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An Investigation of Factors Determining the Token Value in the Blockchain-based Early Funding Mechanism

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Abstract

The research employs WLS Regression for examining the main determinants of the ICO profitability in the crowd-funding stage. The variables are divided into three main categories: financial and technological aspects, and the ICO characteristics, with the aim of verifying which parts most influence the funds raised. The results imply that financial and technological aspects might indeed have an impact on the ICO profitability. The key factors covered are the open-source code availability and the preset hard cap. Overall, the econometric analysis discloses that the amount raised during the ICO is not affected by the availability of a white paper and pre-sales, even though some researchers argue differently.

Keywords: Initial coin offering (ICO), Cryptocurrencies, Blockchain, Weighted least square regression, Ether, Bitcoin

JEL classifications: G1, G15, O31

Introduction

Cryptocurrencies are no longer a complete novelty, as the market capitalization of digital coins has skyrocketed, increasing with it public awareness significantly. It is not only investors who have great interest in virtual currencies, but more and more also national governments, and just as much also policy-makers as are the U.S. Securities and Exchange commission, European Securities and Markets Authority, etc. The prevalence of the improved distributed ledger technology (DTL) and cryptocurrencies has fostered the growth of a new phenomenon, called the Initial Coin Offering (ICO), as the new financing instrument for entrepreneurial ventures. Generally, ICO is defined as a decentralized method of funding, where blockchain-based organizations issue new

tokens (that can be sold online or used in the future to obtain products, services or profits) in exchange for the preexisting cryptocurrencies (usually, Bitcoin or Ether) (Adhami et al., 2018; Huang et al. (2020)). ICOs are simply considered an alternative to the already existing methods of funding as are, for instance, Venture capitalists or conventional crowdfunding. Moreover, the major part of ICOs has the listing stage, which has attracted high interest from both investors and traders.

The occurrence of ICOs has provided companies with direct and immediate early-stage crowdfunding, reduced costs and intermediation fees (Adhami et al., 2018; Fisch et al., 2019), eliminated geographical boundaries and implemented high liquidity for investors (Amsden & Schweizer, 2018). The prevalence of ICO has brought many benefits also for businesses, but has likewise challenged regulation authorities, entrepreneurs, and investors.

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Further, ICO contributors are able to easily avert regulation rules and costs of intermediation (e.g. exchanges) that are applied to businesses, issuing their securities to investors (Masiak et al., 2019). Companies initiating token sale campaigns can collect vast amounts of money with a limited extent of information and without any insurance to participants or investors of the project. Individuals are becoming more aware of what features and signals of the ICO campaigns are reliable, transparent, and expedient, as participants are mostly prospective customers and trustworthy originators. Nevertheless, speculators still appear, since there are no strict and common rules applied for the token sales market, and coins are easily exchangeable for cryptocurrency or fiat money.

The interest in the Initial Coin Offerings might really be newly arisen, but the amount of the empirical analyses on the issue of the cryptocurrency economy is rapidly evolving. Researchers mostly focus on the success factors (Howell, 2020; Chen, 2019; Fisch et al., 2019; Huang et al., 2020; Adhami et al., 2018), elements of value (Masiak et al., 2019; Felix & von Eije, 2019; Catalini & Gans, 2018), legal and regulation aspects (Zetzsche et al., 2018; Chanson, Gjoen, et al., 2018, b), as well as a general overview of the ICO market (Chanson, Gjoen, et al., 2018, b; Coinbase, 2019). Despite everything, there are still many questions that recent literature is only starting to undertake. In 2020, the most analyzed topic turned out to be towards the ICO market returns, market efficiency, and information asymmetry (Fisch & Momtaz, 2020; Domingo et al., 2020, etc.). However, there is a lack of implications composed in regards of the post-ICO market and pricing. In addition, determination of the aspects influencing the ICO profitability helps to improve not only the ICO campaign performance and the settlement of success, but also market transparency. As tokens in the ICO project do not have any present value, no pricing mechanisms are applied, thus making an estimation of the time framework of the profitability of the project difficult. In addition, coins issued during an ICO become valuable only, when the network of the campaign matures. Many substantial forces lead to constantly increasing the demand for blockchain-based early funding, and qualifying the attributes that cause the increased value for tokens is one of the main forces that induces buyer competition and incidence of the ICO projects.

