaller transactions in an affordable manner. The consequence of having an option of changing or reversing a transaction results in many outstanding payments, since the payments can be declared null and void at the end (Low & Teo, 2017). In contrast, in the crypto world, the online addresses are without charge and users can create as many as they want. Monetary policies cannot have any impact on the network, since the system is pre-set with a 21 million cap of Bitcoins (Zohar, 2015).

So far, blockchain is perceived as a data formation made out of linked blocks by cryptography equations (Haber & Stornetta, 1991). A block is a group of transaction orders represented by a mathematical function called hash. Transactions from the same block are thought-out to materialize concurrently. If a change occurs on just one block, the blockchain as a whole changes. Within the system of blockchain one can find many old and new concepts combined all together such as the public keys and hashes, the consensus mechanisms on the validation of the data contained, the Proof-of-work, to ensure a safety net by blocking false information and one should not forget the economic inducements of miners and nodes (Bartling, 2018). The proof of work is some data which is time inefficient to generate but simple to validate and which contents specific necessities.

To summarize: Blockchain is, as already mentioned, a decentralized system without a single point of collapse. The operations flow cannot be stopped by switching off a computer system. It is a distributed system, which signifies that not one, but many entities and computers are sustaining the service alive by holding a copy of the whole database on many machines or some computers are sharing portions of the system. All data is immutable, which means that the data cannot be changed, at least not without evidence of that change happening. Every change is written within a sort of a logbook of alterations. The last feature of the blockchain is transparency. All work done by computers can be proven and the available information on this matter is authentic (Bartling, 2018).

1.1 Analysis of the Bitcoin transaction process

The list of categories of information held by blockchain is expanding and is being fortified against controversial falsifying by anyone in the community, even by the miners, other users or the original creator. All information is connected within a ledger in a chronological order and accessible to the public. Each user records, verifies and keeps the data on all transactions in order to protect the authenticity of the information within the blockchain without a trusted third party (hereinafter: TTP). The TTPs exist for the prevention of double spending the same unit of value. Each individual transaction information is immediately updated and added to the chain of blocks, hence it is almost impossible to hack and harm the system. Since a TTP is not needed, the costs that are usually allocated to the third party do not exist, hence the cost are quite lower (Yoo, 2017).

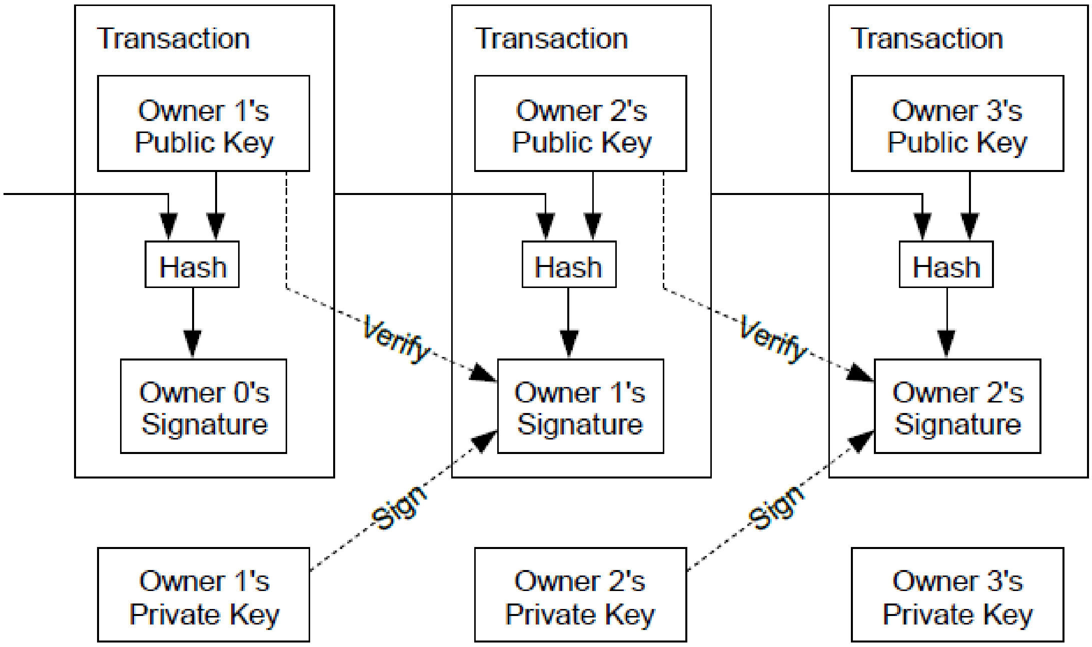
A transaction information within the blockchain consists of:

- Sender,
- Receiver,
- Document (e.g. smart contract),
- Digital signature,
- Hash algorithm for the digital signature,
- Digest,
- Public key,
- Private key,
- Key algorithms for public and private keys.

Every transaction is shielded by a digital signature, which serves to bind a person to some digital data. Thus, each user that has been part of a transaction, i.e. either sent or received a coin has a public key and a private key. In order to make a transaction happen, a user needs to sign the digital contract or document with his private key to verify the authenticity of the document. The document's content is run through a hash algorithm. The algorithm creates a unique array of numbers and letters called the digest. The digest is then encrypted with the author's private key, which outputs the digital signature of the document. The digital signature is the combination of the content of the document, its certification, and the author's private key. The receiver can verify the legitimacy of the document by reversing the process; by running the same algorithm that the sender used previously. The latter outputs again a digest that should be exactly the same as the original. The same digest can be obtained by decrypting the digital signature with the sender/author's public key. One digest is based on the digital signature and the other is based on the content of the document. If both digests match, the content and the digital signature are verified.

For a more comprehensive overview of the whole cycle, a diagram from Nakamoto is represented below.

Figure 2: Blockchain transaction cycle diagram



Source: Nakamoto (2008).

To avoid the double spending problem, it is decided that only the first transaction matters. Only by holding a database of all transactions made from the first day, each transaction can be verified if it is true or false.

To rephrase how the blockchain works, each block's hash is essentially time-stamped and publicly available on a time-stamp server. This time-stamp is used as a proof of existence of each hash. Every time-stamp contains the prior time-stamp. This consequently leads to a connected chain of all hashes (Nakamoto, 2008). It follows from this process, that at any given time there are many different chains present in the network. The longest chain is treated as the legitimate one.

The nodes have to assure two things before a transaction becomes a part of the public ledger. Firstly, it is necessary to ensure that the digital signature is authentic in conjunction with the specified transaction. Secondly, it is necessary to inspect the spender's public key in a transaction and his account, to ascertain that the spender has adequate balance.

To finalize and recap the blockchain processes, here are the main steps for operating the system (Nakamoto, 2008):

1. Each transaction is transmitted to all nodes.
2. Every node compiles the transactions into a block.

3. Every node searches for a proof-of-work for its block.
4. After the proof-of-work is found, the node shares and transmits the block to all nodes.
5. The block is accepted by the nodes if and only if all containing transactions are verified and authentic.
6. At the end, the nodes show the consent of a block by including the past block's hash in their new created block.

When the situation arises that two nodes transmit to the blockchain dissimilar blocks at the same time, a group of other nodes can collect one block first, meanwhile the other group of nodes the other block. The block that has been time-received before has priority. Nonetheless, the other, later-received block is put aside whether it evolves into the longer one. All nodes shift to the longer branch when one branch surpasses the other. The nodes are quite lenient on a missing block. A missing block will be definitely required and searched for, when a new block will be collected that will contain the hash of the previous missing one.

To economize the memory space necessary without fracturing the hash of a block, all hashes are saved in a Merkle Tree. The latter includes only the root of each hash. In this way, the branches of a tree can be made by compressing and stamping past old blocks.

1.2 Differences in Crypto Assets

Since the rise of the crypto world we were and still are mostly talking about cryptocurrencies. While Bitcoin, which out of all the crypto assets gained the most media focus, truly is a cryptocurrency, most of other tokens are not. Tokens have different ways of usage, different properties and different underlying values. There are, however, some shared usage ideas and properties that are used, i.e. token as currency, token for payment, token as stock. We can use these to establish a blueprint for token types with similar properties and start differentiating between different crypto assets instead of wrongly just calling everything cryptocurrency.

Tomaino (2017) focused on what the underlying value of crypto assets is. He recognized four major token types that offer different types of fundamental value. If a token does not fit clearly into one of these categories, he believes that it will be hard for it to maintain any long term value. The four token types are:

- Traditional asset token - A token type that cryptographically represents underlying traditional assets such as gold, equity, real estate, etc.
- Usage token - A token type where the token is required to access or use the digital service offered by the project. Its fundamental value is determined by the uniqueness of the resources underlying the digital service and the utility of the service itself.

– Work token - A token type that gives token holders the right to contribute work to the project. It can help enable that decentralized organization to function. Fundamental value is determined by the utility that token holders get from decentralized organization. Utility can come in the form of fees or good will.
– Hybrid token - Many future tokens may function as both usage and work tokens. That will be the case of Ethereum, when it will switch from proof of work to proof of stake. That way it will be both a usage token (for network usage) and a work token (for the right to validate transactions and be paid for that).

Euler (2018) and his fellows and Untitled INC published a Token Classification Framework. They devised a multi-dimensional tool for understanding and classification of crypto tokens. First, they classified tokens in five dimensions: purpose, utility, legal status, underlying value and technical layer. Then, in any of the aforementioned dimensions they identified various token types, which summarized their main characteristics. Dimensions and types are shown in figure 3, with accompanying examples.

After classifying a fair number of tokens through the framework, some patterns emerged. Looking at those patterns the authors derived 4 token archetypes (Euler, 2018):

– Cryptocurrency - Used as a store of value or means of payment. They are not issued by a central authority and can be mineable or pre-mined.

– Tokenized Asset - These give access to assets. Their underlying asset needs to be held by the issuer. They are exposed to counterparty risk (contrary to cryptocurrency).

– Tokenized Platform - Platform like networks, which are now owned and operated by a single entity. The roles in a platform are distributed and available to every network participant (before, users had limited roles). Value, either financial or utility, flows freely throughout the network.

– Token-as-a-share - A tokenized instrument to invest in companies that has characteristics of stock. Its shares are flexible and programmable via smart contracts. There is a high uncertainty with tokens of this type, as regulatory frameworks are only beginning to emerge.

Euler (2018) notices, that while this framework is useful in classifying and distinguishing between various token types, these crypto tokens do not exist in isolation, but are a component of a bigger, distributed ledger system. In this three layered system, tokens are an integral component, but other two components, governance (e.g. tokens legal entity, community infrastructure, network governance) and technology layer (e.g. blockchain/ledger architecture, protocol code, underlying platform) should not be overlooked.

Figure 3: Main token types per dimension

MAIN TOKEN TYPES PER DIMENSION

Technical Layer

Blockchain-Native Tokens

Description: A token that is implemented on the protocol-level of a blockchain

Characteristics:
- Critical to operate the blockchain
- Integral component of the blockchain's consensus mechanism
- Part of the blockchain's incentive mechanism for block validators/other nodes

Examples: BTC (Bitcoin, Bitcoin); ETH (Ether, Etherum), STEEM (Steem, Steem)

Non-native Protocol Tokens

Description: A token that is implemented in a cryptoeconomic protocol on top of a blockchain

Characteristics:
- Integral component of the protocol's consensus mechanism
- Part of the protocol's incentive mechanism for nodes
- Tracked on an underlying blockchain to which it is not integral (e.g. ERC20 Tokens on Ethereum)

Examples: REP (Decentralized Oracle Protocol, Augur)

Purpose

Cryptocurrencies

Description: A token that is intended to be a "pure" cryptocurrency

Characteristics:
- Intended as a global medium of exchange
- Functions as a store of value

Examples: BTC (Bitcoin), ZEC (Zcash), KIN (Kin, Kik)

Network Tokens

Description: A token that is primarily intended to be used within a specific system (e.g. network, application)

Characteristics:
- Token has functionality within the issuers system
- Not intended as a general cryptocurrency

Examples: GNO (Gnosis), STX (Stacks, Blockstack)

Underlying Value

Asset-backed Tokens

Description: A token that functions as a claim on an underlying asset

Characteristics:
- Allows trading via IOUs without actually having to move the underlying asset
- The issuer is responsible to hold the underlying asset
- Introduces counterparty risk

Examples: USDT (Tether USD, Tether), GOLD (GOLD, GoldMint), Ripple IOUs (Ripple)

Network Value Tokens

Description: A token that is tied to the value and development of a network

Characteristics:
- Tied to the value generated and exchanged on the network (e.g. transaction fee volume)
- Closely intertwined with key interactions of network participants

Examples: ETH (Ether, Ethereum) STEEM (Steem)

Utility

Usage Tokens

Description: A token that provides access to a digital service, similar to a paid API key

Characteristics:
- Grants holders access to exclusive functionality of the service

Examples: BTC (Bitcoin), STX (Stacks, Blockstack)

Work Tokens

Description: A token that provides the right to contribute to a system

Characteristics:
- Owning Tokens is the precondition for contributing to the system
- Contributions are either incentivized with a rewards system or holders get utility from the system/decentralized organization

Examples: REP (Reputation, Augur), MKR (Maker, Maker DAO)

Legal Status*

Utility Tokens

Description: A token offering owners clearly defined utility within a network or (decentralized) application

Characteristics:
- Closely tied to the functionality of the issuing network or application
- Internal network/app currency but not necessarily attempting to be a currency
- Grants owners the right to actively contribute to the system vs. passive investor role
- Avoids security-like features

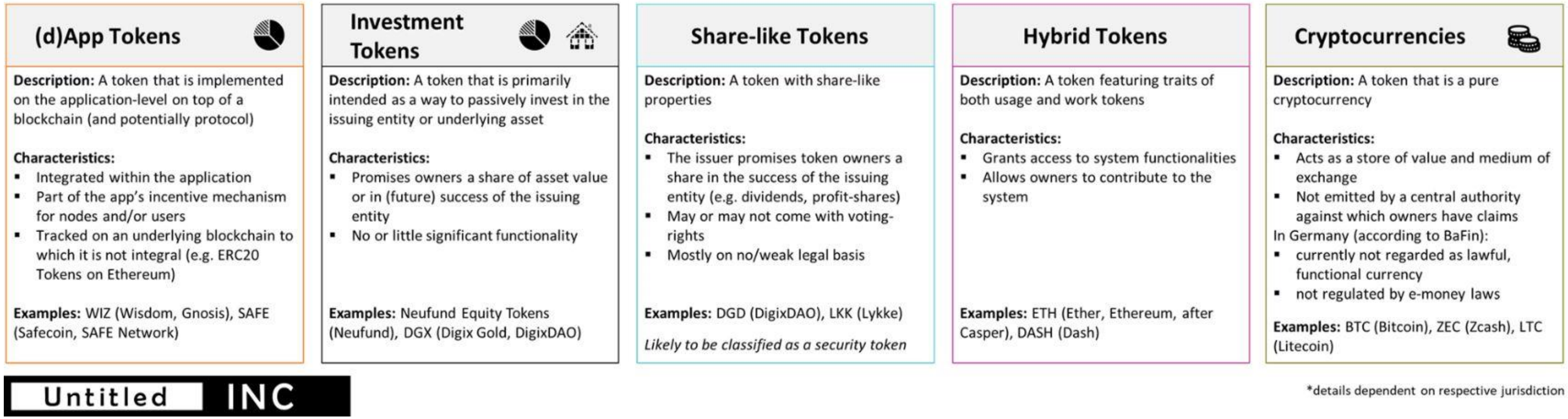
Examples: GNO (Gnosis), STEEM (Steem)

Security Tokens

Description: A token that behaves like a security

Characteristics:
- Showcases security-like features, e.g. voting on decisions regarding the issuing entity, dividends, or profit shares
- Holders are regarded as owners
- Little or insufficient utility

Examples: SPiCE (SPiCE VC), Bitwala (tba)



Source: Euler (2018).

1.3 Regulation

The question of regulation is a big question in the crypto environment. From the initial trading regulation-free utopia we are moving in the direction of regulated crypto markets. While some would argue that a lack of regulation is the cornerstone of crypto, countries and big industries such as banking, simply cannot and will not allow that. Take Bitcoin for example. It disrupted existing banking technologies worldwide and its idea of a decentralized ledger system bypasses banks with ensured safety. Worldwide transactions could be done faster and cheaper and banks and countries would have lost overview and control over these worldwide transactions. The unregulated utopia however, does not come without its dangers. There were many ICO scams that were looking for funding and then disappeared overnight. There were countless frauds related to ICOs, crypto investing, Ponzi schemes and just anything that had even the slightest relation with anything crypto. Companies and exchanges got hacked and after losing clients' assets just closed their doors.

Uncertainty will continue to exist in the crypto world as long as the regulators' position is not clarified. Countries are taking different approaches to crypto regulation. Some countries banned crypto assets altogether. Most countries consider them to be legal, but they struggle with their regulation. Let us look at a few examples of how countries cope with crypto asset regulation.

Japan announced Bitcoin as a legal form of payment on March 8, 2016. The adoption of the digital currency was outlined and legitimized with reference to a positive future and Japan as a leader in Bitcoin and crypto assets adaptation. After China's ban on crypto assets in January 2017, Japan became a super power of crypto assets and took the challenge head on to stay one. First, they took a more relaxed approach to regulation as they were also looking at how other countries were to handle it, but that all changed when the history repeated itself and another Tokyo based crypto exchange got hacked and robbed. After that, they took an active approach to providing regulations in this new field of digital assets (Pollock, 2018). April 2018 marked the launch of the Japan Virtual Currency Exchange Industry Association. This is a new group of 16 licensed Japanese virtual assets exchanges that will have the power to influence rules of regulation and develop standards for ICOs. This launch was a part of the revised Payment Services Act that went into effect in April 2017, which legally defines virtual currency as a form of payment and requires any virtual asset exchange that wants to do business in Japan or solicit its citizen to register with the country's Financial Services Agency (Castor, 2018). Now Japan is looking into the ICOs market. They are looking into ways of protecting investors and eliminating fraud in this unregulated environment. In April 2018, the Center for Rule-making Strategies of Tama University published a Call for Rulemaking on ICO, which will be deliberated by Financial Services Agency. Their proposals are issuance related guidelines for ICOs and trading principles. They propose issuers "should define and disclose conditions for the provision of conveniences such as services and rules on the distribution of procured funds, profits, as well as residual assets, to investors of tokens, shareholders, and debt holders" and "issuers should define and disclose a means for tracking the progress of white papers". For ensuring the protection of investors, they propose that token sellers should confirm the identity (via a method named Know Your Customer) and suitability of customers. The administrative companies that support the issuance should confirm the Know Your Customer of issues. Beside other things they propose a restriction on insider trading after a token is listed and an industry minimum standard on token listings defined by crypto asset exchanges.

We witnessed regulatory impacts in China. Until late 2016 over 90% of all trading volume in Bitcoin came from China and that did not change drastically until January 2017 when the People's Bank of China (hereinafter: PBoC) announced it was investigating Bitcoin trading on exchanges. Soon after, PBoC also issued regulations for trading. However, this was not the first time PBoC announced new regulations. In late 2013, when the price of Bitcoin crossed the $1000 mark for the first time after announcing restrictions on this activity, the price of Bitcoin dropped and continued falling for over a year. However, there was a big difference in January 2017, when the price surpassed $1000 for the second time. After this report from PBoC the price did drop, but it recovered in a month. The difference was that back in December 2013 the average trading volume of Bitcoin was $60 million, while in December 2016 it averaged $4.1 billion. Bitcoin recovered because of the bigger market liquidity and exchange diversity. Investors outside of China took the initiative and this lead to increasing market shares in trading Bitcoin with other fiat currencies. The Chinese yuan's market share percentage fell from over 90% to less than 10% (Burniske & Tatar, 2018). China has now banned ICOs, told crypto exchanges to stop trading in crypto assets and made proposals to discourage Bitcoin mining. Officials were intending to block domestic access to online platforms that offer exchange services for crypto assets. Beside that, they are targeting platforms that allow investors to trade digital assets on overseas exchanges. Trading in Bitcoin and its peers is still allowed in China but can only be performed in over-the-counter markets. China, however, does not seem to be anti blockchain or anti cryptocurrency. In fact, PBoC is running trials for its own prototype cryptocurrency (Clark & Chen, 2018).

The blockchain-friendly island of Malta is becoming a new home for two of the biggest crypto exchanges in the world, Binance and OKEx. While both exchanges were based in Hong Kong, they were having problems with the city's Security and Futures Commission. Their two CEOs called Malta's government to open relocation talks, as Malta is forward thinking and progressive when it comes to crypto and fintech (Nakamura, 2018). Malta's government looks to establish an agency called Malta Digital Innovation Authority to provide legal certainty in the world of blockchain technology. One of the main goals for this agency will be to certify distributed ledger technology platforms, which provides legal certainty for companies or people who wish to use them, so that people and companies would have piece of mind when dealing with a legal entity. Another goal is to set up a framework for ICOs and their regulations (Grech, 2018).

In the United States, in February 2018, the chairman of the U.S. Securities and Exchange Commission (hereinafter: SEC) Jay Clayton stated that all ICOs should be treated as securities. As there is currently no way to register crypto assets as security, this makes ICOs "off limits" to ordinary American investors. When giving a speech at Princeton University, Clayton did reject the idea that all ICOs are fraudulent and acknowledged that distributed ledger technology shows incredible promise for the financial industry, but noted that just because it is a security today, it does not mean it will be a security tomorrow and vice-versa (De & Gnanaseharan, 2018). To date, SEC has not approved any crypto exchanges or ICOs and individual U.S. states and cities took it upon themselves to regulate crypto assets. In Arizona, they recommended the passage of a bill that would allow state residents to pay their tax bills in Bitcoin. If approved, residents could pay taxes and any interests and penalties using Bitcoin or another cryptocurrency. The State's Department of Revenue would then convert the cryptocurrency to U.S. dollars within 24 hours (Higgins, 2018). The Department of Financial Services published the final rules for virtual currency business activity in the New York State Register in June 2015. Additionally, the BitLicence Regulatory Framework is a document for a framework on how should Bitcoin business be regulated in New York and it requires that pretty much every business that deals with crypto assets in New York obtains a license (DFS, 2015).

We can see that there is no globally unified approach to crypto regulations: each country is tackling the question of regulation in its own way. We can be certain that the crypto business will move to countries, which will be more opened to it. Those countries will have the obvious benefits from new business, but will also get the competitive advantage of knowing and understanding the specifics of crypto business better. With that knowledge, they will probably have a bigger role in creating a good, regulated crypto environment, which could attract even more successful crypto businesses.

1.4 Crypto Bubbles

Since the financial crisis of 2007 – 2008, which affected the whole world, everybody knows the terms "bubble" and "financial crisis". Especially since the financial crisis was a consequence of a housing securities bubble in the United States. Now, we have this still relatively new market of crypto currencies, which rose out of nowhere. From October to December 2017, we were following a Bitcoin surge from $5000 to $20000, with daily media coverage. There were countless people and professionals saying that the crypto market is fraudulent and a big bubble, which will come crumbling down and return to dust. Well, until June 2018 Bitcoin did lose more than half its value since it peaked at $20k, but it is still standing and so are the crypto markets. So are the crypto markets a bubble now?

Were they a bubble, or are they just a new kind of markets, which survived a euphoric moment?

In order to answer the question whether the crypto markets are, or were, a bubble, we first need to understand what bubble is. We found a few interesting parallels between crypto markets and one of the oldest recorded economic bubbles in our history, the South Sea Bubble. South Sea Bubble happened in Britain, less than a century after the Dutch tulip mania and it gave us the term we now tremble before – “bubble”.

The 18th century in Britain was a time of prosperity, with a large section of the population having (some) money to invest. There were a few companies offering stocks that were solid and brought lucrative gains to their investors, like the East India Company, but they were hard to get your hands on. To ride the wave of investors’ underserviced demand to its advantage a new British joint-stock private-public venture, the South-Sea Company, was formed (Beattie, 2017). There was a big scheme behind this company, which we will not go into detail here, but we can say that if Securities and Exchange Commission existed back then, everyone associated with the company would have been arrested, as they broke almost every rule in the SEC book (Taylor, 2013). With schemes and profits in mind, the company has manipulated stock started rising in January 1720 and thus began the real hype related to it. People wanted to be a part of it at any price as it looked like the price will only keep rising and profits were just there for the taking. As the price kept rising, it caused a real frenzy and euphoria in Britain. However, all of it lasted for only about 6 months, until it all crashed. In the crash that followed, banks would have folded if the government had not have had them bailed out. Even though some people associated with the matter were convicted, these convictions were more a matter of calming and satisfying the general public, after so many had lost their wealth (Mackay, 2003). From January 1720 when the price was 128 pound per stock, it rose to 1000 pounds in early August 1720. By the end of September 2017, it had fallen back to 150 pounds (Taylor, 2013).