This paper outlines an empirical analysis of what creates value for the ICO projects. The purpose of the research is to investigate the main elements that are most valued by the Initial Coin Offering

investors in the crowdfunding stage. A substantial effort has been made to prepare a methodology for a sound and reliable analysis. Based on the data availability, examined literature, and trends in the empirical financial studies, the Weighted Least Squares Regression was considered to be the most suitable econometric analysis to examine ICOs. The analysis in addition eliminates the heteroscedasticity and is applicable for small data samples. A lot of attention was paid also to the assumption testing, qualitative data collection, and dataset suitability verification. Moreover, the dataset consists of the dependent variable (total funds raised) and three groups of independent variables: financial aspects, technical aspects, and ICO characteristics. The relevancy of the regression analysis and statistical tests of the observation ability to predict the outcome is estimated using R software.

Research is organized as follows, namely it starts with (1) theoretical background, continues with (2) methodology of research models, followed by (3) practical model employment, and finishes with (4) result interpretation. The first part of the research covers an overview of the ICO market, presents the processes and technical operating principles of an ICO, analyzes challenges and opportunities brought by the ICO occurrence (SWOT analysis), and includes a discussion, as well as a comparison, of the diverse research findings. The second part qualifies the methods of the research analysis (WLS regression), where in the methodological part the description, general considerations, assumptions, and testing are covered. The last part represents the results of the investigation and provides consideration of the research findings, highlighting also the limitations of the research.

1 Background and literature review

The digital transformation of the company is not only focused on the new technology, but also relates to the changes in the company business models, structure, and processes (Tomat & Trkman, 2019). Therefore, ICOs might be considered one of the ways for the company's digitalization. In general, Initial Coin Offerings are identified as an open and direct way for early funding, promoted by organizations and entrepreneurs in order to increase financing through cryptocurrencies in exchange for issued so-called "tokens". These tokens can then be sold or used later on to obtain profits, products, or services (Adhami et al., 2018; Chen, 2019; Fisch et al., 2019). Moreover, all ICOs are executed by using blockchain technology and are initially launched to fund technology-based projects. The latter aspects

are also the main ones that differ an ICO from an Initial Public offering. The other important feature that emphasizes the difference between an ICO and the other crowdfunding methods (crowdfunding, Initial Public Offerings, Venture Capital, Angel Investors) is that during the ICO, investors do not buy the underlying asset, but instead buy the money supply of the future project. If the project grows and the technology is well applicable, then the value of the tokens positively correlates with the value of the company. However, at the beginning of the blockchain-based crowdfunding, campaign denomination of tokens is always equal to zero, and the originator's issued coins become more valuable only when the network of the ICO project matures. In the initial stage, the value of tokens strongly depends on the users' perceived future utility of the network. During the pre-sale stage, major investors are risk takers or those who firmly believe in the campaign. In the outset, the value for tokens is given by early birds and their willingness to pay for the project. Over time, more contribution is given to the ICO campaign and the company begins to materialize, eventually becoming able to deliver to end users.

1.1 Process and stages of an ICO

The process of an ICO is complex and only cryptocurrency holders can take part in the ICO project, with certain exceptions as is, for instance, the pre-sale stage. Before the creation of the ICO campaign, the financing-seeking company produces two smart contracts that are deployed on the blockchain platform to determine the key parameters of the token sale project. Despite the fact that up to 90% of the ICOs in the market are based on the Ethereum blockchain, when initiating decentralized crowdfunding, the company can nevertheless build its own blockchain. However, to create its own blockchain for an ICO is expensive and very difficult from the technical perspective. [Amsden and Schweizer \(2018\)](#) also indicate that the implementation of its own decentralized technology would require the company to establish an ongoing incentive mechanism to attract users in order to verify the ledger. At any rate, a smart contract that is located on the blockchain defines the hard and soft caps, the quantity of the tokens, period of the project, etc. In addition, the additional smart contract is created for token distribution and transfers that can be executed after the launch of the project. Moreover, funding is not transferred directly, after the payment the subsequent process is fully automated by the predefined rules in the smart contracts. In other

words, the ICO campaign automatically receives the access to the funding from the ICO Smart Contract and investors automatically get their portion of the issued tokens from the Token Smart Contract ([Chanson, Gjoen, et al., 2018](#)).

In general, the literature identifies three stages of an ICO, namely the pre-ICO stage, the main-ICO stage, and the post-ICO (shown in [Fig. 1](#) as Pre-sale, Disclosure of token sales, and Post-ICO stage). At the pre-ICO stage, originators of the ICO project disclose white paper to provide the information to potential investors about the key aspects of the project. The white paper contains information, as among others the prime idea, technical details, members of the company who initiated the ICO, the number of tokens, and their target prices ([Zetzsche et al., 2018](#)). White papers generally do not provide any guidelines nor standards on how to be filled and disclosed, therefore, certain electronic documents are more detailed than the others, which, in accordance to [Fisch \(2019\)](#), causes information asymmetry in the ICO market. Besides, some entrepreneurs announce the advisory board in order to show the quality of the campaign and even employ experts (from legal, marketing, information technology departments) to run the ICO ([Chen, 2019](#)). Furthermore, in the pre-ICO stage, pre-sales are initiated in order to examine the market readiness and acceptance levels. The initiators of the ICO then provide potential investors with the possibility to participate in open or private pre-sales. Pre-sales increase the interest in the ICO, thus attracting greater attention from the public and enhancing the willingness to invest in a particular ICO ([Masiak et al., 2019](#)). [Adhami et al. \(2018\)](#) agree that pre-sales are one of the major factors that fosters the higher probability of the ICO project success. At the pre-sales, investors are able to use fiat currency that helps to simplify the process for non-users of cryptocurrencies and accelerates the accumulation of soft cap ([Masiak et al., 2019](#)). [Domingo et al. \(2020\)](#) argue that pre-sales are in fact related to the ICO success, however, pre-sales negatively affects the project's returns. During the main stage, the company seeks to collect a predetermined hard cap and exchange the issued tokens to cryptocurrencies. At this stage, to collect more funding, initiators provide bonus schemes for participants of the campaign, which means that early birds receive more tokens for the same price than other investors ([Masiak et al., 2019](#)). At the post-ICO stage, originators of the token sales exchange cryptocurrencies to fiat money to reach their goals of the project, which is to make an investment to develop the product or service, expand the business, etc.