In the midst of all this hype, that everybody wanted to be a part of, numerous new joint-stock companies with their own business plans started popping up. They were nicknamed Bubbles. Most of these companies did not live to see the short span of their existence to its end, before the Bubble Act in June 1720, which prohibited unauthorized joint-stock ventures. Some of these companies lasted for a week or two and were never heard of again. In this speculative market, even the highest of the aristocracy were in pursuit of gains. Dukes and Princesses became part of these new companies. Some projects were sound, while others were extravagant and bizarre. There were nearly a hundred different “official” projects with many others springing up on a daily basis. There was even a Bubble, so absurd, that showed the utter madness of people at the time and its name was “*A company for carrying on an undertaking of a great advantage, but nobody to know what it is*”. It actually received some funding and after the first day of stock subscriptions, the funder was never heard of again. Had some of the schemes, which were plausible enough, been started at a time when there was not this euphoria in the markets, they might have pursued their business and succeeded. In that moment, however, companies were established only with the goal of raising shares. As the first opportunity arose to sell out after a rise, the projectors took it and soon the scheme ended (Mackay, 2003).

We witnessed similar phenomena with the crypto world. As Bitcoin was becoming increasingly more known and its price was on the rise, we had ICOs popping up everywhere. The hype and euphoria rose alongside the price rising toward its $20k mark. Anything that mentioned crypto was rising as well. Then we had the downturn and drop of its price and people gradually lost confidence in it. However, it would be unfair to simply compare Bitcoin to the South-Sea Company. For one, Bitcoin actually delivers on the utility value it promises. We could draw parallels between Bubbles and ICOs, since many of them are fraudulent, bizarre and extravagant, but there are some whose projects could bring big success to the project and its investors, and these latter ones are the ones we have to look for when investing in crypto assets. In addition, the first crypto hype, or if you want to call it bubble, is behind us. Bitcoin and successful project are still standing. We witnessed the demise of some fraudulent and useless assets. Yet many more are still to come. As long as we will continue to operate in this unregulated crypto world, we will just have to get used to this environment.

1.5 Initial Coin Offering

This master's thesis focuses on elaborating different attempts of applying some classical evaluation models to an imaginary coin that would be issued on the market through an ICO. It stands to reason, that we should explain what this new concept of ICO really is, and how does it function.

The Institute of International Finance issued a document in February 2018 named "The Initial Coin Offering: The Frontier of Financing". The document says that the first official ICO was accomplished back in 2013 by the Mastercoin foundation, which raised almost half a million US dollars. Mastercoin was based on the Bitcoin's blockchain. The second ICO to mention is Decentralized Autonomous Organization (hereinafter: DAO) that was based on the Ethereum solution of smart contracts. DAO raised more than $160 million, but ultimately it was shown to be vulnerable, because someone stole millions from the raised money. Regardless of the theft, the well-known and popular Ethereum has become the main foundation for initial coin offerings.

A universal database and platform of all past and future ICOs does not exist, so that the whole area of initial coin offerings is more controllable. Furthermore, the startups that are planning to offer coins do not have common international registration. Most of all popular websites containing information on the world of ICO are updated by the community itself.

The most famous among them is CoinSchedule, with a funding volume of more than $5.8bn (Fisch, 2018).

After the first ICO on, many foundations have decided to raise capital through ICOs. Looking at the CoinSchedule reports, only in 2017 ICOs raised more than 4800 million US dollars. This can be compared to the crowdfunding platform Kickstarter, which raised 3500 million US dollars from the beginning of its existence (Fisch, 2018). Li and Mann (2018) warn against such expansions of ICOs, since they can lead to either a beneficial innovation or a really perilous catastrophe. The authors warn about the fact that ICOs are not being consumer regulated by any laws or insurances, leading to a possible wave of deceptions and profiteering. In many cases, it is hard to substantiate an ICO as a financing venture or product. Fisch (2018) notes a similarity between an ICO and the initial public offering (IPO), with a key difference. The investors in IPOs *de facto* acquire a share of the company and by that become owners. Tokens frequently have no usability in our real economy. The investors in ICOs obtain tokens that will potential become future usable currency.

For all newly founded blockchain companies that go by the name “startup”, ICO is the best way to receive a badly needed financial injection in the early stages. Moreover, this is without giving investors any assurances on spending, on the return on their investment or other promises on the management of the company (Kastelein, 2007).

Initial coin offerings exhibit both dangers and favorable circumstances, and are a risky investment business model. The value of a new crypto currency based on for instance Ethereum or Openledger is set to the discretion of the issuing foundation, which means that the value is assessed on the market’s current opinion. In the next stage, the appraisal is made by a market dynamic pricing dependent on the demand and supply and not by a centralized institution or government (Kastelein, 2007). A foundation that needs money to develop and finalize its product basically issues coins - tokens on a presale to potential customers. Once the product is finished, the buyers will be able to pay for the product of the issuing foundation with the bought tokens. There are some different kinds of tokens. Often, the issued token is a cryptocurrency, a digital medium of value exchange based on the blockchain (Fisch, 2018). Cryptocurrencies usually play an important role in ICOs because the venture sells tokens and in return accepts established cryptocurrency (mostly Bitcoin and Ether) as payment. This cryptocurrency can then be traded for regular currencies, which are used to fund the development of the venture (Fisch 2018). Nowadays, many investors buy tokens on ICOs just for the purpose of reselling them for profitability. The latter distorts the healthy bond between the sale of the product and a protected dissemination of tokens (Li & Mann, 2018).

Fish (2018) finds crypto assets and blockchain as revolutionary innovations from a technical and monetary point of view, whereas initial coin offerings a novelty in the ventures financing. ICOs are quite similar to crowdfunding, with the exemption that the venture capitalists buy token assets that should gain a usefulness element within the project, directly from the foundation.

One of the main reasons why investors keep quite a large flow of their capital into the world of crypto assets are the high profits. For instance, NEM and Monero tokens have gained an increase of more than 2000% in value. The second reason why the venture capitalists invest and try to deal as much as possible with ICOs is because of the liquidity of crypto assets. Additionally the investors can “reduce” the risk of investing just in one startup by putting their money in many different but potentially fruitful ICOs and by that earn back profits faster as well as allowing them to pull money out of the game. It is just necessary to change whatever bought token to Ether or Bitcoin via an exchange, and from that point resell those for a fiat currency. One negative aspect for classic venture capitalists is the ambiguity of regulators; volatile assessments, over capitalizations, the absence of information on the roadmap and the plan, in many times bad financial management and lack of control. Not to mention many successfully completed frauds and attempts of scam. *Per contra*, the crypto community tries to diminish such illicit or deceitful activities by internal due diligences on one hand, and by some firms that are hired to do crypto assessments on the other (Kastelein, 2017).

Kastelein (2017) sees ICOs as “the Wild West of financing”- positioned within a grey zone. The issue stems out of a lack of any guarantee to the investor. The investors are left with only speculations and hope. Moreover, ICOs are not subsumed to each country’s classical legal system, on contrary, they undermine it. To continue, anyone from anywhere can invest in an ICO without being identified and without being controlled by a commonly accepted institution. Fisch (2018) states that without any centralized regulator, the risk increases because of cancerous practices and due to a lack of legal entitlement or real information. As Busenitz (2005) realized more than ten years ago, the potential investors encounter the information asymmetry, since the only ones that know something more on the token issuing foundation, are the individuals participating and working within the company. There are no revelation necessities, these firms arbitrarily disclose relevant material. The latter leads to a more meticulous appraisal of each information presented by the coin issuer. The situation escalated to the point, that last year some countries even banned ICOs, namely China and South Korea (Fisch, 2018).

There are some firms such as Tokenmarket that are trying to provide a solution to the *status quo*, such as Anti-Money Laundering regulations and Know Your Customer framework to mitigate malignant behavior and contribute to a safer way of investing in ICOs. Nevertheless, ICOs are still prevailing in the fundraising competition. One option that presents itself is to just prohibit all kinds of ICOs. Such a response would be understandable from the perspective of governments, but could inadvertently lead to a much higher long-term cost for the banning countries. Restricting and suffocating an innovation like this may shift a country to an enormous competitive disadvantage as opposed to others that embrace it (Li & Mann, 2018).

2 NAUTILUS PROJECT

To present in practice the evaluation models below, we outline a project proposal for a business that will offer its product Nautilus on the market. As sailors, we spend quite some time each year on the sea and many times, we experience unexpected weather alterations or other unplanned things. Thus, we know how hard it can be to find, let alone get to, a safe spot with your boat in a bay or in a marina. Especially in the middle of the summer season. Currently, it is still almost impossible to find a common source of information on boat moorings around you. We imagined an app that enables its users to search for available moorings within marinas as well as bays. Basically, Nautilus is a fictional ICO project that enables its users to search, book and pay for a mooring via the mobile app with Nautilus tokens called NAUT.

In the sailing season, between June and September, popular bays can get easily and very rapidly overcrowded and consequently they become dangerous. Skippers and their crew are sometimes searching hours for a safe place for the night, often unsuccessfully. This poses a significant safety risk, particularly for the inexperienced sailors. By introducing Nautilus to the market, sailors alongside moorings holders in bays and marinas would have an innovative, yet elegant solution for all the troubles mentioned above. Sailors could see in real time all free moorings in their vicinity and book a chosen mooring instantaneously. Then, it is a matter of time to reach the reserved spot and spend the night in safety. On the other hand, marinas and the moorings holders could predict and therefore improve their revenue, optimize capacity utilization and provide higher levels of safety and service reliability to their customers.

The Nautilus solution is based on the blockchain technology. Each time a user pays or exchanges NAUT tokens for a mooring reservation, a smart contract is created and saved within the Nautilus blockchain. Smart contracts are represented within transactions for moorings bookings, which occur between sailors and marinas or holders of moorings in bays. Smart contracts differ from what we usually entail under contracts within contractual law and business practices, because they do not necessitate a third party to assure the credibility of the contract. The only key part to be validated for a smart contract to become enforceable are the transactions, which are validated by Nodes, and these hold intrinsic incentives for the miners because they get paid with NAUT for each validated transaction. The validation enables the conclusion of a transaction. Before continuing to the part of the master's thesis where our evaluation examples are shown, we need to further elaborate on a few key required assumptions.

Nautilus project assumptions for further calculations:

- Our calculation inputs are based solely on the information for the Croatian market. It is hard to define accurately how many moorings are in the world, not to mention the number of buoys. Hence, we have chosen just one market for the purpose of balancing simplicity with fairly accurate estimations. The paramount parts are the methods used within the evaluation models, not the figures themselves. Thus, we use such tangible information and not fictitious ones, in order to demonstrate a more real example.
- Croatian Bureau of Statistic stated in 2017 that the country has approximately **17,067** moorings with **329,247** moorings rented overnight.
- To obtain an estimate on total buoys available (relevant to the project's business objectives) we took a rough number of buoys on per inhabited island **(60)** and multiplied it with the number of all **50** inhabited islands, where the buoys are being rented. Thus, we get a total of **3000** available. Again, this is just an assumption of ours. It is of course arguable that the figure is incorrect, but it does not matter for our ultimate goal of this master's thesis, which is to show different evaluation approaches of a fictitious crypto asset that tries to enter the market via an ICO. To further obtain occupancy of rented moorings (just from renting the buoys), we assumed that June and September have an occupancy of **58%** and July and August of **97%**, while the rest of the year has 0% occupancy. To continue, we multiplied 30 (days) times four (months of season) with the number of all available buoys (3000) and with the occupancy percentage (average of 78%, over the four months in season). At the end, the sum of all four months gives us **279,000** overnight rented buoys.
- Total overnight rented moorings (from previous two points) sum up to **608,247**. In addition, we forecasted a **1%** growth rate of rented moorings.
- To show a deeper perspective, we need to decide what percentage of this Croatian market is accessible to us. Because our solution is rather unique and innovative, it allows the marinas to get future bookings and are moreover capable of forecasting its occupancy. And by that, they can estimate future revenues and get payment in advance. The latter leads to better preparation for a higher volume of traffic, higher marinas utilization, higher transparency, etc. At the end, it also increases the safety within the nautical traffic. All of those provide a strong incentive for the moorings owners to participate in this business model. Having said that, we assume that Nautilus project can achieve **85%** of the Croatian booked moorings.
- For our calculations below, we should specify the saturation percentage of the 85% of the market at different times in the future. We assume that at the beginning in 2019, the solution is taken by just a few curious and innovative marinas, hence Nautilus reaches 10% of the market and seven years from the launch, in 2025, it reaches 90% of the addressable 85% of Croatian booked moorings. This is due to a booming trend, good marketing and a really versatile and useful Nautilus solution.
- Let us continue with the total planned supply, meaning the total number of to be issued tokens. Since we plan to enter just this one market, it is more convenient to maintain

the number of token relatively low with **100,000** tokens, so that the value of each token becomes fairly high.

– Token distribution in percentage:
  - Private sale: 10%
  - ICO: 70%
  - To foundation 10%
  - Founders 10%
– Private sale means that 10% of all tokens will be available for buyers before the official launch and distribution. Investors have an opportunity to buy assets that they think will gain value over time, hence make them a profit. The initial coin offering consists of 70% of all tokens, because 10% goes to the founders and lastly, 10% to the foundation itself, in case of any additional costs or other unexpected events. It is believed, that if a foundation releases more than half its tokens, it expects that the community, buyers, holders, etc. will nourish the crypto-economy's development more (Mougayar, 2017).
– We assumed that the foundation's lifetime would be **30** years.
– The lock-up period for founders is 5 years. The intention is that the owners who bought and invested in the private sale before the official issuing cannot sell all tokens immediately after the ICO. This is a preventive restriction for not taking advantage of the ICO system itself. In many successful ICO launches, the token's value is quite higher compared to the private sale price, hence many investors would sell their tokens immediately after the ICO, just for the sake of earning on their investments.
– We definitely must set an average price for the mooring. In our case, the cost per mooring is 50 €. This figure is based on our own approximation of the average cost of a mooring in marinas in Croatia and moorings on buoys in bays.
– After using and calculating our second token pricing with the VOLT model, we decided to use the estimated velocity for all other models to be as consistent as possible. Hence, we will be able to compare and qualitatively comment the results.
– One of the last few things to determine is the inflation rate. Since the Nautilus ICO releases all tokens at the same time, there will be no token inflation.
– Our discount rate is 30%, due to the fact that we calculate the present value of a risky asset and the investors expect a higher return on more volatile and risky assets. At the end of all evaluation models, we will examine and contrast the present value with a forecasted value in 10 years.
– The VOLT model includes also the assumption, that the costs decline over time. We assumed that the start of our costs decline will be in 2020, since in that year the NAUT token should overtake 15% of the Croatian market while simultaneously encountering a fast growth.
– Lastly, the transaction costs. There are the exchange fees, the network fees and the wallet fees. Exchange fees are basically representing the commissions for selling or buying a crypto asset. Commissions can be fixed or variable. The maker-taker models present volatile commissions, that are influenced on the amount paid for a transaction.

The higher the amount, the faster a transaction will be validated. Next, the network fees are a sort of compensation and motivation for the Nodes or in some cases miners. They validate all transactions and keep track that each token transaction is not executed twice. Our assumption is that the NAUT transactions costs are relatively high, but can be even higher. Lastly, the wallet fees are the fees paid to firms that offer users token storages on the market, so that users can hold "safely" their crypto assets (Williams, 2018). You will see below, that certain evaluation models include the transaction costs, while others do not. For instance, the VOLT model contains the transaction fees of exchange, network fees and other, but not the wallet fees of course. Our transaction cost is set to €20 at the beginning and through time will most likely decline.

3 INTRODUCTION TO CRYPTO VALUATION MODELS

When researching about existing crypto asset valuation models we learned that most of them were based on valuation theory of Token Velocity Thesis. This thesis is actually a crypto adapted derivative of Quantity Theory of Money. Since this theory was pretty much unknown to us and is not usually connected with valuing assets, we decided to present a brief introduction to it in its classical style and crypto adapted style.

3.1 Quantity Theory of Money

Quantity Theory of Money is a theory that in its core claims that variations in the money supply are related to variations in price. Its origins date back to the late 19th and early 20th century, but the most common version of this theory, which is used in economic literature, was published in 1911 by a Yale University economist, Irving Fisher in his book, The Purchasing Power of Money (Weber, 2018). Quantity Theory of Money was especially popular with monetarist economists and suggests that there is a fixed proportional relationship between changes in the money supply and general price level. Fisher explained the theory through the equation of exchange, which we will now explain as well.

The equation of exchange is a statement of total transactions made in a given community in a determined period of time. It is obtained by adding together the equations of exchange for all individual transactions. The same money, during the same period, usually serves for several transactions, which is why the money side of the equation is greater than the total amount of money in circulation (Fisher, 1922).

The equation of exchange is simply put, the sum of all individual exchanges in a year. In every purchase and sale, the goods and money exchanged are equivalent, so the grand total of all exchanges within a year is the total money paid, equal in value to the total value of goods bought. The equation has a money and a goods side. Products of quantities of goods exchanged multiplied by their prices make the goods side. Product of the quantity of money multiplied by its rapidity of circulations, which represents the total money paid, makes the money side (Fisher, 1922).

Equation of exchange:

$$M * V = P * Q \tag{1}$$

Where:

M * V = money side of the equation (also presents nominal GDP)
M = total, averaged amount of money in circulation during a period or money supply
V = transactions velocity of circulation

P * Q = goods side of the equation (also presents nominal GDP)
P = price level in terms of currency per unit of output (products & services) in the economy
Q = quantity of output in units of output in the economy

An important factor, the velocity of circulation, or more often referred to as velocity of money is obtained by dividing the the goods side in the course of a year by the average amount of money in circulation by which those payments are affected (Fisher, 1922). It is shown in equation (2).

$$V = \frac{P * Q}{M} \tag{2}$$

This velocity is a kind of average of the rates of turnover of money from different people, or how many times a euro is spent buying products and services. Some people like to keep money under the mattress, so their velocity of money is low, while on the other hand, those who spent it as soon as they get it, have a high velocity of money. Each person has his own turnover rate, which can be calculated by dividing the amount of money spent per year by the average amount he carries (Fisher, 1922).

Let us look at an example. The money supply in a county is 10,000,000€ and its velocity of circulation is 10 times per year. The total amount on the money side of the equation, the amount of money changing hands for buying goods, per year is 100,000,000€ (10,000,000€ * 10).

Therefore, we have the money side of the equation worth 100 milion € and since we are dealing with an equation, the goods side must be the same. Because if 100 milion € have been spent for goods during the course of a year, then 100 milion € worth of goods have been sold in that year. For simplifying measures, let us assume that there were only three kinds of goods, bread, coal and cloth. Their sales were:

- 15,000,000 loaves of bread at 1€ a loaf.
- 5,000,000 tons of coal at 10€ per ton.
- 7,000,000 meters of cloth at 5€ per meter.

The value of transactions is, 15 milion € worth of bread plus 50 milion € worth of coal plus 35 milion € worth of cloth and it all sums up to 100 milion €. The equation of exchange would than look like this:

10,000,000€ * 10 times a year = 15,000,000 loaves * 1€/loaf
+5,000,000 t * 10€/t
+7,000,000 m * 5€/m

As we can see, this equation has two variables on money side, the quantity of money (M) and its velocity of circulation (V). While on the goods side we have two groups of variables, the quantities of goods exchanged (Q) and prices of these goods (P). This equation is equal by definition and its four sets of variables are mutually related and because this equation must be fulfilled, the prices relate to the three other sets of variables (Fisher, 1922).

Now, let us say that we would double the money supply in our economy, while the velocity of money and quantity of output remained the same. Velocity of money and quantity of output would remain the same, because in the short term, the economy could not just decrease velocity by making its users spent less and it could not just produce twice as much goods. In this case, it would be impossible for the prices to remain unchanged. Under these conditions, prices must change in a way to raise the goods side from its initial value to double its initial value. This doubling could be made by an even or uneven rise in prices, but there would have to be some rise in prices (Fisher, 1922). This is roughly the idea of using Quantity Theory of Money in predicting and regulating economies inflation and money supply.

3.2 Token Velocity Thesis

Now, let us look at the adapted Quantity Theory of Money for crypto assets, which we apply to a crypto project economy that uses tokens. We use equation of exchange, with crypto adapted inputs:

$$M * V = P * Q \tag{3}$$

M = number of units of Token in existence (asset base size)
V = number of times a unit of Token changes hands
Q = output of projects economy in a period (quantity of the digital resource being provisioned)
P = price of a unit of Q in terms of Token (Token / unit of Q; price of the digital resource being provisioned)

Weber (2018), points out two notes in regard to this crypto modification of the equation. Firstly, that velocity, V, is the number of times a unit of Token is spent on the project's output during a period and does not represent the number of times a unit of Token is spent on USD or some other currency. Secondly, P is the price of a unit of Q in Tokens terms. It is not the price of USD in terms of Token. This is because the units on both sides of the equation must be the same for the equation to hold. Failing to satisfy this, can lead to misuses of the theory when applied to tokens.

While the Token Velocity Thesis is often a part of models trying to assess value of crypto assets, it still has some recognized criticisms. The Velocity factor cannot be precisely measured or defined, but in order for it to be used in the model, it is assumed that that it can be defined. The other factors of the thesis also cannot be easily measured and you might need models just to estimate any one of these variables together with their correlations with each other. Factor M is also extremely difficult to measure, since there can be locked up or unmined tokens that may reflect on factors value. The idea that a change in Velocity is reflected in M, P or Q is arbitrary and produces different implication for token price. In addition, the velocity's relationship with other factors is dynamic and assuming a steady relationship with P, Q and M is again arbitrary and problematic (Lannquist, 2018).

Velocity of Token

You have probably heard the idea that since there is a fixed supply of tokens in a project, with the increase of demand for a token, so shall there be an increase in price. This idea however, fails to take into account the velocity problem. Samani (2017) says, that velocity is one of the key factors that will impact long term value and since most utility tokens do not provide a good reason for people to hold the token for more than a few seconds, assets with high velocity will struggle to maintain long term price appreciation (not taking into account speculation). That is why protocol designers will help their projects by incorporating mechanism in their protocols that encourage holding. Samani (2017) defines velocity as:

$$Velocity = \frac{Total\ Transaction\ Volume}{Average\ Network\ Value} \tag{4}$$

Therefore:

$$Average\ Network\ Value = \frac{Total\ Transaction\ Volume}{Velocity} \tag{5}$$

Velocity can be measured in any timeframe, but is normally measured annually. Transaction Volume does not only include trading volume on exchanges, but includes actual usage on the platform and over-the-counter trades, which makes it difficult to measure. Assets also need some velocity to achieve their intrinsic value and lack thereof would cause the asset to trade at a discount to its full intrinsic value. A problem almost all utility tokens have is that if nobody wants to hold a payment token, velocity will grow linearly with transaction volume. This means that transaction volume could grow a thousandfold and the network value could remain constant. To increase network value, it would therefore have to reduce velocity (Samani, 2017).

Concerning reducing velocity, Samani (2017) offers some ideas on how to achieve it:

- Introduce a profit-share (or buy-and-burn) mechanism - this mechanism reduces token velocity because as the market price of an asset increases, its yield increases. If the yield becomes very high, market participants looking for high yield will buy and hold the asset, thereby increasing price and reducing velocity.
- Build staking functions into the protocol that lock up the asset - In the case of a platform that powers online casinos, the house must maintain reserves to pay out highly unlikely events, like a user winning big and/or winning multiple times in a row. Casino operators need to lock up more than 50% of their tokens.
- Balanced burn-and-mint mechanics - Imagine users burn tokens to use the protocol as project designed. Independently, the protocol mints X new tokens each month and distributes them to validators. If users do not burn X tokens in a month, supply increases, which should pressure the price to go down. On the other hand, if users burn more than X tokens per month, supply decreases, which should pressure the price to go up.
- Gamification to encourage holding - imagine a platform that prioritizes customers based on having held X tokens for Y days.
- Become a store of value - this is by far the most difficult to achieve, since it is not only a function of a specific design mechanic. To become a store of value there is a bigger question of broader technical viability and market acceptance. If people believe in a token as a store of value, then they will be willing to hold excess tokens rather than sell them for something else. Reason for that may be that they expect an increase in price, as is or was the case with bitcoin. Another reason is maybe just to hold an asset in expectation that its value will be stable.

4 CRYPTO VALUATION MODELS

Before getting into various crypto valuation models, we should emphasize, that all models are an adaptation of classic evaluation models made explicitly for cashflow valuation, stock valuation and option valuation. Uses of valuation models that will be presented are based on our fictitious project Nautilus, which launches with an initial coin offering.

Even though evaluation models below are derived from real valuation models in financial world, they are still mainly just concepts of what crypto valuation models could look like in the future. They do however, help us in observing variables and other influences that could play a role in determining crypto assets real value.

4.1 INET Valuation Model

INET Valuation Model is a model based on the discounted cash flow (hereinafter: DCF) analysis. Its author, Chris Burniske, is also the author of the book titled, Cryptoassets: The Innovative Investor's Guide to Bitcoin and Beyond. INET, which became the name for its valuation model, is just a name for his fictitious token he used in this evaluation model. He modified the DCF model with the equation of exchange by substituting a firm’s profits, margins and revenues with each year’s utility value. All forecasted utility values have to be brought into a present value with the method of discounting.

Let us start with the first part, the equation of exchange (3). For the Nautilus project’s core product (booking of a mooring), we interpret:

Price (**P**) = the price of each mooring (Average)
Quantity (**Q**) = the quantity of moorings booked per year (Average)
Velocity (**V**) = the number of times Nautilus token changes hands
Size base (**M**) = size of the token base released

The GDP of this crypto-economy is represented by the equation P*Q, same as for a country’s economy GDP calculation. The difference between real and crypto world is within the books of record (ledgers) used in the latter one, which are unchangeable and open to public - blockchain.

The monetary base (M) is the essential size of a token economy needed to support the system itself, which “travels” with the speed of velocity (V). M can be calculated by dividing P*Q with V. Despite the GDP of a crypto-economy is quite acceptably depicted by the volume of transactions on blockchain, it can be frequently imprecise by up to 30% due to trading on exchanges. The latter is usually ignored in the GDP metrics and interpreted as a method of speculation.

The INET model is divided in four key segments. The first one determines the number of tokens in circulations in each year. The second measures and calculates the GDP of NAUT token, as well as a necessary monetary base and the utility of a token at the end. The third forecasts the percentage of market penetration and presents the utility value on a graph, and the last one represents the present value by discounting a chosen year of a chosen utility value.

To begin with, the first section, in the table below are all fundamental parameters necessary for this calculation.

Table 1: NAUT Supply Schedule inputs

Metric	Assumption
Total Planned Supply	100,000
Percent of Tokens Issued in Private Sale	10%
Lock-up Period for Private Sale Investors	5
Percent of Tokens Issued in ICO	70%
Percent of Tokens Issued to Foundation	10%
Lifetime of Foundation	30
Percent Issued to Founders	10%
Lock-up for Founders	5
Percent of Tokens in Float Bonded by Nodes	15%
Percent of Tokens in Float Initially by Holders	60%
Decrease in percent of NAUT that is hold each year	4%

Source: own work.

As already mentioned in the Nautilus project presentation, the total supply of all tokens is only 100,000 due to the fact that we want to keep the value of each token relatively high, for the purpose a mooring can be paid with just few tokens. Another reason is because we would like to issue a utility token, not a currency coin.

We plan to issue 100,000 tokens. Of these, 10% will be sold in a private presale, 70% are sold publicly, 10% stay in the house (in the foundation) and the founders are keeping last 10%. Additionally, there is a safety pin for a more stable token price called, the lock-up period for private sale investors, which limits investors in selling their share of tokens in the first five years. It often happens that presale investors sell all of their tokens immediately after the ICO (when the price of a token is higher than at the presale price), consequently draging the price downward substantially. Now we can overlook at the more subjective part of the assumptions. The 15% percent of tokens bonded by nodes means that the pool of nodes needs to own a certain level of tokens, for the reason of validating the transactions. Usually a person needs to own an X amount of tokens to be eligible for validating tokens and receiving transaction fees. Holders (initially 60%) are people who hold the tokens because they believe that the value will increase over time, which means they understand NAUT token as a store of value. Tokens owned by holders and bonder have a velocity of 0. At this point, we can also mention the decrease in the retention rate of tokens, which we set up to be 4% and lastly, the 30-year lifetime of the foundation behind the Nautilus project.

Our utility token as well as our crypto economy are subsumed to the Proof of stake, which is a sort of algorithm that enables the blockchain to gain a distributed consensus. The distributed consensus is an agreement on specific data value, required by the calculation. Because of the Proof of stake algorithm, we assume that our crypto network will demand more bonding by the nodes. Bonding alike is a stimulus to act correctly for them on one side, or to withdraw from such activity on the other. Considering that this network does not consist of miners, nodes earn their income on transaction fees.

Table 2: Supply Schedule Output

Year From Launch	2018	2019	2020	2023	2026	2028
Released from Private Sale that year	2,000	2,000	2,000			
Released from Public Sale that year	70,000					
Released from Foundation that year	333	333	333	333	333	333
Released from Founders that year	2,000	2,000	2,000			
Aggregate Number of Tokens Released	74,333	78,667	83,000	92,000	93,000	93,667
Number of Tokens in Float after Bonders	63,183	66,867	70,550	78,200	79,050	79,617
Percent of Tokens Released that are Holded	60%	56%	52%	40%	28%	20%

Source: own work.

By analyzing the whole calculation table in appendix D, we can see that for the first five years, each year the Private Sale owners will sell 2000 tokens, a total of 10% of all tokens at the end. The same applies for the founders, in light of the assumption that, if a foundation sells more than half of its tokens and holds 10% to 15%, the token society will take care of the foundation's progression. Nonetheless, if the foundation requires more time to pass a balanced decentralization, it can be exposed to a lack of impact in further development, except in case the token gains value rapidly in continuity (Mougayar, 2017). Meanwhile, since we assumed that the foundation will exist for 30 years and total supply of tokens is 100,000, each year the foundation releases 333 tokens. Having said that, we observe an increase of tokens in circulation through time. The aggregate number of tokens released is the sum of private and public sale on one side and the foundation and its founders on the other. The table above shows some of chosen years for the purpose of giving the reader an overview.

The second section represents the crypto economy, resulting in the calculation for M - the necessary monetary base to support the NAUT project's GDP. We assumed that the customers' cost of mooring (P) will be on average 50€ and since a growth of vessels is perceived for the last period, we additionally assume an appreciation of mooring price by 2%. As already stated in the Nautilus project presentation, there were 608,247 booked moorings (Q) last year in Croatia. Because of an increasing demand for moorings, we assume there will be a 1% compounded annual growth rate of number of moorings. Furthermore, there is an expectation of 85% of total addressable market (TAM) and lastly, a velocity (V) of 55, taken from the VOLT evaluation model. We decided to go with same velocity just to be as consistent as possible with assumption for a higher accuracy of the results. NAUT economy inputs can be seen in the table below.

Table 3: NAUT assumptions

Metric	Assumption
Cost per Mooring	50.00€
Cost appreciation for mooring	2%
Annual global booked overnight moorings	608,247
CAGR for global overnight moorings	1%
% of mooring market addressable for NAUT	85%
Velocity	55

Source: own work.

The calculation table 4, which consists of some chosen years from the first to ten years in future, is quite straightforward and clear. Moorings average costs appreciate and so does the number of all available moorings. Nautilus solution is able to capture a maximum of 85% all available moorings in Croatia.

Before we get the calculated M, we firstly need to estimate how much traffic is taken over by NAUT through years. The author corrects the model by using a simple S-curve formula with some inputs, which are shown in the table 5.

Base year is the starting year of the project and the adoption. The percentage of 90% saturation indicates the utmost takeover proportion of NAUT potential market. This represents 508,581 facilitated moorings out of 588,406. We aim for such optimistic and high saturation, because our project aims to enter a relatively small market - one economy and additionally, we assume that we would experience a booming demand, because of such a user friendly and unique product. Saturation percentage input has a large effect on the results. The start of fast growth represents a key growth point of the economy, which is set up to happen in just one year. The latter dictates the slope of the S-curve. Finally, the take over time presents image of time reaching a 90% of its saturation percentage. All inputs are subjective and derived from our own assumptions. The author's evaluation model also contains a hack adaptation, which appears in the start of the crypto project at minimal adoption. The Adoption table of outputs can be seen in the appendix D, but we can see a clear result within the graph below.

Table 4: NAUT economy and Utility Value Output

Year From Launch	2018	2019	2023	2026	2028
Cost per mooring for NAUT use (€/mooring)	50,00	51,00	55,20	58,58	60,95
Annual global overnight moorings	614,329	620,473	645,666	665,231	678,602
Annual global moorings available to NAUT	522,180	527,402	548,816	565,446	576,812
% Share of mooring Market Facilitated by Token	2.28%	6.24%	49.24%	78.24%	84.48%
Traffic Facilitated by NAUT Each Year (moorings)	11,891	32,901	270,256	442,395	487,270
GDP Facilitated by NAUT Each Year in €	594,547	1,677,935	14,919,200	25,916,826	29,698,994
Monetary Base Necessary in €	10,810	30,508	271,258	471,215	539,982
Current Utility Value of Each Token in €	**0.15**	**0.39**	**2.95**	**5.07**	**5.76**

Source: own work.

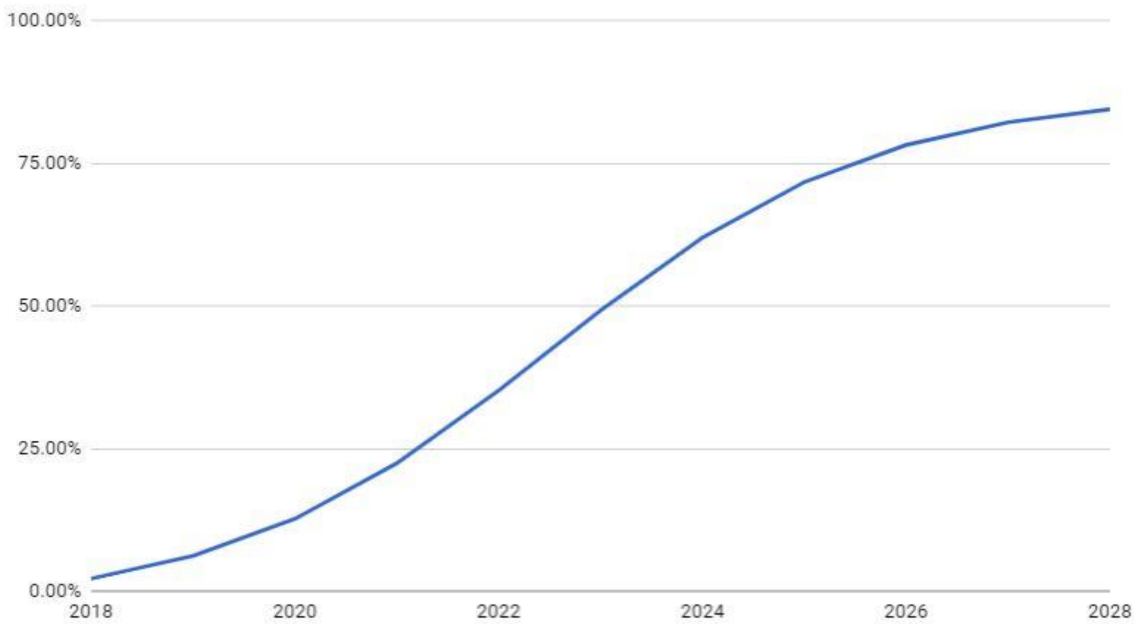
Table 5: Adoption S-curve inputs

Metric	Assumption
Base Year	2018
Saturation Percentage	90
Start of Fast Growth	2019
Take Over Time	7

Source: own work.

By having the Adoption curve outputs, we can proceed the explanation of the NAUTILUS economy table. The next row we have is the row that estimates all facilitated moorings - traffic (annual available mooring to NAUT multiplied by the percentage of market facilitated by NAUT). Forward on, we seen the NAUT GDP, which we obtain by multiplying the traffic facilitated by NAUT and the cost per mooring. This is also increasing accordingly to all assumptions at beginning. The necessary monetary base to support the whole NAUT network is a result of NAUT GDP divided by the project's velocity. These requirements are logically increasing, as is simultaneously the number of facilitated moorings, transactions, tokens and circulation. Finally, by dividing each year's necessary monetary base with the aggregate number of released tokens, we attain the tokens utility values, which resemble the classic cash flows of a non-crypto project. The NAUT token starts with an estimated token utility value of 0.15€ and reaches a value of 5.76€ at year ten. This is an optimistic increase of 3964.2%, but certainly possible. Note, that the author's utility value is calculated by using the number of tokens in float after bonder and holder, instead of the aggregate number of tokens, as we did. This is because we are not excluding the existence of those tokens, nor the value of them. We argue that this would be the same to say that the amount of euros you save in a piggy bank are valueless.

Figure 4: S-curve of Saturation Percentage of NAUT by year

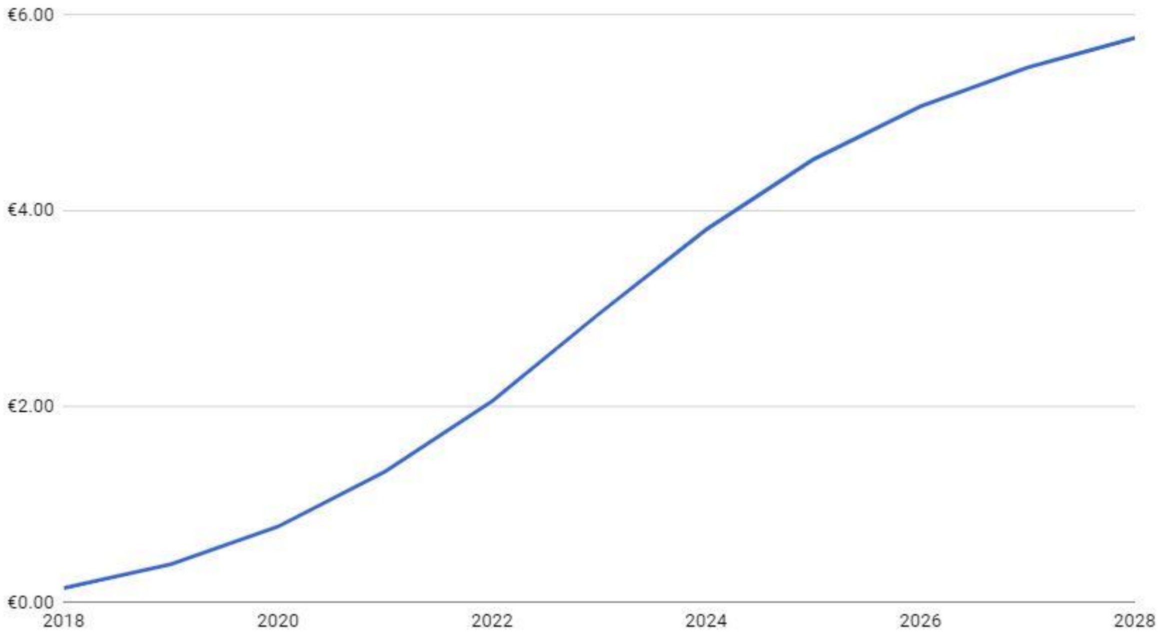


Source: own work.

Within this master's thesis, we do not agree with Burniske on the part that tokens that are bonded or holded are not included into the utility value calculation. It is just like having your saved money in the piggy bank and asserting that it does not have any value.

Our utility value is a prediction of each year's future value of NAUT token that is necessary to maintain the network "alive". The same goes for the size of the network. In addition, the utility value is not corresponding to the market value of a crypto asset. The appraisal for that is realized on the crypto asset exchanges by the people who invest and believe in this technology, at least to some extent. For now, these activities represent nothing more that speculation. To illustrate you a comprehensive increasing token utility value, we present the graph below.

Figure 5: S-curve of NAUT utility value by year



Source: own work.

At the end, we shall overview the final part of this model. This section discounts and brings all future values of each year to a value in the present. In other words, pulls the cash flows backward in time by dividing them with our pre-set interest rate. It is finding the equivalent value today of a future cash flow—is known as discounting (Berk & DeMarzo, 2016). Since the crypto asset, investments are relatively risky compared to stocks of well known firms on the market, NAUT interest rate is set to 30%. The discounting technique is not increasing by additional years as it is in the classic DCF, due to the fact that a NAUT token gets into someone else's hands once it is used. Discounting inputs are shown in the table 6.

When discounting NAUT utility value of 5.76 € from year 2028 discounting to present value it at a rate of 30% yields a rational market value of 0.42 €. The estimate is done by dividing 5,76 € with $1{,}30^{10}$. We should not omitt, that there is an apprehension at the point when the saturation percentage of NAUT reaches its goal. There could be less and less holders and therefore a higher chance of perilous crypto asset appraisal.

Table 6: Table of Discounting inputs

Metric	Value
End Year	2028
Years Between 2018 and End Year	10
Discount Rate	30%
Market Value in 2018 based on Expectations for Future Utility	0.42 €

Source: own work.

Lastly, we can have a look on the results of current utility value in year 2018 versus the expected and discounted utility value, which is a deduction of NAUT market value in 2018 based on Expectations for Future Utility (0.42 €) and the current utility value in 2018 (0.15 €). A portion of the discounted value from year 2018 in already covered by the current value, while the rest should be supported by the anticipation value in future.

Table 7: Current utility value in 2018 vs. discounted expected utility value

Metric	Value	Percentage of Value
Current Utility Value in 2018	0.15 €	35%
Discounted Expected Utility Value	0.27 €	65%

Source: own work.

Undoubtedly, there is a place for a thought of some ambiguity, since a substantial percentage of the NAUT crypto asset value is situated on forthcoming prediction and that puts a curtain of speculation to the whole thing. However, this aspect has been practiced for decades on stock trade markets, where people spend money by buying stocks above their book value based on future forecasts.

In conclusion, we can observe, that the Nautilus token market value is covered by 35% of its utility value, which could be seen as satisfactory.

Discussion and model analysis

Evans (2018) says that it is obvious that “the output of the model is extremely sensitive to variations in the hard-coded values for both the discount rate and velocity, neither of which is explored in detail”. What is controversial in INET model, is that crypto assets not intended to be stored and by that, not expect higher value in future, will most likely undergo a decrease in value and desirability due to high velocity, which is a consequence of the crypto community not holding the token, because there are no worthy reasons. Of course such opinion is quite reasonable, but hard to put in practice. The latter can be seen as a lack of accuracy at determining and measuring the velocity through time. Burniske in his model assumes that the velocity remains constant, which is definitely too generalized. A big disparity can emerge, since P, Q and M figures are individually measured based on dissimilar points of information.

When doing a recap on Evan's comments on velocity thesis, we can find that he sees the velocity being used as a variable that completes or in other words put equal weights on both sides of the equation P*Q = M*V, but instead in many times just seize the flaw of our calculation of other changing inputs. Velocity P * Q divided by M, should be calculated and observed alone, without a correlation with other variables and obviously forecast a varying volatility through time. This leads us to a conclusion that not everything depends on the value of velocity, but velocity still has a big effect on the token's value. More importantly is to find an answer on how velocity alteration correlates with alterations within P * Q. If there are no correlations, the crypto asset utility value decreases or increases narrowly with demand of the elemental utility. On one hand, we would see dissociation between crypto asset value and its rise of transaction number, when the correlation is high and positive. On the other hand, there would be many uncontrolled price fluctuations, respective to a higher or lower P * Q. Thus, we should study the rates of growth of P * Q and velocity to establish velocity thesis, which states that the utility value of a token deteriorates, when the velocity increases at a higher speed than P * Q. Many advocate to customly use the velocity abolition methods. Probably the best-case scenario to use the velocity is to use it when is precisely precisely determined. After elaborating the velocity thesis, we can conclude the model analysis with few observations from a monetary theory point of view.

The INET model puts in the same pool the demand for in our case NAUT token, as well as the demand for moorings. Thus, the demand for cash should be independent of demand for various commodities. The INET model additionally isolates the token and its economy from the potential market competitors within the same industry or supply. It is just like having one provider of bicycles with its unique currency, therefore without any rivalry. The demand of NAUT should be than constructed out of expected returns of other firms and their products. What's more, the speculative and transactional demand should be idealistically separated, in order to obtain different pull factor and incentives. The INET model's demand of speculation is apprehended within the decline of mooring supply, meaning that the tokens are out of the market float. When a token is considered as a non store-of-value asset, its speculative demand should be redirected to another asset in a fashion that value is found in the monetary demand. There are many internal clashes within the crypto world and its economies. Clashes originate from cost of transactions, insolvency, disruption, transaction fees and so on. All mentioned could be improved by adopting and modeling these clashes, additionally design their attitude and analyze their impact on various assets demand. The INET model does not calculate any correlation between P * Q and velocity, but meanwhile there is a perfect correlation between P and P *

Q. The velocity estimate should alter each year and be notable compared to other variable inputs, such as money supply. Only this way, we can observe and analyze all outcomes derived from P * Q and value growth. To conclude and carry on on the last mentioned part, the INET model also ignores the disbursement motive. The only important mathematical part at the end is that all payments reach the same total as the volume of transactions. But it is not the same if a user acquires a large sum of crypto assets once a year and consumes them moderately through time, or if the user acquires the same tokens only when he needs them, many times in small sums within a period. The impact on the crypto asset's value are significantly different. To repair this neglection of Burniske, we should look on velocity and value by forming various reimbursement motifs in a singular, unique way (Evans, 2018).

4.2 VOLT Valuation Model

The next evaluation model with which, we try to justify the value of our fictitious crypto asset is called the VOLT model by Alex Evans. This model is also based on the classic DCF model as the previous one from Burniske, but with some additional adaptations. It is a sort of upgrade and critique of the INET model that tries to remedy a few important notable issues. VOLT is also an Evans' fictitious token that enables its holders to buy or better, exchange the crypto asset with electricity under market prices. The author presupposes that in this economy, there is on one hand the VOLT asset and on the other, the store of value asset with an expected annual return (Evans, 2018). Each token within VOLT community has at the start of the year an anticipated annual rate of return. If somebody wants to buy the product that the token is supporting, he has to exchange a fiat currency with VOLT token and than buy the product with VOLT, meaning there are two transfers and each transfer charges the user with a transaction fee. Evans uses the Baumol-Tobin "cash inventories" approach within his VOLT evaluation model.

Before continuing with the model, we shall first explain some essential parts of the formulas used at the beginning. The transaction fee is C. These costs are for making the exchange between a store of value and the VOLT token. The total necessary transactions to support or enable an unwrinkled operating course of the network is N. R is the anticipated rate of return of the asset with some store of value. Finally, we have the GDP of the crypto asset's economy, which is Y. This is basically the sum of all money consumed that the community intent to spend on the token every year.

In order to obtain the total cost from transaction fees, we need to multiply C * N. The total average money remaining in the account of the VOLT economy is Y divided by 2N, since there are always two transactions. One is for instance from euro to VOLT or in our case NAUT and the other is made when a user pays or exchanges the token for a specific product, supported by the same token. An omitted part of the VOLT/NAUT token return is calculated by R * Y / 2N. In order to diminish the expenses, the community grips to N, accountable to C, R and Y. The formula for the total cost function would be R * Y / 2N + C * N. The transmission forms the formula source in regard with N, we get:

$$-\frac{R * Y}{2N^2} + C \tag{6}$$

For a diminishing expenses formula for N, the formula should be even with zero. We get:

$$Minimum - cost\ N = \sqrt{\frac{RY}{2C}} \tag{7}$$

To achieve a money demand curve with respect to C, Y and R, we need to place the aforementioned formula with its value in the Y/2N formula. The result is the money demand function:

$$Average\ VOLT\ holding = \sqrt{\frac{YC}{2R}} \tag{8}$$

The conclusion is that the diminishing expenses (cost-minimizing VOLT/NAUT) that the community possess every year, which is constructed by GDP / Y, R and C is the same as the money demand.