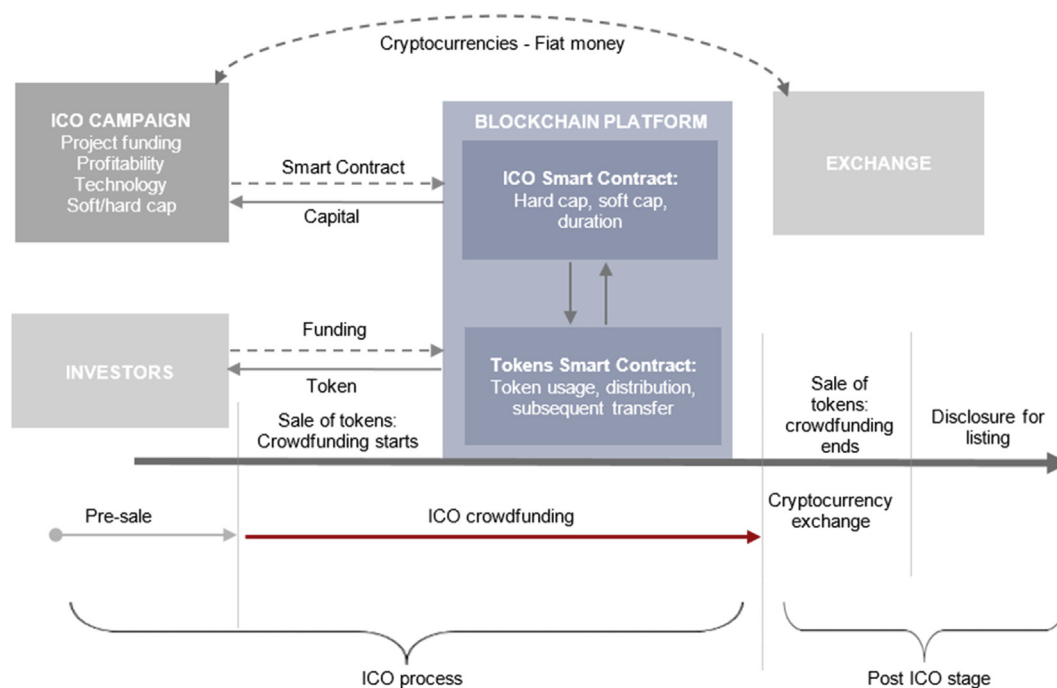


Fig. 1. Initial Coin Offering process and stages (including listing stage). Prepared by the authors in accordance with [Chen \(2019\)](#), [Masiak et al. \(2019\)](#), [Chanson, Risius, and Wortmann \(2018\)](#).

Additionally, some ICO companies offer the opportunity to trade their tokens on a secondary market (shown in [Fig. 1](#): Disclosure for listing). This latter opportunity is comparable with an IPO, however, in the latter tokens/coins are traded only on cryptocurrency exchanges ([Chen, 2019](#); [Masiak et al., 2019](#)). According to the authors, during the listing, the main factors that influence the token price are the company's disclosures on social media, code updates, and token sale performance in the main stage. Moreover, [Chen \(2019\)](#) research ascertains that the value of the listed tokens is very sensitive to low credibility and easy-interpretable signals. Investors consider the listing of tokens as a positive cause, since ICOs with a planned secondary market trading possibility tend to collect more capital. In addition, the liquidity in the token market is considerably high. However, to seek admission to trading, the company must as a prerequisite be listed on the exchange, and the preparation for listing takes time and can last up to several months.

1.1.1 Types of Tokens

The very first token sale was named Initial Coin Offering. However, since the phenomenon evolved, companies have been issuing other types of sales. The currently most prevalent are three sorts of tokens, namely currency, equity, and utility ([Fisch, 2019](#); [Masiak et al., 2019](#)). Utility tokens can give access to the service or product created by the

venture (e.g. EndChain), equity tokens represent a claim on the issuer's asset or grant contribution to the funding development (e.g. DAO), and coin tokens are used as the medium of exchange ([Adhami et al., 2018](#); [Fisch, 2019](#)). The issue of the different types of tokens increases the attractiveness of the ICO project and is one of the main distinctive substantial features among different token sale campaigns. Nevertheless, [Adhami et al. \(2018\)](#) complain that the marketing and usage of tokens only slightly influence prosperity in the ICO mechanism, especially when compared with the presale's impact on the ICO success. Furthermore, all ICOs are related to the blockchain technology, through which P2P exchanges are made in the funding mechanisms. As a base, blockchain could be widely adopted in business, since every technology includes different type of data that is stored in the blocks. The type of data depends on the sort of network, e.g. Bitcoin blockchain includes information about the sender, receiver, and the number of coins traded, while the technology provides the ability to distribute data securely between non-trusted parties without intermediation ([Zaninotto, 2016](#)).

1.2 ICO problems analyzed in the literature

Researchers have mostly analyzed aspects that relate to the determinants of success and value, legal aspects, information disclosure, comparison