At this stage, we could argue that we have the indispensable basis for attaining the velocity outside of a straight connection to the monetary concept M, within the equation of exchange. Having said that, velocity can be interpreted as the same as optimum figure of transactions, multiplied by two. It is equivalent to VOLT's evaluation model GDP of economy over the request for the VOLT/NAUT balances. The rationale is that, once a user buys a token with a store of value currency, such as dollar or euro and later buys with that token a product that possibly derives from the same company that issued the token, it is considered that the token changed hands twice. With all mentioned above, the VOLT evaluation model presents a volatile or variable through time velocity, which was wrongly a locked input in the INET model. Alternatively, VOLT model sees velocity as part of function C, R and Y, at the side of money demand. Attention, the final outcome should be still MV = PT, meaning that the Y * V is the same as money demand.

The VOLT model does not include or consider any holders of NAUT tokens, instead users rather possess the store of value asset, since they are reluctant to take risks. Nonetheless, it is curious that all three money formulas above are accomplished by different assets. Firstly, we use the euro, which is the constitutional unit of our account. Secondly, we use a store of value asset and finally, NAUT, which is an instrument of commerce. Nautilus project assuptions for VOLT model can be seen in the table below.

Table 8: VOLT's model: Nautilus project assumptions

Money Supply Assumptions	
Initial Year	2018
Total Initial Tokens Issued	100,000
% Annual Inflation	0%
% Issued to Founders	10%
Percent of Tokens Issued in Private Sale	10%
Founder Vesting Period (no. years)	5
% Issued to Foundation	10%
% Reserves Spent By Foundation Annually	3.33%

Source: own work.

Again as in the INET model, our Nautilus project consists of 100,000 tokens all together. The founders get 10,000 tokens and release 2,000 tokens each year for the first five years (founder vesting period). The same model applies to the tokens sold in the private pre-sale (before the ICO). The users who bought up to 10% of all tokens in the presale can re-sell up to 2,000 tokens altogether each year. Thus, we assume that they will sell the maximum possible amount every year. The last part is the value of 333 spent each year by the foundation. The foundation comes into possession of 10%, meaning 10,000 tokes as well, but spends 333.33 tokens every year for the next thirty years, which is derived by the assumption of the foundation's lifecycle. The difference with the INET model is that this model is capable of considering the inflation of money supply. In our case, the inflation is equal to zero because we release all tokens at the beginning. Token distribution can be seen in the table 9.

All VOLT's model assumptions for the demand table are not completely applicable with the Nautilus project inputs for the purpose of obtaining a reasonable outcome. Hence, we adopted few things. As previously stated, our cost of mooring stays the same as in the INET model at an average of 50 €, but with one difference, the price does not change through time. Note that this assumption is applied only for the Croatian market. The annual booked overnight moorings are again equal as before in INET and are increasing year by year with a 1% growth rate. As we reckon our project very optimistic, we think that the Nautilus project is able to achieve or reach up to 85% of Croatian moorings market at best-case scenario as shown in the table 10.

Table 9: Token supply by years

Annual Money Supply	2018	2019	2020	2023	2026	2028
New Tokens Issued		0	0	0	0	0
Tokens Released By Founders	2,000	2,000	2,000	0	0	0
Tokens Released from Private Sale	2,000	2,000	2,000	0	0	0
Tokens Released By Foundation	333	333	333	333	333	333
Total Circulating Tokens	74,333	78,667	83,000	92,000	93,000	93,667

Source: own work.

The goal is to achieve the necessary Y to satisfy the network to operate. Even Evans admits there are some understatements of assumptions.

Table 10: The Nautilus Demand Assumptions

Moorings Demand Assumptions	
Cost per mooring for NAUT use (€/mooring)	50.00 €
Annual Croatian booked overnight moorings	608,247
% Mooring Growth	1%
% of Market Addressable by NAUT	85%

Source: own work.

In light of a more realistic percentage penetration by year, Evans also uses the S-curve for adoption. For accuracy and consistency, the S-curve adjustment as from INET evaluation model is included and with some assumptions in the table 11.

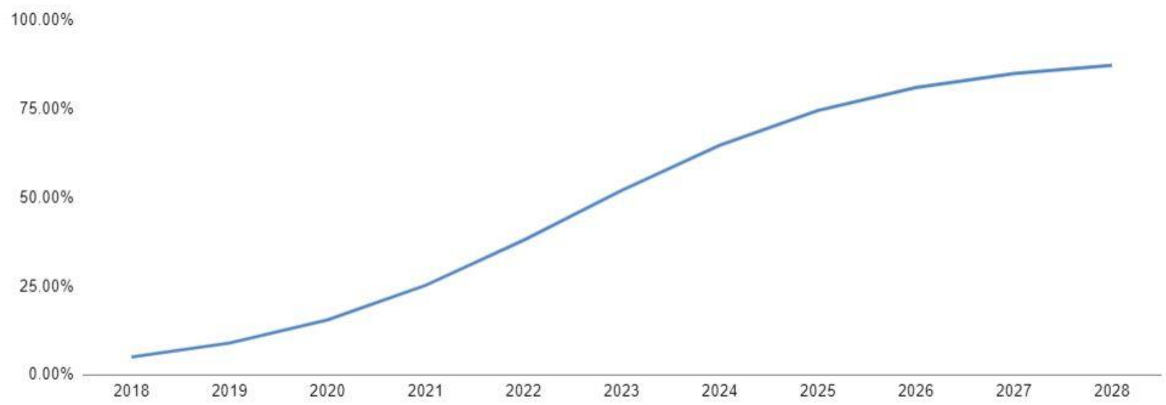
Table 11: S-curve inputs

Market Adoption Assumptions	
Peak	90%
Base Year	2018
Start of Hypergrowth	2019
Takeover Time (no. years)	7

Source: own work.

We optimistically assume that we will experience a quite significant higher growth from second year and to reach the goal of 90% of penetration of the 85% addressable Croatian market in 7 years.

Figure 6: Adoption S-curve of NAUT



Source: own work.

The graph above can serve us as an overview of NAUT conquered market percentage each year. In the table 12, we can observe an increasing number of total moorings through time by 1%, as well as the total number of addressable mooring to NAUT token, that we calculated by multiplying each year's total mooring with 85%. In between, we can find the total amount spent on moorings in Croatia in euros. At the bottom of the table, we can see a drastically growth of moorings provided by the Nautilus foundation's token and finally, the GDP of NAUT gained from total mooring provided multiplied by the average price of a mooring, which is 50€.

Table 12: Mooring Demand outputs

Annual Mooring Demand	2018	2019	2023	2026	2028
Total Moorings annually	614,329	620,473	645,666	665,231	678,602
Total Moorings Spend in €	**30,716,47**	**31,023,638**	**32,283,322**	**33,261,539**	**33,930,096**
Annual global moorings available to NAUT	522,180	527,402	548,816	565,446	576,812
Moorings Provided by NAUT	11,891	32,901	270,256	442,395	487,270
Annual Spending in NAUT in €	594,547	1,645,035	13,512,780	22,119,762	24,363,519

Source: own work.

Now we need to shape the demand curve. For this matter, we need an expected rate of return from the store of value asset, the cost or fee of a transaction and a transaction deteriorating line. We assumed the expected return, which is considered as the risk free rate to be 5%. It is quite high, but we already emphasized that we feel optimistic with the Nautilus project. If you want to be more realistic, we advise you to have an expected return of 1% or 2% as it has a normal national bond. It would be more accurate to additionally adjust the risk free rate through time. We assumed a 20€ transaction cost, which in the author's opinion is an underestimation. The transaction cost could be represented by the transaction fees obtained by nodes or miners, exchange fees and spreads, illiquid costs, imbalances stimulating the community to prudently hold the token for a fluent operating network, then the delays for transaction validations, additional expenses for the exposures to risk or token possession, any disruption or other burdens. Definitely, a normal user's psychological agitation of unpredictable token's future value is the most powerful. Obviously, the more precisely our appraisal of the transaction cost is, the more our result will be realistic at the end of this evaluation model.

The predominant curiosity is to examine the velocity thesis that asserts the values of the token's utility will go downward close by the transaction costs through years. Evans structures the transaction costs such way that decrease over time, eloquently with the already used S-curve adoption. One argument of lowering transaction cost could be that the community becomes more use to utilizing the crypto asset, another could be due to the second layer scaling solutions. Let us now look at the table 13 with inputs for the tansaction cost curve.

Table 13: Transaction Cost Decline Curve

Transaction Cost Decline Curve	
Peak	30%
Base Year	2018
Start of Accelerated Decline	2021
Takeover Time (no. years)	10

Source: own work.

We assumed that the transaction cost would reach a 30% decrease within ten years, but start rapidly declining in three years, meaning in year 2021, when the hyper growth starts (i.e. when mainstream users, not just early adopters, begin using the network as per the traditional S-curve "diffusion of innovation" theory). Now that we made all necessary assumption, we can have a look at the Annual Money Demand table and compare the utility values through time.

As we can notice, the transaction costs decrease to 7.4€ in ten years, in respect with the starting point at 20€. This can be justifiable by assuming that through future years, there will be more and more transaction, so the nodes will still have enough simulation to operate and do their work. By using the functions from beginning of this evaluation model, we calculate N (the transfers needed to support the NAUT network), as a function of NAUT Y, the risk free rate or in other words the expected rate of return and finally, the transaction costs (C). Mathematically speaking, we can calculate the N by multiplying the

NAUT revenue with the expected rate of return and divide this amount with the square root of transaction cost multiplied by two, since there are always two transactions in order to use the NAUT token. To continue, we need to explain the average NAUT balance held in euro. The latter is equal to divide the NAUT revenue of each year with 2 * N. This result tells us what is the necessary amount of money each year to support a smooth functioning network. Furthermore, we estimated the amount that users should get, but forget each year. That is average NAUT balance held times the expected return. An important parameter for VOLT model is obviously, the velocity. It is determined by how much of average NAUT balance held value (money demand) is represented within the NAUT revenue. By dividing these two factors we figure how many times each token changes hands in a particular year. By multiplying the transfers by two, we calculate the velocity. Finally, the utility value of token is obtained by dividing the average NAUT balance held (money demand) in euro with the total amount of tokens in circulation (money supplied) within each year.

Table 14: Money demand annually

Annual Money Demand	2018	2019	2020	2023	2026	2028
Transaction Cost in €	20.00	19.74	19.34	16.80	11.49	7.40
Number of Transfers Per Year (N)	27	46	66	142	219	287
Average NAUT Balance Held in €	10,905	18,018	25,622	47,641	50,413	42,467
Annual Forgone Return in €	545	901	1,281	2,382	2,521	2,123
Token Velocity	55	91	132	284	439	574
Utility Value Per Token in €	**0.15**	**0.23**	**0.31**	**0.52**	**0.54**	**0.45**

Source: own work.

For a more comprehensive insight, you can find the table of the transaction costs decline in percentage by year in appendix E, as well as velocity and GDP growth at the end of this master's thesis.

Above all, we must not forget that this is a DCF based evaluation model. At the end of all elaborated so far, we shall use the discounting method to bring back to present the future utility token value. The discounting rate is differently structured compared to the discount rate from the INET model. The VOLT model consists the risk free rate or the expected rate of return and the risk premium. Considering we want to remain consistent, we assemble the risk free rate of 5% and the risk premium of 25% to yield a 30% discount rate as shown in the table below.

Table 15: Discounting inputs

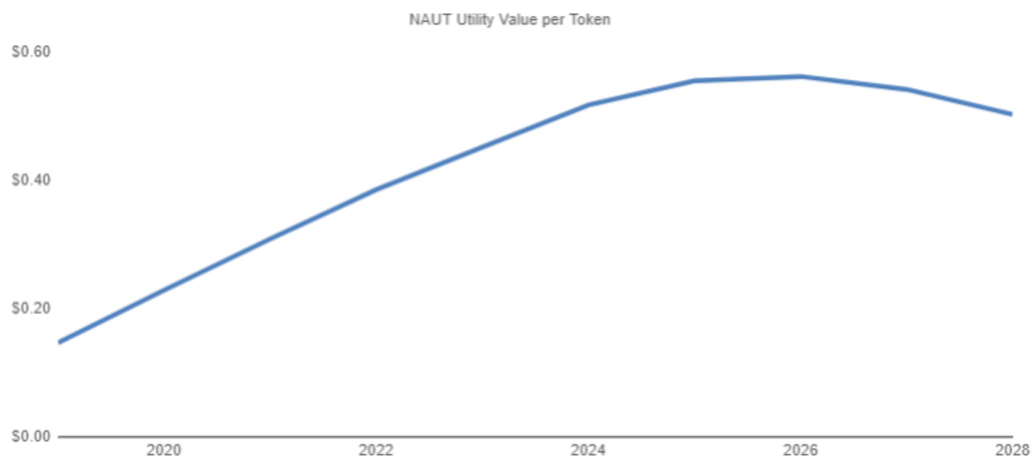
Discounting Future Value	
Initial Year	2018
Final Year	2028
Return on Asset	5%
Risk Premium	25%
Discount Rate	30%
PV in 2018 of Utility Value in 2028	0.033 €

Source: own work.

The result is that the forecasted token utility value 0.15 € is much higher that the present value in 2018 of utility value in 2028. In essence, NAUT would have to trade at a higher level to harvest an above zero expected return for a holder that plans to detain the token until 2028.

When observing the table of the annual utility token value, we encounter an interesting phenomenon of the adoption s-curve from year 2026. First, the curve increases utill year 2024 and 2025, when it reaches the highest value and from there, it starts to decrease, although the revenue is still increasing. This is an example of an accurate forecast obtained from the velocity thesis. All mentoned in this paragraph can be observed in the graph below.

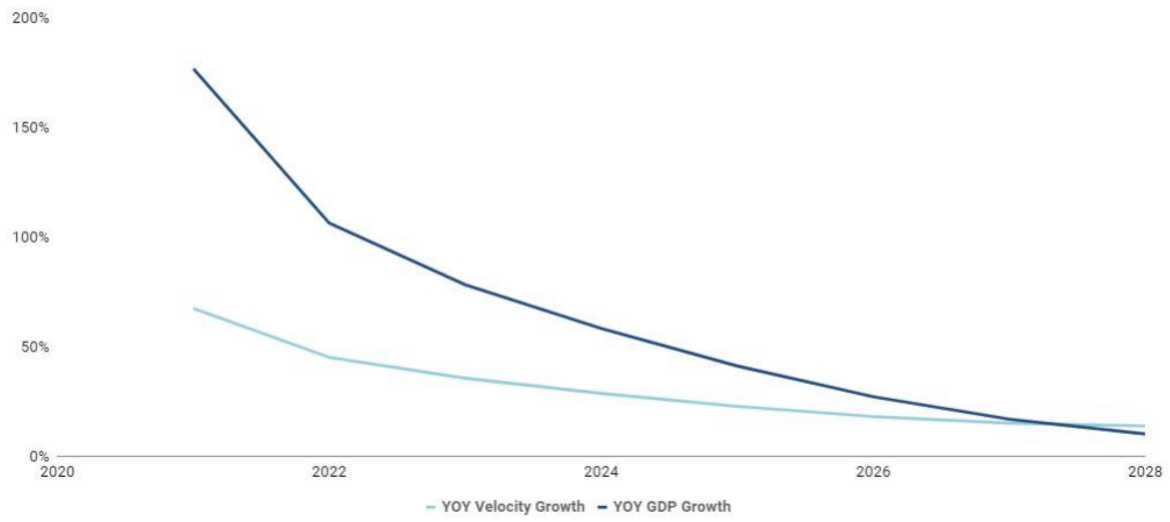
Figure 7: NAUT Utility Value per Token



Source: own work.

The INET evaluation models could not allow such a slope, because the crypto asset demand and the money demand are considered as one equivalent thing. To make it clear, let us turn back to the velocity theis. When troubles or distortions within the network happen and have a consequence of a downturn for the economy, the utility token demand descents, while the velocity encounters rise and engulfs the growth of GDP (P * Q). Let us look to what extent coincide the growth of GDP and velocity in the graph below.

Figure 8: GDP vs Velocity Growth Rates



Source: own work.

As demonstrated, the velocity gains higher figures from 2026 and beyond compared to the NAUT GDP growth, hence bringing a burden on price increasement. Nevertheless, there is a significantly bigger balance brought from booked NAUT moorings in year 2028 in comparison with year 2025, the crypto economy is capable of fulfilling the increased demand and at the same time possess 20% less NAUT tokens remaining in the account. Users can detain more store of value assets and generate more transfers with lower NAUT amount rather than scarcely any big transfers to dodge the forgoing return, attributable to decreasing costs of transactions. A posteriori points that an increasing velocity simultaneously leads to a declining demand of money. On one hand, velocity is a part of the NAUT GDP formula and on the other hand, it is influenced by the transaction costs. Our costs of transaction meet a downward boost in five years, after 2023. In case of a constant declining rate, the decrease in the transaction cost would be moved five years in the future, where Y and velocity would in the meantime drop conjointly.

While we can see an almost perfect positive correlation between the Y (GDP) and the velocity in the table below on one side, we have an inverse negative correlation betwixt the velocity and the transaction costs, which is just fine. The crucial and final correlation to subsume it under our velocity thesis is the one that measures correlation between the GDP and the utility token value. In our case, the correlation is positive and quite high at 0.84.

Table 16: Correlations of GDP, Velocity, Transaction costs and Utility Value

Correlations	
GDP & Velocity Correlation	0.98
Velocity & Transaction Costs Correlation	(0.98)
GDP & Utility Value Correlation	0.84

Source: own work.

All of this manifest how velocity is able to dissociate the utility token value from GDP enlargement. Compared to the figures from the INET evaluation model, we have an absolute correlation of one amongst the token value and the GDP growth and additionally, we see conversely a zero correlation between GDP growth and velocity. The latter correlation is quite notable, considering that, we start from same assumptions and base on the same classic evaluation model of DCF. Lastly, we can say, that the NAUT utility token value from the VOLT evaluation model rely upon external variables, meaning from variables that are outside of the core of the network, such as the costs of transactions and the risk free rate/expected rate of return.

By finishing this evaluation model, we should say some words on the sensitivity analysis of initial transaction costs and the expected return on the store of value assets as shown in the table below.

Table 17: Present Value in 2018 of Utility Value in 2018

		Expected return on store of value assets				
	0.03289€	0.1%	1.0%	5.0%	10.0%	25.0%
Initial transaction costs	400 €	1.2500	0.2616	0.0890	0.0451	0.0112
	200 €	0.8839	0.1850	0.0629	0.0319	0.0079
	20 €	0.2795	0.0585	0.0199	0.0101	0.0025
	10 €	0.1976	0.0414	0.0141	0.0071	0.0018
	2 €	0.0884	0.0185	0.0063	0.0032	0.0008

Source: own work.

The results in red are under the present discounted utility value. Note that the results depend largely on various dissimilar inputs for the transaction costs on one hand and the expected return on the other.

Discussion and model analysis

The VOLT models sets the price of the token for each year in a manner that it is totally dependable on Y, which is the GDP of the NAUT economy calculated by determining the future market size. Continuing with C, the costs of transactions, R, the expected rate of return or risk free rate and finally the number of total token released in the circulation. Antos and McCreanor (2018), the authors of a later evaluation model within this master's thesis based on the black scholes model, say, that all Evans' inputs and the model core structure principally ignore any probability distribution of other possible authentic monetary formulated value within the token estimation. The latter is quite acceptable since the NAUT token aims just on one economy, which is the Croatian market. Nonetheless, the VOLT does not include any possibility of a successful and genuine use case that reaches an unthinkable level of growth and international spreading. Hence, the model is suitable for a project with a concentrated particular target or area. However, just the discount rate includes the only suggestion of the value that presents image of the elemental probability distribution of profitable provisioning. Having said that, we can see that VOLT's model does not consider the chance that the NAUT crypto economy is build and designed successfully, or the possible overtake percentage of the targeted market set by the fundamental probability distribution, or the chance that the foundation puts on the market a really catchy and original mechanism/product/service. Antos and McCreanor point out a disparity between the token gaining value through time to year 2026, where a decrease in value emerges because of the velocity hike surpassing the growth of GDP.

There is obviously a lack of inducements towards costs reduction of transfers, if all other inputs remain the same, because when the transaction costs increase, the price of the token increase as well. At a possible consequent balance in the future, all above could not be viable. New successful or semi-successful crypto projects present incentives for similar project with less user and foundation costs or even sometimes a pushing force that separates just a vital part of the whole project and continues the life cycle of that adapted part. When having a perfectly competitive market without any fees for exiting or entering, at balance, the marginal costs of transaction has to be the same as the marginal revenue created by miners. To conclude, we shall again emphasize, that VOLT's models is not bad for an evaluation when the project's target is just one market, but ultimately it is weakly dependent on the external variables such as transaction costs and the expected rate of return.

4.3 A Model

A Model is a crypto valuation model made by ARK Invest. The company's director of research, Brett Winton, published it in late 2017. At ARK Invest, they began by looking at crypto assets as a new asset class. There are fundamental differences between them and more well established assets and therefore traditional valuation frameworks do not apply.

So they asked themselves, what do you pay for an asset that offers no claim on underlying business generates no operating cash flow and promises to pay nothing to its owners?

What they came up with, is this simple generic model for valuing crypto assets. It was presented on a fictitious decentralized blockchain-based social network application and the full example can be accessed and downloaded online. For our presentation, we will use this valuation model on our fictitious ICO project, Nautilus.

In the table 18, we can see the imputs and assumptions we used when evaluating NAUT token value. After entering our inputs into the model, we got the results presented in appendix C. In the table 19, we present the projects utility value, prices all six orders of investors would be prepared to pay and token’s price, generated by the model.

Table 18: Inputs used in A Model calculation for NAUT token

End market fundamentals		
Total daily moorings used	614,328	moorings
Mooring price	50 €	per mooring
Max target market reachable %	85%	
Adoption curve		
Launch year	2018	
Inflection year	2019	Start of mainstream adopter phase
Take Over Time	7	Project reaches maturity
Saturation Percentage	90	Maximum penetration of reachable market
Project fundamentals		
Initial token launch year	2018	
Start tokens	100,000	
User Velocity	55	
Investor fundamentals		
Investor discount rate	30%	

Source: own work.

Projects utility value is determined by the value of tokens that are held aside in user's wallets to facilitate projects transaction flow. It is calculated by dividing total GDP facilitated with velocity. Utility price per token is derived simply by dividing projects utility value by the number of tokens outstanding. Since there is no shorting mechanism, a project's value should never fall below its utility value and therefore utility price can be considered as the valuation floor.