between diverse funding methods and ICO, hazards, and opportunities, and more. [Fisch et al. \(2019\)](#) and [Masiak et al. \(2019\)](#), however, analyze the motives of ICO investors. They point out that motives can be broken down into three categories, namely ideological, technological, and financial. In addition, the result of their analysis shows that ICO contributors are mostly driven by technological motives, because they have an interest and see high potential in blockchain-based projects. Further, [Chen \(2019\)](#) and [Fisch \(2019\)](#) analyze the asymmetry in the blockchain-based token sale market. White papers generally do not provide any guidance, standards, nor agreed regulations on how to be filled and disclosed, and as a result, some electronic documents are more detailed than the others and can be interpreted differently by every individual. The latter issue, in accordance with the authors, causes information asymmetry in the ICO market. Moreover, [Huang et al. \(2020\)](#) analyze the legal and regulatory aspects of ICOs. The main concern of their research is why in one country token sales are more prevailed than in others. As a result, ICO initiators are more interested in the countries that have well-developed financial markets, as well as a clear legal and regulatory framework for token sales. In addition, [Haddad et al. \(2019\)](#) underline that financial innovations appear more often in the countries that have more secure internet service providers and digital technologies. On the contrary, [Huang et al. \(2020\)](#) argue that advanced technologies are not enough for an ICO spread, but that well-developed investment-based crowdfunding platforms are also crucial. [An et al., \(2020\)](#) add their finding that countries with investor protection have more developed ICOs. [Chanson, Gjoen, et al. \(2018\)](#) and [Barsan \(2017\)](#) emphasize that an implementation of regulation in the ICO market could cause law conflicts, due to the absence of geographical boundaries. Further, [Fisch \(2019\)](#), [Fisch et al. \(2019\)](#), [Adhami et al. \(2018\)](#), [Amsden and Schweizer \(2018\)](#),

[Felix and von Eije \(2019\)](#), and [Chanson, Gjoen, et al. \(2018\)](#) analyze the ICO success factors, which is otherwise already the most broadly examined topic in the literature. Authors indicated argue that success is not affected by the availability of white paper, but rather by the set of open-source codes introduced for the ICO project. [Fisch \(2019\)](#) generally agrees that an increased amount of funding is highly related to the quality of code. In addition, the researcher indicates that the success in an ICO is associated with a credible commitment to the ICO, as well as with the quality of information disclosure signals. Furthermore, [Adhami et al. \(2018\)](#) show in their analysis that success probability increases, when the campaign not only collects earlier findings, but also depends on the structure of an ICO.

1.3 SWOT analysis of ICO campaigns

The prevalence of Initial Coin Offerings around the world brings many benefits to the business world, but likewise imparts plenty of challenges and risks for market authorities, enterprises, investors, and more, identified in the SWOT analysis (see [Table 1](#)). The ICO participants can easily avoid regulation rules and costs applied to businesses, issuing their securities to investors in the exchange markets ([Masiak et al., 2019](#)). However, ICOs are controversial, as ventures implementing token sale campaigns could collect huge amounts of money without any insurance to contributors, investors, and provide limited data. One important aspect is that lack of regulation increases investment risk ([Fisch et al., 2019](#)). Equally important is that tokens in the ICO mechanism do not have current value, which means no pricing mechanism is applied and projects are very speculative, giving a high potential for fraud ([Chen, 2019](#)). Therefore, a few business ideas in the ICO market actually materialize. Typically, companies initiating IPO already have an actual product, while ICO companies have only an

Table 1. SWOT Analysis of Initial Coin Offerings. Prepared by the authors in accordance with [Adhami et al. \(2018\)](#), [Fisch et al. \(2019\)](#), [Chen \(2019\)](#), [Huang et al. \(2020\)](#), [Masiak et al. \(2019\)](#).

STRENGTHS	<ul style="list-style-type: none"> - Participants of ICOs provide direct and rapid funding for ventures. - Lower costs due to intermediaries and absence payment. - ICOs are open—no strict time for investment; availability for early contribution agents.
WEAKNESSES	<ul style="list-style-type: none"> - No pricing mechanism specified for token sales. - Information asymmetry exists between external investors and entrepreneurs and is especially heavy in the cryptocurrency market. - Lack of transparency in the ICO market due to the absence of mandatory disclosures.
OPPORTUNITIES	<ul style="list-style-type: none"> - Tokens can be traded on the secondary market—high liquidity. - Lower competition—allow a potentially easier way to collect funding.
THREATS	<ul style="list-style-type: none"> - Lack of regulations increases investment risk. - Lack of value determination leads to a highly speculative market and high potentials for fraud.

idea of the product or service, altogether making it difficult to assess the profitability of the project and the period when the project will start to produce returns (Amsden & Schweizer, 2018; Chen, 2019; Masiak et al., 2019). In the same way, high information asymmetry heavily occurs in the ICO market (Chen, 2019). As a result, the ICO market lacks transparency. Nevertheless, there remain many reasons why accepting innovative technologies is important for business. Adhami et al. (2018), Fisch et al. (2019), and Amsden and Schweizer (2018) emphasize the main causes, which are namely that by adopting DTL, a business could reduce costs of fundraising and avoid intermediaries, besides, token mechanisms allow building a post-ICO market for their investments with high liquidity, they avoid geographical boundaries, have the open-source access to capital, and much more. Not only the latter facts, but also the authors themselves indicate that ICOs are less expensive, include fewer parties, and are an easier method to collect funding in comparison to angel investors or venture capitals.

Additionally, ICOs involve nonprofessionals by providing an easier way of participation in startup financing, hence increasing greater liquidity and reducing monitoring costs (Masiak et al., 2019). On the other hand, those investors may just follow other contributors, without taking into consideration and assessment any other facts without their own experience, which may lead to irrational herding behavior in the ICO markets (Masiak et al., 2019). Anyhow, investors of ICOs provide the company with early-stage funding that is available to the venture directly and immediately. In addition, tokens can be traded on a post-ICO market to raise funds, and the liquidity is considerably high (Fisch et al., 2019).

Moreover, as there is the absence of regulations in the ICO market, no restrictions are applied to investment and marketing (Amsden & Schweizer, 2018), which leads to easier and faster preparation to collecting funds. Although, no regulations are applied for information that should be disclosed, and even more injurious is the fact that no one supervises the information that is disclosed. This may lead to counterfeiting of the project in order to collect more money. Due to an unregulated environment and lack of participation of parties with good public reputation, ICO contributors may be deluded by fraudulent projects (Chod & Lyandres, 2018; Zetsche et al., 2018). At the same time, an ICO helps to build a community of the campaign before even introducing the actual product, which helps the originators to realize the project quicker and with conditions that are more favorable.

2 Hypotheses, data and methodology

The second chapter of the research describes the structure and the process of the statistical research model by providing a detailed plan of the methodology applied. A substantial effort has been made to prepare a methodology that would produce a sound and reliable analysis. Based on the data availability, examined literature, and the trends in the empirical financial studies, the WLS Multiple Regression method was considered as the most suitable for examining the ICO value determinants in the crowdfunding stage. Below, the selected methodology is acknowledged by providing assumptions, formulas, variables, samples, time horizons, and hypotheses.

2.1 Method, time horizon and sample size

As ICO historical data are short and the values of the dependent variable have great differences, the dataset violates the homoscedasticity assumption. Therefore, the Weighted Least Squares Regression analysis was selected to evaluate the influence of the chosen predictors for the total amount raised in an ICO and to examine the main factors that cause the ICO profitability. WLS regression attributes each observation with a weight that is based on the variance of its fitted value, hereby reducing the sum of the weighted squared residuals and eliminating the heteroscedasticity (Garson, 2013). WLS regression can be used for linear, as well as nonlinear, data in the parameters and is an efficient technique for small data samples. The final presentation of the regression model formula is provided as per below:

$$Y_i = \beta_0 + \beta_1 X_i + \dots + \beta_n X_n + \epsilon_i \quad (1)$$

here:

- β_0 – intercept;
- β_n – coefficients;
- ϵ_i – residual $N\left(0, \frac{\sigma^2}{w_i}\right)$;
- n – number of observations;
- X_i – predictor

The WLS estimates of β_0 and β_n :

$$Sw(\beta_0; \beta_n) = \sum_{i=1}^n w_i (y_i - \beta_0 - \beta_n X_i)^2 \quad (2)$$

where w_i are inversely proportionate, namely (1) the data points with lower variation were assigned higher weights, and (2) the data points with higher variation were assigned lower weights. After that, WLS is given as:

$$\beta_0 = \bar{y}_w - \beta_1 \bar{x}_w \tag{3}$$

$$\beta_1 = \frac{\sum w_i (x_i - \bar{x}_w) (y_i - \bar{y}_w)}{\sum w_i (x_i - \bar{x}_w)^2} \tag{4}$$

where \bar{y}_w and \bar{x}_w are the weighted means.