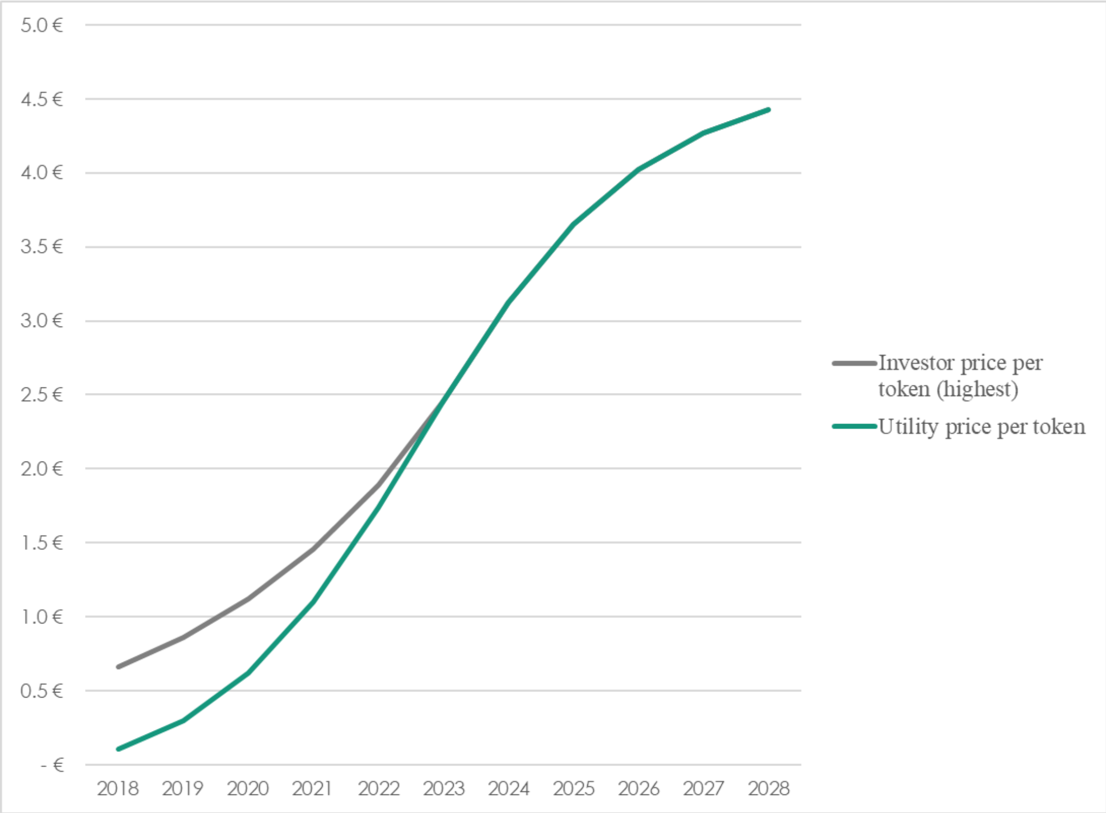
Table 19: Price per token of NAUT calculated by A Model

Category	Units	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Project utility value	euro	10,810 €	29,910 €	61,717 €	109,992 €	174,046 €	245,686 €	312,363 €	365,080 €	402,177 €	426,764 €	442,972 €
Utility price per token	euro	0.11 €	0.30 €	0.62 €	1.10 €	1.74 €	2.46 €	3.12 €	3.65 €	4.02 €	4.27 €	4.43 €
1st order investor price per token	euro	0.23 €	0.47 €	0.85 €	1.34 €	1.89 €	2.40 €	2.81 €	3.09 €	3.28 €	3.41 €	- €
2nd order investor price per token	euro	0.37 €	0.65 €	1.03 €	1.45 €	1.85 €	2.16 €	2.38 €	2.53 €	2.62 €	- €	- €
3rd order investor price per token	euro	0.50 €	0.79 €	1.12 €	1.42 €	1.66 €	1.83 €	1.94 €	2.02 €	- €	- €	- €
4th order investor price per token	euro	0.61 €	0.86 €	1.09 €	1.28 €	1.41 €	1.49 €	1.55 €	- €	- €	- €	- €
5th order investor price per token	euro	0.66 €	0.84 €	0.98 €	1.08 €	1.15 €	1.19 €	- €	- €	- €	- €	- €
6th order investor price per token	euro	0.65 €	0.76 €	0.83 €	0.88 €	0.92 €	- €	- €	- €	- €	- €	- €
Price per token	euro	**0.66 €**	**0.86 €**	**1.12 €**	**1.45 €**	**1.89 €**	**2.46 €**	**3.12 €**	**3.65 €**	**4.02 €**	**4.27 €**	**4.43 €**

Source: own work.

Beside tokens that will be bought by users, there will be tokens bought and held aside by investors. They will not use them to make transaction on project's network but will hold them in anticipation of future price appreciation. In case of many crypto assets today, as they do not have working products, every holder is an investor and entire value of the asset is determined by the potential return expectations. Investments however, require a rate of return. The investor must be rewarded for not spending the money today, as well as compensated for risk that the investment will not pay out as planned and the price will go wrong way. These factors determine investor's discount rate and together with investor's timeframe help determine how much he is prepared to pay for a token.

Figure 9: Price per token of Nautilus, calculated by A Model



Source: own work.

The first-order investor, who bases his decision only on anticipating future utility, would demand his price before buying a token. However, these are not the only investors, but there are other investors that are using the same valuation models, rather than anticipating future utility, might anticipate the price that a future first-order investor will be prepared to pay for owning the token. This investor has same expectations and looks over the same realization timeframe, but anticipates that he will ultimately sell his token to a first-order investor, rather than to a network user. Next layer anticipates the value that second-order investors will pay and so on through fourth, fifth and sixth order of investors. Ultimately, the price per token should be the maximum amount that any of the potential holders will pay. Over time, the price setting moves from higher order speculators toward network users. Share of tokens held in user wallets for platform usage increases until the entire network is facilitating its utility function. With increasing share of token utility users, velocity should also accelerate.

In the figure 9 graph, you can see the price per token calculated by the model. We can see that up untill the year 2023, investors would determine the price of the token, as they would be prepared to pay a premium to the current utility price for future expected gains. From 2023 and onwards, the price would be determined by its utility value. This means that investors will not be prepared to pay a higher than utility price for their investments as they could not realize their expected gains in the future. The A Model also expects a 100% utility usage of tokens in 2023 and therefore any price changes in the future would be based solely on the projects utility value.

As said in the beginning, this is still a simple generic model for valuing crypto assets and is intended to illustrate some of the key drivers of token valuation. There is also an important factor that this model does not capture, which is the potential of creating a revolutionary project and disruptive technology/business model. This potential upside is not included in the model and could be of significant difference if the project was to achieve something like that. Another shortcoming of the model is that the velocity used is made as an assumption and is constant.

4.4 Crypto Valuation Model Based on Black-Scholes Model

For now, we have looked at valuation models that focus on tokens intrinsic value. There have however been but few new valuation model concepts presented that try to understand market efficiency in crypto assets. This model tackles this problem head on and aims to identify the unstated assumptions and proposes a theoretical valuation framework that includes expectations about the big potential upside of crypto assets as well as the massive potential downside. It is supposed to factor in the potential that crypto asset and project behind it will create something disruptive or revolutionary that will create a massive new design space and on the other hand, the possibility that crypto asset will turn out to serve no real purpose. Crypto valuation model based on Black-Scholes model was published in 2018 by Johnny Antos and Reuben McCreanor.

There is a danger of expecting a linear change when making assumptions and expectations about crypto assets. Burniske (2017) notes, that change is actually exponential. With that said, most of current crypto evaluation models seem to disregard that and still deal in determining rational token prices using narrowly defined target market sizing concepts. Nevertheless, if crypto assets are truly revolutionary and change is exponential, there should be a different way to value them.

This valuation model is motivated by the idea that it is easier to predict long-term prices than short-term. Authors took the view that actually, both, long-term and short-term are unpredictable and predicting prices in longer term will probably not stand, since we are dealing with extremely nascent industries. In the future, an industry with such development potential will probably have products that we cannot imagine today. Therefore, if we are not able to image such revolution, we can say that it is nearly imposible to accurately asses a rational price for crypto assets.

Crypto Black-Scholes

Let us look at the adjusted Black-Scholes framework for crypto assets valuation. It is conceptualized as a crypto call option on the real economic resource for some provisioned product. It includes the volatility in the outcomes of real world delivered economic value, which authors hypothesize as one of the major factors that could be driving utility token prices beyond what can be justified by the actual project development. As there was a rise of the information age with an increasing usage of internet, so should be considerd that it is probable that crypto assets will have a game changing impact on the world. Prior crypto valuation frameworks severely underestimate projects potential network value as they include only a finite number of uses for a given crypto asset. Since they are based on today's world, they only include what already exists and fail to grasp the potential of what may exist in the future. Prior crypto valuation frameworks also assume that utility tokens are just a lower-cost solution of transferring value for uses that currently exist. However, there might be some projects and teams behind them that on their path will not only deal with innovation to existing products, but will rather create technologies and new uses that will potentially cause huge disruptions. Authors of the model claim that investors implicitly believe that some crypto assets have the possibility of becoming ubiquitous, with innovations and uses beyond currently imaginable incremental innovation on existing technology infrastructure. Because of the hypothesis that some innovations could potentially lead to creating disruptive technologies and entirely new sectors in the economy, authors conceptualize the purchase of most tokens as a call option on the real economic value of both, the current envisioned uses and those uses that can only be conceived in the future, once these current uses have occured.

The token valuation in this framework may be considered as semi-strong form efficient, which means that they include past prices, as well as all current publicly available information and there can be no superior gains obtained by using either fundamental or technical analysis.

Imagine a crypto adapted Black-Scholes model for valuating a utility token as an European call option. We consider the European call option for simplicity reasons, even though there is no actual date of maturity. Partial Differential Equation in a traditional Black-Scholes model looks like this:

$$\frac{\partial V}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS\frac{\partial V}{\partial S} - rV = 0 \tag{9}$$

We will skip the explanation of variables and assumptions of a traditional Black-Scholes model and focus just on the adapted crypto version of the model. Variables in the crypto Black-Scholes model are defined as:

V - The price of the crypto asset
S - The real economic utility value of the underlying product provided by the crypto asset
t - Time
r - Risk-free rate
σ - Volatility of S
K - The frictional transaction cost of spending a token at exercise

Following are the hypothesized crypto analogies for this model:

1. The rate of return on the riskless asset is constant and thus called the risk-free interest rate.
2. The instantaneous log return of the real economic utility value is an infinitesimal random walk with drift; more precisely, it is a geometric Brownian motion, and we will assume its drift and volatility is constant.
3. This real economic utility value does not pay a dividend.
4. There is no arbitrage opportunity
5. It is possible to borrow and lend any amount of cash, even fractional, at the riskless rate.
6. It is possible to buy and sell any amount, even fractional, of the real economic utility value, this includes short selling.
7. The above transactions do not incur any fees or costs, we have a frictionless market at maturity, time T. Until T, there could be both, nonzero friction and transaction fees.

Assumptions one, three, five and seven are fairly reasonable. Assumption four might come true sometime down the road in the future and assumption six is not required right now in this context. What we are left with is the second assumption that the real economic utility value of a product that a crypto asset provisions is a random walk in the short term. This is not necessarily true. Expectations for a crypto asset’s adoption and real utility value usually do not change that quickly. In the longer term, however, one could justify that the movements of S are a random walk with drift. Since most of the projects are still in early stages and effectively untested, we could imagine that over time, as more and more crypto assets will be integrated into the functioning world, volatility will decrease. If someone was to argue that S does not fit into any sort of geometric Brownian motion that does not change any of the intuition behind the model.

Another important part in the Black-Scholes model are the greeks letters. When adopted for crypto assets, some interesting properties emerged:

Delta - measures the rate of change of the theoretical token value (V), with respect to changes in S. There is however a difference between stocks and crypto claims on the underlying asset. Traditional option has a claim on the underlying asset whose value by definition has an upper bound compared to crypto assets claim which is basically a claim on an uncertain value creation. Therefore, with crypto assets, S is unbounded until some time of maturity, T.

Vega - measures the sensitivity of V to volatility. The idea that the volatility of crypto assets value creation is enormous is essential to the models thesis. In addition, token value V strictly increases as σ increases, so Vega is greater than zero.

Theta - measures the sensitivity of V to the passage of time. In traditional Black-Scholes, the value of Theta measures the time (t) which is left until time T, which is the time of maturity. When European option reaches maturity (t = T), it can be either exercised (if in the money) or it expires (if out of money). That is why the time value is usually negative for long calls. In crypto, however, it is not clear what T would refer to. The letter T might refer to a point in the future where the asset would become successful or not and the market would have 100% certainty about the real economic value of the asset. However, a more realistic way to define T could be as the long run in which all potential economic value has been realized. Covering the possibility that protocols could always be forked or picked up by a new developer team, at some point in the future.

The intrinsic value of a crypto asset is S - K and now is probably very low or even zero. That is because there are currently no fundamentally transformative blockchain technologies that have achieved high adoption and utility yet. But if we look far into the future at the time T, with accompanying big volatility in the movement of S over that time, then seemingly high V could be justified as being 100% composed of time value.

Nautilus Black-Scholes

We will now evaluate our crypto asset Nautilus, using the crypto adjusted Black-Scholes model. Imagine the value of Nautilus crypto call option as a call option on the utility value of what crypto asset might someday provision. The formula we used is one for European option calls:

$$C(S,t) = N(d_1)S - N(d_2)Ke^{-r(T-t)}$$
$$d_1 = \frac{1}{\sigma\sqrt{T-t}}\left[ln\left(\frac{S_t}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)(T-t)\right]$$
$$d_2 = d_1 - \sigma\sqrt{T-}\,t \quad (10)$$

In the calculations for NAUT, we used 4 different utility values (S). Three of them are taken from valuation models we used before, the INET, the VOLT and the A Model. Fourth is a fictitious version of what could happen if we saw this project rise to unbelievable heights with new and disruptive technologies. Imagine that become the standard for the whole maritime industry, not just overnight moorings, or the developed technology for this project could be used in others profitable industries. We named this version APOT, as an amazing potential that the project could project. Since the project predicts a quite fast development and target market penetration by default, we took utility value of the first three years from the INET model. After that, the amazing expansion would start and so would the rise of assets utility value. The utility values we have predicted so far are presented in the table below.

Table 20: Predicted real utility value of Amazing Potential (APOT) scenario

APOT	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Real utility Value (S) in euro (€)	0.30	0.62	1.10	5.00	12.00	30.00	70.00	120.00	170.00	210.00

Source: own work.

The transaction costs (T) are taken from the VOLT model for all examples, since it was the only model to actually address transaction costs. The value we use is half of the transaction costs as from the VOLT model, because the VOLT model predicts the transaction cost once, at the point when fiat currency convert to crypto asset and a second time, when the crypto asset is used for its purpose. By using the adapted Black-Scholes model, we are interested for transaction cost when spending a token at exercise. That is the reason why the transaction costs from VOLT are halved.

The risk free rate (r) remains at 5%, as in previous valuation models.

For the time to maturity (T - t), which is expressed in years, we use first the ten years after the project's launch. In the first ten years, our fictitious project already achieves big market penetration and should already run a successful network. However, other crypto assets might have the maturity time of up to thirty years or even more and by that time, its disruptive technology and full potential could or should be delivered.

Next, we derive volatility (V) from the already presented valuation models. First, we calculated standard deviation of our four valuation models. All of them can be found in appendix B. We then decided to use two out of four standard deviations as volatility for the Black-Scholes model. The VOLT's volatility of 0.1061 (10.61%) and the INET's of 1.8963 (189.63%). We have decided to leave out APOT's volatility of 74.1974 (7419.74%), since it yielded similar results as INET's. A Model's standard deviation was close to INET's at 1.4999 (149.99%), thus, we also decided to skip it.

All results and calculations of crypto adjusted Black-Scholes call option for Nautilus can be found in appendix F. In the two tables below we present you the value of NAUT crypto asset, derived from the European call option formula using our assumptions. In the Table 21, the model was calculated with volatility of 10.61% (derived from VOLT model) and in the Table 22, the model was calculated with the volatility of 189.63% (derived from INET model).

When using volatility of 10.61%, we can see that based on utility value derived from VOLT model, the Nautilus token would have no value for all ten calculated years. In case of INET's utility value, we get our first value of 0.03€ in the sixth year. In the A Model that value would become 0.11€ in seventh year. In case of the Amazing Potential utility price scenario, we get the initial positive value in fort year, which in comparison to other models, is the start year of its amazing growth. We can also see that after amazing growth starts, the value of token also picks up and starts narrowing the gap to the real utility value. After tenth year, all values are still not near the real utility values with the exception of APOT scenario's values.

When using volatility of 189.63%, we can first notice that every model has a positive value already in its first year. Value also starts narrowing on its real utility value faster and if we look at the 10-year option for all input scenarios, we can see that value of token is almost the same as its real utility value. In some cases, that happens even earlier.

In perfect equilibrium at the time of maturity, only intrinsic value remains, since there is no time value remaining (V=S-K). However, we can see that volatility has a big impact on the calculated value. When using the volatility of 189.63%, the token value is pretty much similar to real utility value for all ten-years options. A volatility higher than this caused the token value to be closer to utility value even in earlier years. With a lower volatility such as used in the first model, we see that token values do not come near real utility values. The only exception is the APOT scenario, whose utility value growth seems to dominate the model and helps to overcome the low volatility, as the ten-year token value actually does come close to its utility value. Based on the history and things that happened with many tokens, we can argue that we are no strangers to big volatility in crypto world. Having that said, we can see that it is of vital importance to insert the appropriate utility values to calculate the right token values for our crypto assets.

Table 21: Call option value of NAUT with volatility 10.61%

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
T - t	1	2	3	4	5	6	7	8	9	10
Transaction costs (K) in euro (€)	9.87	9.67	9.38	8.97	8.40	7.66	6.76	5.74	4.70	3.70
INET										
Real utility Value (S) in euro (€)	0.39	0.77	1.34	2.06	2.95	3.81	4.53	5.07	5.46	5.76
Value of Nautilus token in euro (€)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.41**	**1.34**	**2.48**	**3.52**
VOLT										
Real utility Value (S) in euro (€)	0.23	0.31	0.39	0.45	0.52	0.56	0.56	0.54	0.50	0.45
Value of Nautilus token in euro (€)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A MODEL										
Real utility Value (S) in euro (€)	0.30	0.62	1.10	1.74	2.46	3.12	3.65	4.02	4.27	4.43
Value of Nautilus token in euro (€)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.11**	**0.56**	**1.35**	**2.19**
APOT										
Real utility Value (S) in euro (€)	0.30	0.62	1.10	5.00	12.00	30.00	70.00	120.00	170.00	210.00
Value of Nautilus token in euro (€)	**0.00**	**0.00**	**0.00**	**0.02**	**5.46**	**24.33**	**65.24**	**116.15**	**167.01**	**207.76**

Source: own work.

When the real utility value is used for the adapted crypto Black-Scholes, we observe that the value of the token cannot exceed it. It is therefore important to accurately estimate what the real utility value will be in the future. We help ourselves with different models, which could be a good solution, but all of them have some shortcomings too. In this case, we would first have to be sure about the model we would be using to predict real utility values, because successful predictions of that model would affect successfulness of this one. As you can see, our imaginary APOT scenario yielded very different results, when applying amazing potential that the project stumbles upon. Inserting the real utility values from the future is vital and would be best achieved with a crystal bowl. It would definitely be incredibly lucrative for anyone who has it. As real utility value presents itself as a ceiling for a crypto assets value, we can argue that this valuation model is meant for long-term investments and not short-term ones. It is believed that in the long run tokens values will become same as its real utility value, as in time, token will be mainly used for its purpose of use. Nevertheless, in the short term, there is very limited usage in these new projects and prices are comprised of premiums and expectations that lifts the value above its current real utility value, which this model does not take into account.

Table 22: Call option value of NAUT with volatility 189.63%

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
T - t	1	2	3	4	5	6	7	8	9	10
Transaction costs (K) in euro (€)	9.87	9.67	9.38	8.97	8.40	7.66	6.76	5.74	4.70	3.70
INET										
Real utility Value (S) in euro (€)	0.39	0.77	1.34	2.06	2.95	3.81	4.53	5.07	5.46	5.76
Value of Nautilus token in euro (€)	**0.05**	**0.41**	**1.04**	**1.84**	**2.80**	**3.72**	**4.47**	**5.03**	**5.45**	**5.76**
VOLT										
Real utility Value (S) in euro (€)	0.23	0.31	0.39	0.45	0.52	0.56	0.56	0.54	0.50	0.45
Value of Nautilus token in euro (€)	**0.02**	**0.12**	**0.25**	**0.37**	**0.46**	**0.52**	**0.54**	**0.53**	**0.50**	**0.45**
A MODEL										
Real utility Value (S) in euro (€)	0.30	0.62	1.10	1.74	2.46	3.12	3.65	4.02	4.27	4.43
Value of Nautilus token in euro (€)	**0.03**	**0.31**	**0.84**	**1.54**	**2.32**	**3.04**	**3.60**	**3.99**	**4.25**	**4.42**
APOT										
Real utility Value (S) in euro (€)	0.30	0.62	1.10	5.00	12.00	30.00	70.00	120.00	170.00	210.00
Value of Nautilus token in euro (€)	**0.03**	**0.31**	**0.84**	**4.65**	**11.70**	**29.75**	**69.80**	**119.87**	**169.92**	**209.95**

Source: own work.

There is also a question regarding the transaction costs (K) used in the model instend of the strike price. Investors could have a problem because of not knowing the initial value of constantly changing K. We used the transaction costs from the VOLT model and you can see them lowering by value each year. The latter seems as an expected predisposition, because as networks and projects tokens will be used more often, so should the transaction costs decrease. This however means, that strike price (K) used in model will decrease and the real utility value or the price of the asset (S) will increase, thus making all call option valuations deep in the money.

While crypto adjusted Black-Scholes seems like an interesting approach for valuating crypto assets, it has a long way to go towards creating a model that could be used successfully on a daily basis. Values needed to use the model, as S, σ, K and T are basically unknown beforehand and some predispositions and assumptions might be argued about. As authors notice that this is just their viewpoint, which provides some structure but is still fairly abstract and does not provide an answer such as “crypto asset is worth X”. It shows however, a different insight into what could be the factors that drive crypto assets valuations. We also find the idea that any rational expectation must incorporate some probability of a crypto asset revolution appealing. We eagerly await an additional future development of this crypto adjusted Black-Scholes model.

4.5 Other Crypto Valuation models

In the master's thesis, we focused on a few crypto valuation models which we explained in detail. There are however other concepts that could help in valuing crypto assets. Many focuses on only one metric of crypto assets and some might be more specific for just one type of tokens. While many of these have not been thoroughly defined and explored, they could serve as food for thought when assessing value and creating new valuation models for crypto assets.

Network Value-to-Transaction Ratio

Network Value-to-Transaction Ratio (hereinafter: NVT) compares network value or market cap with network’s daily on-chain transaction volume. NVT may be useful for indicating token’s under or over valuation by looking at utility that users derive from network. It is represented by the network value relative to the network’s transaction volume (Lannquist, 2018). Definition of the ratio is:

$$NVT = \frac{Network\ Value}{Daily\ Transaction\ Volume} \tag{11}$$

NVT is supposed to be similar to equity Price/Earnings valuation ratio. In traditional P/E ratio, earnings are a representation for the underlying utility of the company, created for the shareholders. Because crypto assets do not have earnings, one can say that the total value of transactions that go through the network are a proxy for how much utility value users derive from the chain. It is important to notice that Daily Transaction Volume in equation takes into account only on-chain transactions (Kalichkin, 2018).

Mining profitability

Mining requires investment and creates costs. All tokens are not mined the same way and do not have the same returns on mining. There are differences in the nature of mining, e.g. is tokens mining dominated by large mining pools or is it also accessible to individuals and smaller rigs (Glazer, 2018). Take in account that tokens price is constantly changing and we can quickly recognize that a token that is best in value for mining today, might not be tomorrow. While mining profitability could be a part of other models for crypto valuation in the future, it is currently used as an important valuation model for miners.

Ownership structure

Various ownership base characteristics can play a part in crypto assets value. That is why we could be looking at metrics like: how many tokens are held by insiders, how many investors own tokens that are in value above a certain threshold (e.g. above 1000€), how concentrated is the ownership of a crypto asset (e.g. how many tokens are held by top 1% or 10% of investors), how many tokens are owned by early investors (Glazer, 2018). Characteristics like these can affect price development and even potential market manipulation.

Daily active addresses

Daily active addresses represent the number of users that do transactions in the crypto network on a daily basis. As there are daily active users measured for software and apps, so could daily active addresses provide information about the number of users on the network (Lannquist, 2018).

Number of transactions per second

This could be a useful metric for crypto assets that deal in transactions (mostly cryptocurrencies). Following the number of transactions per second could tell us about frequency of network and token usage and their progress on reaching mass consumer adaptation (Glazer, 2018).

4.6 Picking Best Value Crypto Assets

Currently the most used and most effective approach to crypto assets valuation is known as the Venture Capitalist's (hereinafter: VC) approach. Valuation models that we were looking at before are hard to generate and adapt to the crypto world due to scarcity of financial and many other information about the projects. They also often include assumed variables that have an influential impact on the prices derived, and if not chosen correctly, can lead to poor results. The VC approach differs in the way that it is adapted to the information available on the market right now. However, these are not black and white facts, rather information and data that needs to be interpreted. Since data are also subjected to biased and subjective interpretations, it is of vital importance for the investor to define and use the best approach, criteria and guidelines.

Before we elaborate the process of evaluation, let us look at the information about the projects. Most of what is needed for the evaluation that will be presented below can be obtained online with some additional research. We do, however, want to show that that is not the only way to obtain information. An investor presented an interesting method in 1960's. Philip A. Fischer is a renowned investor and author that in his investment strategy did not focus on financials, but rather on questions about the company's factors like R&D, management team, treatment of employees, etc. We find some of his evaluation questions at that time relatable and appropriate in today's approach to evaluating crypto assets and in different forms, many are already incorporated in the VC's approach to crypto asset valuation. In his writing, he also presented the "scuttlebutt" method for finding information about companies from sources we do not usually think of.

Fischer mentions as the first source of information the business, or now we could call it the crypto, "grapevine". The author notices that it is amazing how accurate a picture of relative points of strength and weakness can be obtained from a representative cross-section or the opinions of the people that are in some way concerned with the project. Most people like to talk about the work they are in and will talk freely about their competitors, as long as there is no danger of them being quoted. If asked the right questions, they might help paint a surprisingly detailed picture of the projects. Beside competitors' employees, a great deal can be learned from marketers and customers about the real nature of a business. We can also reach out to research scientists and programmers in universities, the government and even competitive projects. Another group of people, which is now small, but will get bigger as the projects get bigger too, are former employees. These people have a good insight into the projects' strengths and weaknesses, but need to be dealt with carefully, since they might have prejudices about their former employer (depending on how they parted with their former project). A crucial guideline when obtaining information from any sources, is that source of information can never be revealed. If you do not hold up to this policy, there is a danger of getting informants in trouble, which will consequently lead to you not hearing unfavorable opinions again. Times have definitely changed since then and the internet brought about an abundance of information and ways to communicate with people across projects and companies, but it also brought an abundance of false information. That is why in today's world a critical approach to information interpretation and sources integrity is of vital importance. Here we also wanted to show that internet is not the informational holy grail and that there are other ways that can lead to obtaining information of better quality and importance when talking with people connected to the project.

Tomaino (2018) and his colleagues at 1confirmation shared their evaluation process that is based on four simple fundamentals. They believe these fundamentals will drive the long-term value of any token based projects and in order for them to invest in it, all four project's categories need to be exceptional. The four fundamentals are:

1. Team - When looking at the team, the most important question is, who is the founding team behind the project? Since all token based networks require buy-ins on a global scale, the founding teams must operate in a buyer/investor attractive manner and need to understand the workings of the blockchain community to draw in buy-ins. In this framework, each founding team receives an overall aggregate founding team score, which is between 1 and 10. The target score is above 9. The criteria on which the founding team is evaluated are: history of success, shown ability to overcome obstacles to success and strong desire beyond money, did the team attract and surround themselves with top technical talent who are inspired by vision and leadership, is the team obsessive about the problem they are solving, are they mature thinkers (know their problems and are realistic about growth) and is the team uniquely suited to tackle the technical problem.
2. Product – The main question about the product should be to consider whether or not the product solves an important problem for a segment of the people. Many tokens and projects can be filtered out by this criterion alone, since they do not solve any problem or add any additional value. Currently, many projects are focused on solving problems for the existing crypto community rather than problems beyond it. While it is interesting to think about mass adoption and successful user-end applications for blockchain projects, authors still think that in next 2-4 years, the most successful projects will be associated with infrastructure and middleware that serves the existing community. When assessing product, each project receives an overall score between 1 and 10, with the target score being above 9. Assessment is based on: the technical specification that describe the product (Is it thorough and does it demonstrate mastery of the subject matter?), are there at least two customer or potential customer reference calls and are there people who want the product now, does the product benefit from network effects, does the product have an advantage that could lead to competitive differentiation, does the product surprise and delight users.
3. Community - Communities are an essential part of successful projects in the crypto world. We need to check if there is a community developing around the project or is there maybe a group of people within the existing community that values what the project would bring. Is it also important to look and the potential of the founding team to grow and retain a vibrant and healthy community in the long term. The community factor is assessed by an overall score between 1 and 10, with the target score being above 9. Assessment is based on: Reddit community (its number of subscribers and daily engagements), Slack, Rocketchat, Github, Telegram (its number of members and daily engagements), has the founding team shown characteristics necessary to build a

healthy community and have the public or private relations been balanced and unemotional.

4. Token Mechanics - Since there are differences in crypto assets, we need to know what kind of token are we dealing with. Is it a usage token, work token, security token, or a combination? Token mechanics are evaluated on: is the team distributing the tokens in a fair and equitable manner, taking into account all market participants and optimizing for long term usage of the product goal, rather than short term fundraising; for usage tokens, is the digital service offered useful and does the underlying network have the ability to differentiate the service in the long term; for work tokens, is the service useful to people, does the network want to contribute, is it strong enough and is the user experience well thought through; and for security token, is there some technology underlying the security that can give the token a long term competitive advantage.

The second framework of the VC's evaluation of crypto assets that we will take look at was established by Moore and Moore (2018). Their framework is more finely defined and consists of 23 metrics that are fitted into six key categories, with the goal of ranking assets on a scale of one to three for each metric. Six key categories are presented in the tables below with the criteria and scales for each category. This kind of analysis primarily applies to altcoins. What they could not capture in the model, but will have an impact on crypto assets, are network effects, which are presented separately after the key categories.

Table 23: Product evaluation criteria

Category	1 (Low)	2 (Medium)	3 (High)
Whitepaper	Doesn't exist	Exists but confusing or lacking key info	Exists and is clear and thorough
Competition	Large field of competitors and currency is lacking key features or otherwise will likely be the loser	Some competitors but appears to be fairly well positioned	No clear competitors OR has competitors but has a clear technical advantage
Time to clear block	Blocks take longer than 2 minutes to clear	Blocks take up to 2 minutes to clear	Instanteous or almost instanteous (<5 seconds) clearance of blocks
Value of blockchain	Utility token – blockchain is not necessary	Blockchain adds value but is not absolutely core to the nature of the transaction	Blockchain adds significant value and is core to the nature of the transaction

Source: Moore & Moore (2018).

The first category is **product**. The main question here is if the project is a unique and valuable implementation of blockchain. Criteria are presented in table 23.

While *time to clear block* is not so crucial for tokens acting as a store of value, given that many tokens claim feasibility for frequent transactions, the authors consider shorter *time to clear block* as a positive factor.

The second category is **community**. The main question here is, what is the volume and quality of conversation around the token, from both crypto influencers and the broader community. Community evaluation creteria are presented in table 24.

Table 24: Community evaluation criteria

Category	1 (Low)	2 (Medium)	3 (High)
Online forums	Doesn't exist or lacks activity (market cap of $300k+ for each Reddit reader)	Exists but with small subscriber base/activity (market cap of $100k – $300k for each Reddit reader)	Exists with large and active subscriber base (market cap of <$100k each Reddit reader)
Communication channels	Doesn't exist or lacks activity (market cap of $850k+ for each Telegram member)	Exists but with small subscriber base/activity (market cap of $200k – $850k for each Telegram member)	Exists with large and active subscriber base (market cap of <$200k each Telegram member)
Advisors	None listed or identities cannot be confirmed	Some advisors listed with experience in space, but none with significant influence or expertise	One or more high profile or extremely experienced advisors (e.g. Vitalik Buterin, Charlie Lee)
Influencer sentiment	Mixed to negative general sentiment, with no particularly strong statements from core influencers	Mixed to positive general sentiment, no particularly strong statements in support from core influencers	Mixed to positive general sentiment, but with one or more non-advisor core influencers making statement in support

Source: Moore & Moore (2018).

Twitter, which is an important forum for discussing crypto, is not included in the community evaluation because of the volume of fake users, automated twitter bots and spam. To avoid being unfair to tokens that are still quite unknown, those that have smaller communities or a small market cap, the authors decided to evaluate Reddit and Telegram communities as a function of the market cap for the token (instead of raw data points).

The third category is **code**. The main question here is, can the code actually do what the product promised and is there a talented and active team making progress on it. Code evaluation criteria are presented in table 25.

Table 25: Code evaluation criteria

Category	1 (Low)	2 (Medium)	3 (High)
Developer backgrounds	Less than two non-anonymous developers	More than two developers are non-anonymous, backgrounds are either not relevant or somewhat unimpressive	More than three developers are non-anonymous, backgrounds are relevant and somewhat impressive
Developer engagement – all time	<1000 Github commits and/or <20 total contributors	<4000 Github commits and/or <40 total contributors	>4000 Github commits and/or >40 total contributors
Developer engagement – one month	All 3 of the following apply: (1) <5 commits;(2)<5 contributors; (3) closed/new issue ratio <1	1-2 of the following apply: (1) <5 commits;(2)<5 contributors; (3) closed/new issue ratio <1	None of the following apply: (1) <5 commits;(2)<5 contributors; (3) closed/new issue ratio <1
Developer concentration	3 or more developers each contributed 10%+ of commits, and/or top developer contributed 35%+ of commits	1-2 developers each contributed 10%+ of commits, and/or top developer contributed 20-35% of commits	No developers individually contributed 10% or more of commits

Source: Moore & Moore (2018).

While the bulk of code being written by a single developer may not be necessarily negative, it can be seen as a risk to depend on a sole developer, since many projects are still in their early stages.

The fourth category is **traction**. The main question here is, how far along is the platform in terms of development and is it being used to make transactions or being implemented by companies. Traction criteria are presented in table 26.

Table 26: Traction evaluation criteria

Category	1 (Low)	2 (Medium)	3 (High)
Product status	Product is not live and code is not public	Product is live and in use with non-public code, OR product is not live but approaching launch, and code is public	Product is live and in use, and code is public
Transaction traction	Transactions are not yet being made on the platform	<5000 transactions per hour	>5000 transactions per hour
Partnership traction	No announced partnerships	Partnerships or corporate clients but with small or relatively unknown players	Partnership announced with one or more major corporations (ex. IBM, Microsoft)

Source: Moore & Moore (2018).

As seen in the table above, when trying to differentiate between tokens that are regularly used from those that are still difficult to use or unproven, the authors suggest 5000 transactions per hour seem like a reasonable number based on transaction data from the top fifty tokens.

The fifth category is **trading**. The main question here is what the recent trading activity around the token is and what is the process for investors to buy into or sell out of it. Trading criteria are presented in table 27.

The authors assume that a recent high return on the coin is undesirable from the perspective of expected future short-term return. Tokens that have already significantly risen are less likely to make another big pop. Exchanges can be looked at from the perspective of short and long-term returns. If a token is not yet listed on any major exchanges, a significant pop can be expected when it joins one of these exchanges and becomes easier to buy. In the long term this criterion is reversed, tokens that are easy to buy will probably perform better.

The sixth category is **network**. The main question here is, are people talking about and/or purchasing the asset. Network evaluation criteria are presented in table 28.

Table 27: Trading evaluation criteria

Category	1 (Low)	2 (Medium)	3 (High)
One month return	Currency has risen more than 80% in last month	Currency has risen more than 0-80% in last month	Currency has fallen in last month
One year return	Currency has risen more than 10,000% in last year	Currency has risen 2000-10,000% in last year	Currency has risen <2000% in last year
Ease of buy/sell	Currency is listed on 4-5 of top five exchanges, and/or more than 15 exchanges total	Currency is listed on 1-3 of top five exchanges	Currency is listed on none of the top five exchanges
Token distribution	2-3 of the following apply: (1) Token has open cap; (2) Distribution not linked to product roadmap; (3) Company does not disclose tokens given to team and vesting schedule	One of the following apply: (1) Token has open cap; (2) Distribution not linked to product roadmap; (3) Company does not disclose tokens given to team and vesting schedule	None of the following apply: (1) Token has open cap; (2) Distribution not linked to product roadmap; (3) Company does not disclose tokens given to team and vesting schedule

Source: Moore & Moore (2018).

The success of a given crypto asset on the medium-to-long term will depend heavily on network effects. If more people own a token it is easier for the token to gain widespread adoption, legitimacy and this makes it more difficult to disrupt the token. The metrics in the table above are there to help us create a picture of how many people own or are aware of the token.

Table 28: Network evaluation criteria

Category	1 (Low)	2 (Medium)	3 (High)
# of Twitter mentions (30 days)	*<4k Twitter mentions*	*4k – 10k Twitter mentions*	*10k+ Twitter mentions*
# of news mentions (30 days)	*<100 news mentions*	*100 – 500 news mentions*	*500+ news mentions*
Google Trends score (1 year)	*Score of 0*	*Score of 0.01 – 1.0*	*Score of 1.0+*
Social following	*<Reddit readers and/or <50k Twitter followers*	*10k - 40k Reddit readers and/or 50k - 150k Twitter followers*	*40k+ Reddit readers and/or 150k+ Twitter followers*

Source: Moore & Moore (2018).

When talking about network, we should also keep in mind the **network effects** that have an impact on evaluation of crypto assets (Moore & Moore, 2018):

- Trading - Since almost all altcoin trading requires you to make purchases with Bitcoin and/or Ethereum, there is an intrinsic benefit for these crypto assets from the perspective of investors purchasing and holding the assets in order to transact in altcoins.
- Institutional interest - Institutional investors have the possibility to bring huge amounts of capital into a crypto asset, but are concerned with risks of assets legitimacy, liquidity and price stability. Larger coins are usually perceived as more legitimate and additionally have enough liquidity to sustain bigger investments without huge price jumps. Its prices are also often more stable, since investors have an interest in preventing massive depreciations.
- Security - More widely adopted crypto assets will naturally have better security. Larger consensus groups are more difficult to attack and there will be more developers looking to identify and fix potential vulnerabilities. In addition, assuming investors want to buy assets that are built on more secure platforms that will result in more capital flowing into assets with better security.
- Press - While there is an abundance of crypto assets, the press usually focuses on the assets with the highest adoption. Many people bought crypto assets they heard mentioned most often in the press, which creates a self-fulfilling prophecy or self-feeding cycle as the coins with larger user bases get more press coverage. Bitcoin practically became a synonym for crypto assets.
- Medium of exchange - Larger currencies, like Bitcoin, are being adopted by retailers. As the crypto asset is being adopted as a medium of payment by more retailers, that will attract more consumers to own the coin, which will then attract even more

retailers. Retailers will also want to limit their initial exposure and will surely use crypto assets that are most widely spread and used.

– Regulatory legitimacy - It would be harder for regulators to shut down a large crypto asset with millions of owners, than a small one with a few investors. Regulators are also incentivized to work with the widely spread crypto assets, which could lead to a more hostile stance on smaller altcoins.

Crypto projects offer no financial data on which we could evaluate them. That is why this kind of approach to crypto asset valuation is currently the most widely adopted by VC's, funds and investors. It captures a wide array of available information, which seem to affect the success of crypto projects. The problem here is that rankings and scales are subjective and if not defined properly can lead to biased results. This can also happen due to subjectivity in assessing the value of different factors. Hence, while this is currently the most widely used method, it needs to be applied with care.

4.7 Discussion

In order to better illustrate the comprehensive calculations and detailed analyses above, we compare the various valuation models in the tables below with additional commentary. We focus on the utility values of the NAUT token and the present value discounted from the year 2028 in order to be as consistent across models as possible. Notice that in the first table there are only three models; the INET model, the VOLT model and finally the A Model. These models are relatively similar with some exceptions, but nonetheless all of them are able to calculate a present value for the utility token. The Black-Scholes model operates and calculates its results based on utility values, the risk free rate, transaction costs and the volatility of the models from the table below. Besides, the Black-Scholes has an entirely different rationale behind it, since it is a model used in the derivatives field.

Table 29: Comparison between INET, VOLT and A Model

Year	2018	2019	2020	2023	2025	2026	2028
INET token utility value	0.15€	0.39€	0.77€	2.95€	4.53€	5.07€	5.76€
VOLT token utility value	0.15€	0.23€	0.31€	0.52€	0.56€	0.54€	0.45€
A Model token utility value	0.11€	0.30€	0.62€	2.46€	3.65€	4.02€	4.43€

Source: own work.

At first glance, we can observe that the NAUT values in the INET and A Model are relatively similar, while the values in the VOLT model are not. From the year 2026, the value of the token even starts decreasing according to the VOLT model, but not according to the A Model and INET models. We reckon that the VOLT model is the only one that calculates the velocity by itself and additionally takes into account a dynamic estimation of velocity. Furthermore, VOLT also estimates decreasing transaction costs due to higher volumes of token usage and total number of tokens on the market.

All three evaluation models start at a bit over ten cents per token utility value. The NAUT token's utility value within the INET models reaches 5.76 euros and within A Model a bit less, but still reaches a significant 4.43 euros. Meanwhile, the NAUT token encounters a much lower value increase until the year 2025, and afterwards a decrease in value year by year, ending in 2028 with a value of just 0.45 euros. If we were to obtain a similar result from VOLT, we would need to adjust the transaction cost by making them much higher or lowering the investors expected annual return on store of value assets from 5% to at least 0.5%. The hindrance for VOLT model preventing itself to reach the levels of INET or A Model stems from VOLT calculating velocity by multiplying the number of transaction by two, since it is based on the assumption that each time a user buys a token and later spends it to buy another token or product, the velocity equals to two. Once for buying the token, and the second time for spending it. This is of course arguable, but we have stayed with the model original framework to be as accurate and thorough as we can be. The VOLT model by Evans is definitely more complete than the other two, but still contains possible flaws, with such high levels of velocity being based on its theory.

Table 30: Present utility value comparison

Metric	Value
End Year	2028
Years Between 2018 and End Year	10
Discount Rate	30%

Present value from year 2028	
INET future utility	0.42€
VOLT future utility	0.03€
A Model future utility	0.64€

Source: own work.

By looking at the discounted utility value based on the expectations for the year 2028, we can see that the A Model is the most optimistic among the three mentioned models. Again, the biggest deviation can be observed within the VOLT present value. The reason remains the same velocity calculations and assumptions, as elaborated before.

Now that we covered the evaluation models with shared similarities, we can take a look at the results of our calculations based on the Black-Scholes model. In these models we calculated four different scenarios. The fourth scenario called APOT represents a possible and amazing token potential that would reach unbelievable heights of value. Thus, we assumed rather higher utility values compared to other values obtained through previous evaluation models. We elaborate only three of them, since the VOLT's model values were practically insignificant.

Table 31: Comparison on Black-Scholes model - volatility: 10.61%

Year	2019	2020	2021	2023	2025	2026	2028
INET value of a call	0.00€	0.00€	0.00€	0.00€	0.41€	1.34€	3.52€
A Model value of a call	0.00€	0.00€	0.00€	0.00€	0.11€	0.56€	2.19€
APOT value of a call	0.00€	0.00€	0.00€	5.46€	65.42€	116.15€	207.76€

Source: own work.

We can immediately see that the results in the year 2028 are slightly lower in value compared to the values in the tables above. Nevertheless, the first three years are comprised of practically insignificant values, hence the table contains so many zeroes (rounding effect).

Table 32: Comparison on Black-Scholes model - volatility: 189.63%

Year	2018	2019	2020	2023	2025	2026	2028
INET value of a call	0.05€	0.41€	1.04€	2.80€	4.47€	5.03€	5.76€
VOLT value of a call	0.02€	0.12€	0.25€	0.46€	0.54€	0.53€	0.45€
A Model value of a call	0.03€	0.31€	0.84€	2.32€	3.60€	3.99€	4.42€
APOT value of a call	0.03€	0.31€	0.84€	11.70€	69.80€	119.87€	209.95€

Source: own work.

When having a much higher volatility the results are a bit higher, hence very close and approaching the calculated utility values from INET, VOLT and A Model models, but never surpassing them. Lastly, all evidence above shows that the higher volatility, the higher and closer will be the derived values of each call to the inserted and assessed utility value, which are basically copied utility values of each above mentioned models.

In conclusion, if excluding the APOT utility values, the INET model shows us the most lucrative outcome. Its deficiency is the fact, that it keeps the same volatility through time, it does not include any transaction cost and it ignores the possibility of crypto asset storage, hence higher levels of value in future can be hardly expected. Additionally, the model is missing the explanation of how does a change in velocity influence a change within the P*Q. If there are no correlations, the crypto asset utility value decreases or increases narrowly with demand of the elemental utility. Finally, we should not forget to mention the fact that INET neglects the difference between the demand for NAUT and the demand for moorings as well as other potential competitors. Therefore, it creates a sort of isolated market for the product of Nautilus. Continuing with the VOLT model, which tries to upgrade and improve the INET model. This model considerably incorporates transactions cost, a variable volatility through time and even the store of value currency, let alone the inflation of money supply. However, it does not cover and consider the different moorings pricing through time, which is reasonable to include. Lastly, VOLT model does not know what holders of a crypto asset are but rather includes holders of a store of value asset. This model gives lower result by value in respect to other evaluation methods. We presume that the latter is due to the theory of switching hands twice when consuming a crypto asset, which influences enormously the volatility's inflation. Because of a bigger volatility by each year, the crypto asset reaches a point where it starts to decline by value. Having said that, we reckon that VOLT is quite pessimistic and to a certain extent inaccurate, but definitely most appropriate for a risk averse investor. Next models is the A Model. This is the least developed and elaborated among the analyzed evaluation models, but tries to illuminate some essential drivers of crypto assets evaluation. We do not percept it as a helpful one, but still includes the concept of six investors' orders, which is reasonable to consider when doing a crypto evaluation. The final model is the adapted version of Black-Scholes model, which appertains to the derivatives evaluation methods. In order to obtain significant values, an investor must be a bit creative and additionally take into account that the more accurate estimation of the utility value is made, the more precise results are obtained. However, this is nearly impossible, since no one knows the future outcomes. Besides, the Black-Scholes model is originally based on some real data from actual markets. For instance, it needs to contain a real market value of a chosen stock, which the calculations are being made on. Moreover, even when obtained some results from the model, we should consider that the mentioned results originally represent the price of a call option, not the value of the stock itself. Thus, we can conclude that this model is probably not suitable, even though customized, for our purposes.

Alternatively, to these mentioned quantitative methods, we advice to perhaps evaluate a crypto asset or a crypto project from a qualitative aspect, such as the presented VC model created by Moore and Moore.

CONCLUSON

When comparing the above mentioned evaluation models, none of them outperforms the others, because each has its own advantages and disadvantages when calculating future token value based on different assumptions.

We found it quite unreliable to simply apply one of the classic quantitative evaluation models, when discussing crypto asset evaluation, since there are many assumptions and the volatility of this asset is much higher than that of a classic financial asset. Alternatively, where the lack of quantitative information prevents us to estimate accurately the potential *value* of a future token, we can resort to the qualitative assessment established such as by Moore and Moore (2018), which allows us to assess the *probability* of a crypto project succeeding, despite not being able to estimate its future value.

The classic evaluation models are based on cash flow or stock price and are designed to fit the assessment of already existing firms and projects. In the case of a fictitious future token, which is subsumed under new innovative technology where the legislation has not laid its regulatory hand on yet, new evaluation models should be created. In this way, the venture capitalist and other smaller investors could make appraisals that are more realistic, hence reduce the financial risk of their potential investment.

This master's thesis tried to apply various traditional adopted evaluation models on an imaginary future token that will try to enter the market and obtain a certain value. Using advanced academic/theoretical modeling, we were able to complete our calculations and at the end, make a reasonable comparison of valuation models. We reckon that the classic business evaluation models cannot be applied to investment considerations in their full aspects or with absolute credibility, but a potential investor can get an overview of possible outcomes for a chosen crypto asset. It is definitely hard to realistically estimate a non-existing limited digital medium with scarce guaranteed security, especially with evaluation models that have been created specifically for the purpose of appraising already existing projects or firms on the market. Nonetheless, the circumstances surrounding current token valuations and ICOs are rather similar to the ones in the fictitious scenario elaborated in the thesis. The asymmetry or lack of information alongside the abundance of assumptions make the thesis' endeavors valuable and comparable to how real life investors think about token valuations. By reading this master's thesis, the reader can gain a better insight into different kinds of approaches that define how (much) can a future crypto asset be worth.

Nowadays, the crypto world remains speculative and to a certain extent ambiguous. The possibilities of losing money or witnessing an economic bubble are tangible and should be considered when making crypto assets valuations. Of course, the blockchain technology can be fruitful in many areas, in fact, many international and powerful companies are trying to implement it within their enormous systems and by doing that, these firms are showing an interest and trust in blockchain. Inevitably, some startups that gained a big amount of starting capital through ICOs will arise in the near future, probably with a bigger impact and bringing important changes to different fields. Having said that, if the crypto world will occupy a stable and recognized role in this world, more suitable and accurate evaluation models are a not just a benefit, but a necessity. Thus, the world will without any doubt develop and use some appropriate innovative evaluation approaches with realistic outcomes. We hope this thesis is one of the first steps alongside the path leading to the crypto future.

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APPENDICES

Appendix A: Summary in Slovene language

V današnjem novodobnem svetu kriptovalut z Bitcoinom na čelu, smo priča veliko obetavnim in inovativnim tehnologijam na različnih področjih strokovnega znanja. Tovrstni kripto projekti so nekaj povsem novega, a vendarle je moč najdi nekaj podobnosti s tradicionalnimi projekti na katere smo vajeni. Kripto svet se ni mogel izogniti borznim aktivnostim, tveganemu kapitalu ter nenazadnje tudi financiranju projektov ali podjetij s strani množice. Najbolj omembe vredna inovacija omenjenega inovativnega sveta je definitivno tehnologija blokovnega veriženja oz. “blockchain”. Brez blokovnega veriženja si tudi samega kripto sveta ne moremo predstavljati. Blockchain je torej temelj nastajajočega ter vsak dan bolj znanega kripto sveta.

Številni kripto projekti iščejo financiranje preko novonastale oblike z imenom “začetna ponudba kovancev” (ang. Initial Coin Offering - ICO), kar je precej podobno prvi javni ponudbi pri delniških gospodarskih družbah. Podobno kot javna ponudba, kripto projekti izdajajo kovance ali žetone, ki lahko predstavljajo delno lastništvo, valuto za nakup storitev in izdelkov, lahko jih razumemo kot sredstvo za transakcijo ali shranjevanje vrednosti ter v nekaterih primerih celo nima relevantnega pomena oz. cilja. Slednje je vodilo do popolnoma novega področja poslovnih modelov, prilagojenih svetu kriptovalut ter blokovnih verig. Kovance oz. žetone nekega projekta investitorji, ki so hkrati tudi špekulanti kupujejo in prodajajo na javnih kripto borzah. Vsakdo jih lahko uporabi za investicijske namene ali zgolj kot sredstvo za nakup oz. izmenjavo specifične storitve ali produkta. Toda koliko so res vredni kripto konaci in kako bi jih lahko dodobra vrednostno ocenili?

Iz globalnega vidika je tržna kapitalizacija celotnega trga kriptovalut zanemarljiva. Pomanjkanje zakonskih predpisov ter pravil, ki bi urejala kripto področje, je odprlo vrata goljufijam, zvijačam in prevaram. Dodatno so nizke tržne omejitve naredile področje kriptovalut bolj dovzetno za tržne manipulacije. Pojavilo se je veliko zagonskih podjetij pod pretvezo fiktivne povezave svoje storitve ali produkta z blokovno verigo, samo zaradi lastnega financiranja. Vsak lahko kadarkoli prosto in anonimno dostopa do kripto borz ter s tem kupuje in prodaja različne kriptovalute iz vsakega kotička tega sveta in ob tem kuje visoke dobičke kot v letu 2017. Pred vsakim investiranjem se mora morebitni investitor vprašati ali je vredno vlagati v določen projekt, in če je, po kakšni ceni? V iskanju verodostojnih odgovorov smo v naši nalogi preverili nekatere klasične evalvacijske modele, prilagojene projektom, ki temeljijo na kripto sredstvih. Investitorji poskušajo vlagati v dobičkonosne projekte ter s tem oplemenititi svoj portfelj. Sami odločajo o diverzificiranosti in razpršenosti kapitala v različnih sredstvih na način, da dosežejo svoje zastavljene cilje. Seveda se investitorji ter njihovi interesi razlikujejo. Za pomoč pri izračunu in doseganju investicijskih ciljev pa se poslužujemo različnih modelov vrednotenja.

Področje raziskave smo osredotočili na uporabo različnih tradicionalnih modelov vrednotenja na podlagi kripto sredstva. V našem prispevku celovito predstavimo osnove blokovnega veriženja, da bralec pridobi dobre temelje razumevanja za nadaljnjo branje. Pregledali smo različne kriptovalute in kovance ter določili različne kategorije le teh, saj obstajajo znatne razlike v sami tehnologiji, strukturi in sami pobudi ustanovitve novega kovanca. Slednje je potrebno zato, da dejansko razlikujemo med zavajajočimi kriptovalutami in pravimi. Dodatno predstavimo pravno-formalne ureditve kripto imetij in njihove prepreke ter kratko zgodovino finančnih balonov. Preučili in obrazložili smo začetne oz. prve ponudbe kovancev, samo strukturo le tega, navedli kritike ICO in navsezadnje preverili varnost ICO (Burniske & Tatar, 2018). Uporabili smo tradicionalno metodo vrednotenja po imenu "Quantity Theory of Money", saj je osnova za večino uporabljenih modelov za kripto vrednotenje. Vsi modeli kripto vrednotenja so predstavljeni in prav tako uporabljeni za oceno vrednosti našega fiktivnega žetona. Med omenjene modele spadajo: INET model (Burniske, 2017), VOLT model (Evans, 2018), A Model (Winton, 2018) in zadnji model, ki predstavlja okvir vrednotenja derivativov (opcij) Black-Scholes (Antos in McCreanor, 2018). Rezultate ocenjevanja smo med seboj primerjali, z namenom razkrivanja razlik. Nazadnje v nalogi predstavimo tudi nekaj drugih alternativnih modelov vrednotenja, katere se osredotočajo na vrednotenje iz drugih, manj računskih vidikov.

Ideja našega imaginarnega žetona, ki se bo preko organizacije in projekta Nautilus ponujal na trgu izviral iz produkta morske platforme, kjer uporabniki lahko rezervirajo privez za svoje plovilo znotraj marin, bodisi zalivov. V nadaljevanju bo Nautilus razvil stroškovno učinkoviti sistem za marine, ki bo optimiziral prejete in zbrane podatkovne baze ter vse operativne procese, ki se odvijajo v samih marinah. Posledično, bodo marine in lastniki privezov v zalivih ustvarjali več prometa in dobička. Raziskava naše naloge je izvedena kot raziskava metod, katera temelji na primarnih in predvsem sekundarnih podatkih. Primarni podatki našega fiktivnega projekta izhajajo iz lastnih raziskav, izračunov, predpostavk in drugih spremenljivk, saj si prizadevamo, da bi ta projekt postal resničen v prihodnosti. Prav tako smo ponazorili uporabo metod vrednotenja tega fiktivnega projekta ICO, ki smo ga ocenili z vsemi evalvacijskimi modeli, ki smo jih uvedli s kripto vrednotenjem. Izpeljane vrednosti so razložene in celovito utemeljene. Sekundarni podatki so bili pridobljeni iz podatkovne analize. Izvedli smo sintezo in kritično vrednotenje obstoječe literature. Ker pa še vedno ni nobenih akademsko priznanih virov na temo vrednotenja kripto premoženja, smo uporabili razne članke, bloge ter druge publikacije pionirskih raziskovalcev, na področju vrednotenja kriptoloških sredstev in katerih ideje so podprte s strani kripto skupnosti.

Nautilus

Kot že omenjeno, Nautilus je ideja mobilne aplikacije za rezervacijo ter plačilo privezov za plovila. Med poletno sezono so priljubljeni zalivi zelo nasičeni in morjeplovec težko dobi prostor za svojo plovilo, predvsem ob večernih urah, ko vsi iščejo zatočišče pred nočjo. Vse to zmanjšuje varnost, sploh je povečano tveganje med manj izkušenimi. Z rešitvijo, ki bi jo ponudil Nautilus, bi si lahko vsak morjeplovec zagotovil prosti privez vnaprej. Marine ter lastniki boj v zalivih pa bi pridobili vpogled v povpraševanje ter si zagotovili stabilnejše prihodke.

Zaradi pomanjkanja verodostojnih podatkov, smo zaradi bolj nazornega ter lažjega računanja določili, da se bo sprva mobilna aplikacija Nautilus ponujala samo na Hrvaškem trgu, za katerega smo uspeli pridobiti določene podatke. Potrebno je poudariti pomembnost metodologije evalvacijskih modelov, bolj kot natančnost vstavljenih števk.

Naše predpostavke za namene računanja z evalvacijskimi modeli so:

- Skupno **608 247** privezov z 1% rasti na letni ravni (seštevek prejšnjih dveh točk),
- Maksimalno doseženi delež hrvaškega trga je 85%,
- **10%** svojega trga Nautilus doseže do konca leta 2019, **90%** pa v naslednjih sedmih letih, torej leta 2025,
- Skupno število izdanih kripto kovancev je **100 000**,
- Doba podjetja Nautilus je **30 let**,
- Obdobje prepovedi prodaje kovance po izdaji je **5 let**,
- Povprečna cena priveza je **50 €**,
- Diskontna stopnja je **30%**, doba diskontiranja pa **10 let**,
- Začetna cena transakcije z NAUT je **20 €**.

Evalvacijski modeli

Večina modelov vrednotenja kripto premoženja temelji na teoriji vrednotenja imenovani Količinska teorija denarja za kripto premoženje (ang.“Token Velocity Thesis”). Ta teza je v bistvu izpeljanka iz teorije količine denarja oz. “Quantity Theory of Money”. Jedro slednje pravi, da so spremembe v ponudbi denarja v korelaciji s spremembami v ceni. Ta teorija je lahko obrazložena tudi preko teorije izmenjave (ang. “the equation of exchange”). Teorija izmenjave predstavlja vse izmenjave v danem letu. Pri vsakem nakupu in prodaji sta blago ter denar izmenjana enakovredna, zato enačba trdi, da je skupna vsota vseh izmenjav v enem letu enaka, vsoti plačanega oz. porabljenega denarja. Posledično je moč razumeti, da ima teorija na eni strani denar, na drugi pa blago.

Prilagojeni elemente enačbe količinske teorije denarja za kripto premoženje (ang.“Token Velocity Thesis”), ki jo uporabljamo za kripto projekte so M - število enot kovancev, ki obstajajo (velikost osnovnih sredstev), V - kolikokrat žeton zamenja roke oz. imetnika, Q - proizvodnja gospodarstva projekta v obdobju (količina digitalnega vira, ki se zagotavlja), P - cena enote ter Q - v smislu kripto kovanca (token/ enota Q), cena digitalnega vira, ki se zagotavlja.

INET model (Burniske, 2018)

Model vrednotenja Chrisa Burniska, imenovan INET, temelji na analizi diskontiranih denarnih tokov (Discounted Cash Flow). INET je ime Burniskovega fiktivnega žetona, uporabljenega v njegovem pilotskem modelu vrednotenja. Glede na to, da je Nautilus zgolj imaginaren, nimamo nikakršnih preteklih denarnih tokov, ki bi jih lahko uporabili za naše namene izračuna. Kot že omenjeno zgoraj, je Burniske svoj model analize z denarnimi tokovi priredil s teorijo izmenjave. Zamenjal je promet, maržo ter dobiček podjetja z letno vrednostjo koristnosti. Vsako napovedano vrednost koristnosti se z diskontiranjem spravi v sedanjo vrednost. Za konkretizacijo primera naj ponovno omenimo teorijo izmenjave. Ker je jedro mobilne aplikacije rezervacija priveza smo interpretirali predpostavke P povprečna cena priveza, Q - število rezerviranih privezov na letni ravni, V - število izmenjanih rok v letu ter M - velikost izdane baze kovancev.

BDP tega kripto-gospodarstva predstavlja enačba P * Q in je enaka kot pri izračunu BDP gospodarstva države. Denarna osnova (M) je bistvena velikost gospodarstva, potrebna za podporo celotnemu sistemu, ki "potuje" s hitrostjo (V). M se lahko izračuna tako, da se P * Q deli z V. Kljub temu je BDP kripto-gospodarstva povsem sprejemljivo prikazan na podlagi obseg transakcij na blokovni verigi. BDP je pogosto tudi do 30% nenatančno opredeljen zaradi trgovanja na borzah. Slednje se v metrikah BDP ponavadi ne upošteva in se razlaga kot metoda špekulacij. Ker smo predpostavke že zgoraj opredelili, velja v tem sklopu poudariti še to, da je kripto kovanec NAUT podvržen protokolu imenovanemu "Proof of stake", ki je nekakšen algoritem, ki omogoča, da blokovni verigi, da pridobi skupno soglasje oz. konsenz. Skupno soglasje je sporazum o določeni vrednosti podatkov, ki ga zahteva sam izračun.

Model INET je razdeljen na štiri dele. Prvi določa število žetonov v obtoku na letni ravni. Drugi meri in računa BDP žetona NAUT ter potrebno denarno osnovo za Nautilus gospodarstvo ter nazadnje uporabnost oz. vrednost koristnosti žetona. Tretji napoveduje odstotek prodora na trg, zadnji pa predstavlja sedanjo vrednost uporabnosti kovanca iz izbranega leta v prihodnosti. Rezultati izračuna narekujejo, da je napovedana in diskontirana tržna vrednost kovanca NAUT 0.42€. Vrednost je pridobljena na podlagi napovedi leta 2028 z diskontno stopnjo 30%. Zaradi lažjega razumevanja bomo pridobljene rezultate vsakega evalvacijskega modela primerjali ter komentirali na koncu dela predstavitev modelov.

VOLT model (Evans, 2018)

Ta model predstavlja nadgradnjo in kritiko prejšnjega INET modela. Avtor prav tako temelji na diskontiranju denarnih tokov v sedanjo vrednost. Evans predpostavlja, da je v svojem gospodarstvu na eni strani na voljo njegovo fiktivno sredstvo VOLT ter na drugi sredstvo z zalogo vrednosti ter pričakovano letno donosnostjo. Najprej naj pojasnimo nekatere bistvene dele na začetku uporabljenih formul. Provizija na transakcijah je predstavljena s črko C. Ti stroški provizije pripadajo izmenjavi med sredstvom z zalogo vrednosti in VOLT-ovim kovancem. Skupno število transakcij, potrebnih za podporo delovanja poteka omrežja je N. R je pričakovana stopnja donosa sredstva z določeno vrednostjo. Končno imamo še BDP gospodarstva kripto premoženja, ki je Y. Slednje je v bistvu vsota vseh porabljenih sredstev, ki jih namerava skupnost porabiti za kovance VOLT na na letni ravni.

Da bi dobili skupne stroške iz transakcijskih provizij, moramo pomnožiti C * N. Skupno povprečje denarja, ki ostane v obtoku znotraj ekonomije VOLT je Y / 2N, ker sta vedno prisotni dve transakciji. Ena transakcija je upoštevana pri izmenjavi od evra za kovanec VOLT ali v našem primeru NAUT, druga pa, ko uporabnik plača ali zamenja žeton za določen izdelek, ki ga podpira isti VOLT kovanec. Izpuščeni del donosa pri VOLT oz. NAUT se izračuna z R * Y / 2N. Za namene zmanjšanja stroškov, se je skupnost spopadla z N, kateri odgovarja za C, R in Y. Formula za skupno funkcijo stroškov bi bila R * Y / 2N + C * N. Če nekoliko enačbo obrnemo v relaciji z N. Za zmanjšanje formule stroškov za N, mora biti formula enaka nič. Da bi dobili krivuljo povpraševanja po denarju glede na C, Y in R, moramo zgoraj navedeno formulo postaviti s svojo vrednostjo v enačbo Y / 2N. Rezultat je funkcija povpraševanja po denarju. Ugotovili smo, da so zmanjšani stroški, ki jih poseduje skupnost vsako leto so enaki (BDP / Y, R in C) povpraševanju po denarju.

Na tej točki imamo podlago za doseganje oz. ocenjevanje hitrosti kripto kovanca, nepovezanega z monetarnim konceptom M v teoriji izmenjave. Evans razlaga hitrost kot optimalno vsoto transakcij pomnoženo z dva. Tukaj VOLT model popravlja oz. nadgrajuje INET model, saj vsebuje spremenljivo hitrost kovanca skozi čas in je pri tem unikaten, glede na ostale evalvacijske modele. Končni izid pa mora biti še vedno M*V = P*T, kar pomeni, da je Y * V enak povpraševanju po denarju. VOLT ne vsebuje nobenih uporabnikov, ki bi zadrževali kovance samega projekta, ampak uporabniki raje posedujejo sredstvo z zalogo vrednosti, kajti niso naklonjeni tveganjem. Zaradi doslednosti pri izračunih, smo v modelu VOLT uporabili enake predpostavke kot v modelu INET.

Razlika tega modela s prejšnjim je cena priveza, ki se ne spreminja skozi čas, upoštevanje transakcijskih stroškov ter zmanjševanje le teh skozi čas, to, da ne izolira kripto kovanca in njegovo gospodarstvo od potencialnih tržnih konkurentov ter nenazadnje upoštevanje in izračun korelacije med P * Q in hitrostjo.

Pridobili smo sedanja vrednost kovanca v višini 0.033€, ki je predstavljena kot diskontirana vrednost (30%) koristnosti kovance iz leta 2028, signifikantno manjša kot pridobljena vrednost iz prejšnjega modela. Diskontna stopnja je sestavljena iz 5% mere donosnosti ter 25% premije na tveganje.

A Model

Ta model je izdelalo podjetje ARK Invest. Na ARK Investu so se lotili proučevanja kripto sredstev kot novega razreda sredstev. Na podjetju pravijo, da so med kripto sredstvi in uveljavljenimi sredstvi bistvene razlike, zato tradicionalni okvirji vrednotenja niso aplikativni in se ne morejo uporabljati. Zanimalo jih je, kako bi lahko ocenili neko sredstvo, ki ne ponuja nič v zameno za nakup. Ne temelji na nobenih denarnih tokovih, ne izplačuje dobičkov, ne ponuja deleža podjetja in trenutno jo sploh ni na trgu.

Avtorji pri ARK Invest pravijo, da je vrednost koristnosti oz. uporabnosti projekta definirana s strani vrednosti kovancev, ki jih zadržijo uporabniki v digitalnih denarnicah ter s tem omogočajo pretok transakcij projekta. Izračuna se tako, da se skupni BDP pomnoži s hitrostjo. Cena uporabnosti oz. koristnosti kripto kovanca se izračuna preprosto tako, da se vrednost uporabne vrednosti projekta deli s številom kovancev v obtoku. Vrednost projekta ne bi smela nikoli pasti pod njegovo vrednostjo koristnosti, zato se cena za uporabnost oz. koristnost lahko obravnava kot temelji vrednotenja.

Nekateri vlagatelji ne bodo uporabljali kupljenih kovancev za izvedbo transakcij na omrežju samega projekta, temveč jih bodo zadržali v pričakovanju prihodnjega zvišanja cen. V primeru številnih kripto projektov, ki še nimajo ponujenih svojih produktov na trgu, je vsak imetnik njihovih kovancev investitor, celotna vrednost kripto sredstva pa je določena z pričakovanji donosnosti. Investitor mora biti nagrajen, ker danes ne porabi kripto kovanca ter zaradi izpostavljenosti tveganju, da se naložba ne bo obrestovala. To so dejavniki, ki določajo diskontno stopnjo investitorja in skupaj s časovnimi okvirji vlagatelja pomagajo ugotoviti, koliko je pripravljen plačati za kripto kovanec v danem trenutku.

A model predvideva šest redov investiranja oz. investitorskih razredov. Investitor prvega reda svojo odločitev utemeljuje na podlagi pričakovani prihodnji koristnosti, zato zahteva svojo ceno pred nakupom kripto žetona. Obstajajo tudi vlagatelji drugih redov, ki z uporabo istih modelov vrednotenja namesto predvidevanja prihodnje koristnosti pričakujejo ceno, ki jo bo vlagatelj prvega reda pripravljen plačati. Očitno, ima ta vlagatelj enaka pričakovanja in gleda znotraj istega časovnega obdobja realizacije, vendar predvideva, da bo na koncu prodal svoj kripto kovanec vlagatelju prvega reda in ne uporabniku omrežja. Naslednji red predvideva vrednosti, ki jo bodo investitorji drugega reda naročili ter plačali. Tako se naprej nadaljuje prek četrtega, petega in šestega vrstnega reda vlagateljev. Navsezadnje bi morala cena za kovanec biti najvišji znesek, ki ga bo plačal katerikoli potencialni kupec oz. imetnik. Sčasoma, se cenovna nastavitev premakne od špekulantov višjega reda do uporabnikov omrežja. Delež žetonov v uporabniških denarnicah se povečuje, dokler celotno omrežje ne vzpostavi prave funkcije uporabnosti oz. koristnosti. Hitrost premikanja kripto kovanca iz ene roke v druge prav tako narašča, s povečanjem števila uporabnikov.

Naj poudarimo, da nam celotna tabela rezultatov prikazuje, da je cena kovanca do leta 2023 določena glede na pripravljenost plačila premije s strani investitorjev, ki je sicer večja kot sama vrednost koristnosti. Od leta 2023 dalje, pa je cena določena s svojo vrednostjo koristnosti oz. uporabnosti. To pomeni, da vlagatelji ne bi bili pripravljeni plačati višje cene kot je sama vrednost koristnosti, saj v prihodnosti ne bi mogli realizirati pričakovanih dobičkov. Model ne zajema vrednosti oz. izračuna za potencialni primer revolucionarnega projekta, katerega kripto kovanci bi dosegli nepredstavljivo visoke vrednosti. Ta potencialna preusmeritev ni vključena v model in bi lahko bila predstavljala pomembno razliko, če bi projekt dosegel takšno raven. Druga pomanjkljivost modela je, da je uporabljena hitrost izmenjave imetnikov kovanca zastavljena kot konstantna predpostavka.

Crypto prilagojeni Black-Scholes model (Antos & McCreanor, 2018)

Za zdaj smo preučili modele vrednotenja, ki se osredotočajo na intrinzično vrednost kovancev. Vendar pa je le malo evalvacijskih modelov, ki poskušajo razumeti tržno učinkovitost kripto sredstev. Ta model se ukvarja s tem problemom in si prizadeva identificirati nepredvidene predpostavke ter predlaga teoretični okvir vrednotenja, ki vključuje nepredstavljivo visoka pričakovanja, torej velik potencial kripto premoženja in nenazadnje potencialne negativne posledice.

Ta model spodbuja ideja, da je lažje napovedati dolgoročne cene kot kratkoročno. Avtorja menita, da sta dejansko oba nepredvidljiva in napovedovanje cen v dolgoročnem obdobju verjetno ni zadostno verodostojen, ker se ukvarjamo z izredno nedorečenimi ter nereguliranimi industrijami. V prihodnost bodo te industrije, ki imajo toliko potenciala za razvoj, verjetno imele izdelke, ki si jih danes ne moremo predstavljati. Zato se sprašujemo, kako lahko zanje določimo realno ceno, če si ne znamo predstavljati potencialne razsežnosti.

Zdaj pa si oglejmo prilagojeni okvir Black-Scholes modela za vrednotenje kripto vrednot. Zasnovan je kot opcija klica (ang. ”call option”) za kripto kovanec na resničnem gospodarskem viru določenega produkta. V njem je vključena nestanovitnost rezultatov dostavljene realne ekonomske vrednosti, kar avtorja domnevata kot enega glavnih dejavnikov, ki vpliva na vrednost koristnosti kripto kovanca v nepredstavljive presežke, v primerjavi s tistim kar lahko upraviči dejanski razvoj projekta. Avtorja pripisujeta potencial kripto svetu, kakršno rast dosega informacijska doba s pomočjo interneta. Okvirji predhodnih kripto evalvacijskih modelov močno podcenjujejo kripto projekte, saj vključujejo le omejeno uporabo določenega kripto sredstva. Prejšnji modeli dodatno predpostavljajo, da kovanci uporabnosti predstavljajo zgolj cenejšo obliko prenosa vrednosti. Vendar pa obstajajo nekateri projekti, ki ne obravnavajo samo inovacij za obstoječe izdelke, temveč bodo v prihodnosti ustvarili tehnologije in nove uporabe, ki bi lahko povzročile velike razvojne premike. Avtorja trdita, da vlagatelji implicitno verjamejo, da imajo nekatera kripto sredstva možnost, da postanejo vseprisotna na obstoječi tehnološki infrastrukturi. Zaradi te hipoteze, da bi nekatere inovacije lahko vodile k ustvarjanju revolucionarnih tehnologij in povsem novih sektorjev v gospodarstvu, avtor konceptualizira nakup večine kripto kovancev kot možnost klica (ang. ”call option”) na resnično ekonomsko vrednost predvidene uporabe iz današnjega vidika ter tiste porabe, ki se lahko zasnuje v prihodnosti, kjer bi bila uporabnost totalno v drugih razsežnostih.

Predstavljajte si, da je prilagojeni Black-Scholes za nakup kripto kovanca uporabnosti kot opcija klica v evropskem slogu (ang. ”European call option”). Predpostavlja se, da je evropska opcija zaradi preprostosti, čeprav ni dejanskega datuma dospelosti. Izpustili bomo razlago spremenljivk in predpostavk tradicionalnega modela Black-Scholes in se osredotočili le na prilagojeno kripto različico modela. Spremenljivke v kripto Black-Scholes modelu je V - cena kripto sredstva, S - realna ekonomska vrednost uporabnosti izdelka, ki ga podpira kripto sredstvo, t - čas, r - stopnja brez tveganja, σ - volatilnost S-ja ter K - strošek transakcije pri porabi kripto sredstva ob izvedbeni ceni.

Domnevne kripto analogije za ta model:

- Stopnja donosa na tvegano sredstvo je stalna in se tako imenuje brezobrestna mera,
- Trenutni dolgoročni donos realne ekonomske vrednosti uporabe je naključen; natančneje, je to geometrijsko Browniško gibanje, kjer domnevamo, da je njeno nihanje konstantno,
- Resnična vrednost gospodarske koristnosti ne izplačuje dividend,
- Ni arbitražne priložnosti,
- Možno je, da se sposodite in posodite kakršenkoli znesek gotovine, celo delnega, s stopnjo brez tveganja,
- Možno je kupiti in prodati kakršenkoli znesek, celo delno, od realne vrednosti gospodarske koristnosti, in to vključuje prodajo na kratko.
- Zgoraj omenjene transakcije ne vsebujejo provizij ali stroškov, smo na trg brez trenja pri zapadlosti s časom T. Toda do nastopa časa T, lahko nastanejo nenamerni stroški trenja in transakcij.

Pri izračunu uporabljamo predpostavko, da temeljimo na Evropski opciji klica. Uporabili smo 4 različne vrednosti uporabnosti kovanca za vsa leta oz. koristnosti (ang. token utility value - S). Med temi smo tri od štirih vzeli iz prejšnjih modelov vrednotenja, INET, VOLT in A Model. Pri tem smo uporabili tudi Četrti model je fiktivna različica tega, kar bi se lahko zgodilo, če bi ta projekt dosegel neverjetno vrednost kot posledica inovativne tehnologije. To različico smo poimenovali APOT, kar je okrajšava za angleški pomen neverjetnega potenciala, ki bi ga projekt lahko dosegel. Za ta model je predviden neobičajno hiter ter učinkovit razvoj ter tržno prodornost. Za prva tri leta vrednostne koristnosti modela APOT smo vzeli vrednosti istih let modela INET, nakar smo predvideli začetek neverjetne širitev, prav tako bi se povečala vrednost koristnosti samih sredstev.

Za izračun modela, smo najprej izračunali različne standardne deviacije iz naših štirih obstoječih modelov, nato pa smo jih uporabili kot volatilnost. Za namene prikaza bomo tukaj omenili rezultate na podlagi dveh volatilnosti, in sicer, volatilnosti iz modela INET, ki je enaka 10.61% ter volatilnost iz modela VOLT, ki je 189.63%. Za prikaz rezultatov se bomo osredotočili na pridobljene rezultate za leto 2028. Spodnje vrednosti prikazujejo realne tržne vrednosti kripto kovanca na podlagi zgoraj omenjenih različnih scenarijev.

Iz pridobljenih rezultatov, je realna vrednost NAUT kovanca na podlagi vstavljenih vrednosti iz INET modela enaka 3.52€, za A Model 2.19€ ter za APOT 207.76€. Rezultatov po modelu VOLT-a nismo vključili, saj so vrednosti zelo blizu nič.

V primeru volatilnosti v višini 189.63%, pridobljene iz standardne deviacije modela VOLT, so cene vrednosti klica višje ter že bolj primerljive z vrednostmi, ki smo jih pridobili v prejšnjih modelih. INET 5.76€, VOLT 0.45€, A Model 4.42€ ter APOT 209.95€. Spoznali smo, da vrednost opcijskega klica, torej realne cene kripto kovanca ne more preseči realne vrednosti koristnosti oz. uporabnosti, ampak se ji vse bolj približuje. Sklepamo lahko, da je pri tem modelu zelo pomembna natančna in realna ocena vrednosti koristnosti v prihodnosti. Seveda je napovedovanje vrednosti v prihodnosti velikokrat zgolj ugibanje oz. špekulacija.

Pri tem modelu velja poudariti, da je sporna predpostavka ko so transakcijski stroški, uporabljeni kot cena stavke (ang. strike price) oz. izvedbena cena. Težava nastane, ker investitorji ne poznajo izvedbene cene na začetku, poleg tega pa lahko slednja zelo niha. V tem modelu smo uporabili transakcijske stroške iz modela VOLT, saj jih le ta izmed vseh ostalih upošteva. VOLT model predpostavlja, da se transakcijski stroški znižujejo skozi leta, kar je povsem upravičeno, saj ob vse večji uporabi projekta ter kripto kovance ter številu uporabniku znotraj kripto gospodarstva, bi se stroški transakcij morali znižati. To pa pomeni, da se izvedbena cena (K) konstantno niža, medtem ko se vrednost koristnosti ter cena sredstva viša, posledično je opcija klica (nakupa) vedno bolj lukrativna.

Sklep

Ob koncu analize kvantitativnih evalvacijskih modelov v naši nalogi, lahko opazimo najbolj optimistične rezultate pri INET modelu. Vseeno pa velja omeniti nekaj pomanjkljivosti kot predpostavka, da je hitrost kripto sredstva konstantna skozi vsak leta, da zanemarja transakcijske stroške ter možnost shranjevanja kripto sredstva. Posledično ni moč pričakovati visoke vrednosti v prihodnosti. Dodatno, INET model ne razlikuje povpraševanja po NAUT ter povpraševanja po privezih za plovila ter nenazadnje, ne smemo pozabiti na to, da model ne poda odgovora glede vpliva spremembe hitrosti na samo enačbo P * Q. Če korelacije med obema ni, se vrednost koristnosti kripto sredstva omejeno zmanjša ali poveča glede na povpraševanjem z elementarno koristnostjo. Zadnja omembe vredna pomanjkljivost INET modela je, da ne upošteva konkurence, zato ustvari za projekt oz. organizacijo izoliran ter zaradi tega bolj varen trg.

Naslednji je VOLT-ov model, kateri poskuša dopolniti INET-ove pomanjkljivosti, kot so transakcijski stroški, časovno spremenljiva hitrost kripto sredstva ter dodatno tudi upošteva navadno (ne-kripto) sredstvo kot shranjevalno vrednost in inflacijo denarne oskrbe. Kljub vsemu, pa VOLT ne upošteva cenovne spremembe privezov skozi čas ter tiste, ki z namenom ustvarjanja dobička kupijo ter držijo kripto sredstvo pri sebi nekaj časa. Menimo, da evalvacija po VOLT-u pričakuje veliko nižje kripto vrednosti v primerjavi z ostalimi metodami, zaradi predpostavke, da je hitrost dvakratnik števila transakcij. Slednje povzroča zelo visoke rasti hitrosti skozi leta ter posledično začetka padca vrednosti kripto sredstva. VOLT model se kaže v reativno pesimistični in morda celo površni luči, kljub upoštevanju novih spremenljivk, vendar ni moč zanemariti pridobljene rezultate, saj so lahko uporabni predvsem za investitorje nenaklonjene tveganju.

Naslednji in predzadnji model je A Model, ki je definitivno najbolj preprost, pa vendar poudari nekaj relevantnih točk, ki jih morda ostali modeli vrednotenja ne. Izstopajoč del tega modela so investitorski redi oz. razredi pripravljenosti vlaganja za namene nakupa kripto sredstva, kar lahko predstavlja zelo uporaben aspekt vrednotenja kripto sredstva za potencialne investitorje.

Zadnji izmed kvantitativnih modelov vrednotenja je Black-Scholes, ki spada v svet derivatov. Bolj kot je natančno opredeljena vrednost uporabnosti kovanaca, bolj natančne rezultate nam model povrne. Toda to je skoraj nemogoče, saj nihče ne more natančno predvideti vrednosti iz prihodnosti. Poleg tega model Black-Scholes-a temelji na realnih podatkih iz dejanskih trgov in tržnih cen. Kot primer, model mora vsebovati resnično tržno vrednost izbrane delnice, na kateri se izvajajo izračuni. In tudi ob pridobitvi rezultatov na podlagi te metode vrednotenja, je potrebno upoštevati, da omenjeni rezultati prvotno predstavljajo ceno opcije klica in ne vrednost same delnice. Sklepamo lahko, da Black-Scholes ni najverjetneje primeren, čeprav je prilagojen do neke mere našim potrebam.

Alternativno zgoraj omenjenim kvantitativnimi metodam vrednotenja, svetujemo vrednotenje kripto sredstev ali kripto projektov s kvalitativnega vidika, kot je npr. v nalogi omenjen VC pristop vrednotenja.

Appendix B: Standard Deviation calculations for valuation models

INET

Year	Utility value	Average utility value	Deviation	Deviation Squared	Average of Deviation Squared	Standard Deviation
1	0.39	3.21	-2.83	7.98		
2	0.77	3.21	-2.44	5.95		
3	1.34	3.21	-1.88	3.52		
4	2.06	3.21	-1.16	1.34		
5	2.95	3.21	-0.26	0.07		
6	3.81	3.21	0.60	0.36		
7	4.53	3.21	1.31	1.72		
8	5.07	3.21	1.85	3.44		
9	5.46	3.21	2.25	5.07		
10	5.76	3.21	2.55	6.51	3.60	1.8963

A Model

Year	Utility value	Average utility value	Deviation	Deviation Squared	Average of Deviation Squared	Standard Deviation
1	0.11	2.14	-2.03	4.12		
2	0.30	2.14	-1.84	3.38		
3	0.62	2.14	-1.52	2.31		
4	1.10	2.14	-1.04	1.08		
5	1.74	2.14	-0.40	0.16		
6	2.46	2.14	0.32	0.10		
7	3.12	2.14	0.99	0.97		
8	3.65	2.14	1.51	2.29		
9	4.02	2.14	1.88	3.55		
10	4.27	2.14	2.13	4.53	2.25	1.4999

VOLT

Year	Utility value	Average utility value	Deviation	Deviation Squared	Average of Deviation Squared	Standard Deviation
1	0.23	0.45	-0.22	0.05		
2	0.31	0.45	-0.14	0.02		
3	0.39	0.45	-0.07	0.00		
4	0.45	0.45	0.00	0.00		
5	0.52	0.45	0.07	0.00		
6	0.56	0.45	0.10	0.01		
7	0.56	0.45	0.11	0.01		
8	0.54	0.45	0.09	0.01		
9	0.50	0.45	0.05	0.00		
10	0.45	0.45	0.00	0.00	0.01	0.1061

APOT

Year	Utility value	Average utility value	Deviation	Deviation Squared	Average of Deviation Squared	Standard Deviation
1	0.30	61.90	-61.60	3794.87		
2	0.62	61.90	-61.28	3755.78		
3	1.10	61.90	-60.80	3696.85		
4	5.00	61.90	-56.90	3237.79		
5	12.00	61.90	-49.90	2490.17		
6	30.00	61.90	-31.90	1017.71		
7	70.00	61.90	8.10	65.58		
8	120.00	61.90	58.10	3375.42		
9	170.00	61.90	108.10	11685.26		
10	210.00	61.90	148.10	21933.13	5505.26	74.1974

Appendix C: A Model calculations for NAUT

Category	Units	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total daily moorings used	mooring	614,328	620,472	626,676	632,943	639,273	645,665	652,122	658,643	665,230	671,882	678,601
Total daily moorings spent	euro	30,716,423 €	31,023,587 €	31,333,823 €	31,647,161 €	31,963,633 €	32,283,269 €	32,606,102 €	32,932,163 €	33,261,485 €	33,594,099 €	33,930,040 €
Adoption curve	percent	2.3%	6.2%	12.7%	22.5%	35.2%	49.2%	62.0%	71.7%	78.2%	82.2%	84.5%
Max market reachable to NAUT	mooring	522,179	527,401	532,675	538,002	543,382	548,816	554,304	559,847	565,445	571,100	576,811
NAUT % of market	mooring	11,891	32,901	67,889	120,991	191,451	270,255	343,599	401,587	442,395	469,440	487,270
GDP Facilitated by NAUT	euro	594,546 €	1,645,032 €	3,394,429 €	6,049,556 €	9,572,532 €	13,512,757 €	17,179,961 €	20,079,373 €	22,119,725 €	23,472,010 €	24,363,479 €
Tokens outstanding	token	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Project utility value	euro	10,809.92 €	29,909.67 €	61,716.89 €	109,991.93 €	174,046.03 €	245,686.50 €	312,362.92 €	365,079.52 €	402,176.82 €	426,763.83 €	442,972.34 €
Utility price per token	euro	0.11 €	0.30 €	0.62 €	1.10 €	1.74 €	2.46 €	3.12 €	3.65 €	4.02 €	4.27 €	4.43 €
1st order investor price per token	euro	0.23 €	0.47 €	0.85 €	1.34 €	1.89 €	2.40 €	2.81 €	3.09 €	3.28 €	3.41 €	- €
2nd order investor price per token	euro	0.37 €	0.65 €	1.03 €	1.45 €	1.85 €	2.16 €	2.38 €	2.53 €	2.62 €	- €	- €
3rd order investor price per token	euro	0.50 €	0.79 €	1.12 €	1.42 €	1.66 €	1.83 €	1.94 €	2.02 €	- €	- €	- €
4th order investor price per token	euro	0.61 €	0.86 €	1.09 €	1.28 €	1.41 €	1.49 €	1.55 €	- €	- €	- €	- €
5th order investor price per token	euro	0.66 €	0.84 €	0.98 €	1.08 €	1.15 €	1.19 €	- €	- €	- €	- €	- €
6th order investor price per token	euro	0.65 €	0.76 €	0.83 €	0.88 €	0.92 €	- €	- €	- €	- €	- €	- €
Price per token	euro	0.66 €	0.86 €	1.12 €	1.45 €	1.89 €	2.46 €	3.12 €	3.65 €	4.02 €	4.27 €	4.43 €

Appendix D: INET Model calculations for NAUT

INET Supply Schedule Output for NAUT

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Released from Private Sale that year	2,000	2,000	2,000	2,000	2,000						
Released from Public Sale that year	70,000										
Released from Foundation that year	333	333	333	333	333	333	333	333	333	333	333
Released from Founders that year	2,000	2,000	2,000	2,000	2,000						
Aggregate Number of Tokens Released	74,333	78,667	83,000	87,333	91,667	92,000	92,333	92,667	93,000	93,333	93,667
Number of Tokens in Float after Bonders	63,183	66,867	70,550	74,233	77,917	78,200	78,483	78,767	79,050	79,333	79,617
Percent of Tokens Released that are Hodl'd	60%	56%	52%	48%	44%	40%	36%	32%	28%	24%	20%
Number of Tokens in Float after Bonders & Hodlers	18,583	22,813	27,390	32,313	37,583	41,400	45,243	49,113	53,010	56,933	60,883

NAUT economy and Utility Value Output

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Cost per mooring for NAUT use (€/mooring)	50.00 €	51.00 €	52.02 €	53.06 €	54.12 €	55.20 €	56.31 €	57.43 €	58.58 €	59.75 €	60.95 €
Annual global overnight moorings	614,329	620,473	626,677	632,944	639,274	645,666	652,123	658,644	665,231	671,883	678,602
Annual global moorings available to NAUT	522,180	527,402	532,676	538,003	543,383	548,816	554,305	559,848	565,446	571,101	576,812
% Share of mooring Market Facilitated by Token	2.28%	6.24%	12.74%	22.49%	35.23%	49.24%	61.99%	71.73%	78.24%	82.20%	84.48%
Traffic Facilitated by NAUT Each Year (moorings)	11,891	32,901	67,889	120,991	191,451	270,256	343,600	401,588	442,395	469,441	487,270
GDP Facilitated by NAUT Each Year	594,547 €	1,677,935 €	3,531,570 €	6,419,848 €	10,361,633 €	14,919,200 €	19,347,458 €	23,064,926 €	25,916,826 €	28,051,271 €	29,698,994 €
Monetary Base Necessary	10,810 €	30,508 €	64,210 €	116,725 €	188,393 €	271,258 €	351,772 €	419,362 €	471,215 €	510,023 €	539,982 €
Current Utility Value of Each Token	0.15 €	0.39 €	0.77 €	1.34 €	2.06 €	2.95 €	3.81 €	4.53 €	5.07 €	5.46 €	5.76 €

Adoption Curve Output

Output	5.04%	9.00%	15.51%	25.25%	37.99%	52.01%	64.75%	74.49%	81.00%	84.96%	87.24%
Percent Penetration each Year (after adjustment)	2.28%	6.24%	12.74%	22.49%	35.23%	49.24%	61.99%	71.73%	78.24%	82.20%	84.48%
Saturation	90	90	90	90	90	90	90	90	90	90	90

Appendix E: VOLT Model calculations for NAUT

Annual Money Supply

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
New Tokens Issued		0	0	0	0	0	0	0	0	0	0
Tokens Released By Founders	2,000	2,000	2,000	2,000	2,000	0	0	0	0	0	0
Tokens Released from Private Sale	2,000	2,000	2,000	2,000	2,000	0	0	0	0	0	0
Tokens Released By Foundation	333	333	333	333	333	333	333	333	333	333	333
Total Circulating Tokens	74,333	78,667	83,000	87,333	91,667	92,000	92,333	92,667	93,000	93,333	93,667

Annual Mooring Demand

Total Moorinngs annualy	614,329	620,473	626,677	632,944	639,274	645,666	652,123	658,644	665,231	671,883	678,602
Total Moorings Spend in €	30,716,474 €	31,023,638 €	31,333,875 €	31,647,213 €	31,963,685 €	32,283,322 €	32,606,156 €	32,932,217 €	33,261,539 €	33,594,155 €	33,930,096 €
Annual global moorings available to NAUT	522,180	527,402	532,676	538,003	543,383	548,816	554,305	559,848	565,446	571,101	576,812
Moorings Provided by NAUT	11,891	32,901	67,889	120,991	191,451	270,256	343,600	401,588	442,395	469,441	487,270
Annual Spending in NAUT in €	594,547 €	1,645,035 €	3,394,435 €	6,049,566 €	9,572,547 €	13,512,780 €	17,179,989 €	20,079,406 €	22,119,762 €	23,472,049 €	24,363,519 €

Annual Market Adoption

% Market Penetration	5.04%	9.00%	15.51%	25.25%	37.99%	52.01%	64.75%	74.49%	81.00%	84.96%	87.24%
Adjusted	2.28%	6.24%	12.74%	22.49%	35.23%	49.24%	61.99%	71.73%	78.24%	82.20%	84.48%

Annual Money Demand

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Transaction Cost in €	20.0€	19.7€	19.3€	18.8€	17.9€	16.8€	15.3€	13.5€	11.5€	9.4€	7.4€
Number of Transfers Per Year (N)	27	46	66	90	116	142	167	193	219	250	287
Average NAUT Balance Held in €	10,905 €	18,018 €	25,622 €	33,688 €	41,431 €	47,641 €	51,299 €	52,097 €	50,413 €	46,955 €	42,467 €
Annual Forgone Return in €	545 €	901 €	1,281 €	1,684 €	2,072 €	2,382 €	2,565 €	2,605 €	2,521 €	2,348 €	2,123 €
Token Velocity	55	91	132	180	231	284	335	385	439	500	574
Utility Value Per Token	0.15 €	0.23 €	0.31 €	0.39 €	0.45 €	0.52 €	0.56 €	0.56 €	0.54 €	0.50 €	0.45 €
Transaction Cost Decline											
% Decline in Transaction Cost		1.3%	2.0%	3%	4.4%	6.3%	8.8%	11.8%	15.0%	18.2%	21.2%
Variable Growth Rates											
YOY Velocity Growth		67%	45%	36%	29%	23%	18%	15%	14%	14%	15%
YOY GDP Growth		177%	106%	78%	58%	41%	27%	17%	10%	6%	4%

Appendix F: Call option value calculations for NAUT

Call option value calculations for NAUT with volatility 10,61%

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Number of periods to Exercise in years (t)	1	2	3	4	5	6	7	8	9	10
Transaction costs (K)	9.87	9.67	9.38	8.97	8.40	7.66	6.76	5.74	4.70	3.70
Free Interest Rate (r)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Volatility	0.1061	0.1061	0.1061	0.1061	0.1061	0.1061	0.1061	0.1061	0.1061	0.1061
INET										
Real utility Value (S)	0.39	0.77	1.34	2.06	2.95	3.81	4.53	5.07	5.46	5.76
d1	-29.980	-16.091	-9.695	-5.893	-3.240	-1.403	-0.042	1.065	2.049	2.979
d2	-30.086	-16.241	-9.878	-6.105	-3.477	-1.662	-0.322	0.764	1.730	2.643
Value of Call	0.00	0.00	0.00	0.00	0.00	0.27	1.78	2.99	2.87	2.24
VOLT										
Real utility Value (S)	0.23	0.31	0.39	0.45	0.52	0.56	0.56	0.54	0.50	0.45
d1	-34.943	-22.214	-16.457	-13.030	-10.571	-8.811	-7.471	-6.383	-5.445	-4.600
d2	-35.049	-22.364	-16.641	-13.243	-10.808	-9.071	-7.752	-6.683	-5.763	-4.935
Value of Call	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A MODEL										
Real utility Value (S)	0.30	0.62	1.10	1.74	2.46	3.12	3.65	4.02	4.27	4.43
d1	-32.428	-17.597	-10.755	-6.677	-4.008	-2.167	-0.807	0.295	1.272	2.194
d2	-32.534	-17.747	-10.939	-6.889	-4.246	-2.427	-1.087	-0.005	0.954	1.858
Value of Call	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.56	1.35	2.19
APOT										
Real utility Value (S)	0.30	0.62	1.10	5.00	12.00	30.00	70.00	120.00	170.00	210.00
d1	-32.428	-17.597	-10.755	-1.703	2.677	6.538	9.715	11.610	12.848	13.695
d2	-32.534	-17.747	-10.939	-1.916	2.439	6.278	9.434	11.310	12.530	13.359
Value of Call	0.00	0.00	0.00	0.02	5.46	24.33	65.24	116.15	167.01	207.76

Call option value calculations for NAUT with volatility 189,63%

Year	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Transaction costs (K)	9.87	9.67	9.38	8.97	8.40	7.66	6.76	5.74	4.70	3.70
Number of periods to Exercise in years (t)	1	2	3	4	5	6	7	8	9	10
Free Interest Rate (r)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Volatility	1.8963	1.8963	1.8963	1.8963	1.8963	1.8963	1.8963	1.8963	1.8963	1.8963
INET										
Real utility Value (S)	0.39	0.77	1.34	2.06	2.95	3.81	4.53	5.07	5.46	5.76
d1	-0.732	0.436	1.095	1.561	1.932	2.237	2.498	2.733	2.950	3.156
d2	-2.629	-2.245	-2.190	-2.232	-2.308	-2.408	-2.519	-2.631	-2.739	-2.841
Value of Call	0.05	0.41	1.04	1.84	2.80	3.72	4.47	5.03	5.45	5.76
VOLT										
Real utility Value (S)	0.23	0.31	0.39	0.45	0.52	0.56	0.56	0.54	0.50	0.45
d1	-1.010	0.094	0.716	1.161	1.522	1.822	2.083	2.316	2.531	2.732
d2	-2.906	-2.588	-2.568	-2.631	-2.718	-2.823	-2.934	-3.047	-3.158	-3.265
Value of Call	0.02	0.12	0.25	0.37	0.46	0.52	0.54	0.53	0.50	0.45
A MODEL										
Real utility Value (S)	0.30	0.62	1.10	1.74	2.46	3.12	3.65	4.02	4.27	4.43
d1	-0.869	0.352	1.035	1.517	1.889	2.194	2.456	2.690	2.907	3.112
d2	-2.766	-2.330	-2.249	-2.276	-2.351	-2.451	-2.562	-2.674	-2.782	-2.885
Value of Call	0.03	0.31	0.84	1.54	2.32	3.04	3.60	3.99	4.25	4.42
APOT										
Real utility Value (S)	0.30	0.62	1.10	5.00	12.00	30.00	70.00	120.00	170.00	210.00
d1	-0.869	0.352	1.035	1.795	2.263	2.681	3.044	3.323	3.554	3.755
d2	-2.766	-2.330	-2.249	-1.998	-1.977	-1.964	-1.973	-2.041	-2.134	-2.241
Value of Call	0.03	0.31	0.84	4.65	11.70	29.75	69.80	119.87	169.92	209.95