Source: mcmaster.ca

2.1.1 Time horizon

The first ICO was initiated in 2013, however, it was only in 2015 that ICOs started to increase by gathering more attention from society and investors. Accordingly, the data for the model were collected in the period from 2015 to 2020, where most cases were taken from the year 2017. As a result, the period of the regression analysis model is 5 years.

2.1.2 Size

The amount of observations in the dataset is calculated by using G*Power software (Fig. 2). Under the confidence level of 95% (as this is the standard of empirical researches), the minimum required sample size is calculated to be 110. However, in order to conduct a more reliable research model, 217 observations were included in the WLS regression, although some observations were later removed when implementing the model, which is also described in the result section.

The analysis includes 217 ICO projects, where each is described by the project name, the website of the project, the trading symbol, the crowd sale duration, and the white paper. Only the completed ICOs are included in the analysis, due to a lack of information and records on the incomplete projects. In addition, the failed ICOs do not fulfill the criteria to be selected for this analysis and are thus

excluded. As the calculated minimum sample size is 110 out of 614, projects were chosen by using stratified random sampling, which is one of the probability sampling techniques. In stratified sampling, firstly, the population is divided into homogeneous groups (called strata), based on particular characteristics, and a sample is then randomly taken from each stratum (Ackoff, 1953). The 614 projects chosen for our research were divided into seven groups under the amounts of funds raised, and from them 31 projects were then randomly selected from each stratum. This approach is applied in order to include all important sub-populations into the model (Taherdoost, 2016) and have at hand all the levels of the projects for a truly precise analysis.

2.2 Variables

Most common regression analyses include two types of variables, namely the dependent variable and predictors. In particular, this multiple regression analysis model consists of 1 dependent variable and 15 predictors. The total funds raised are the dependent variable of this research and stands as the measure of how tokens are valued in the ICO market. This variable was chosen, because of the analyzed literature stating it as the most suitable parameter, considering the design and objectives of the research. The explained variable is expressed in U.S. dollars and is continuous. The independent variables include three types of information: (1) financial aspects, (2) technical aspects, and (3) pre-determined ICO characteristics. The selected groups of variables were chosen in order to examine what factors determine the greater value of tokens, i.e. which tokens are most valued in the market between participants. Every group of predictors was composed with regards to the analyzed literature,

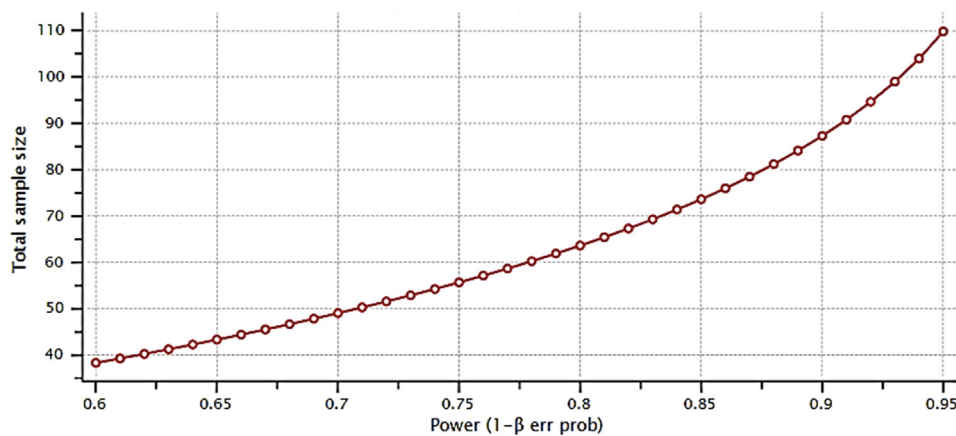


Fig. 2. Minimum Required Sample Size with Confidence Level of 0.95. Prepared by the authors, using G*Power Software.

based on the common trends in the market, together with the considerations of the authors, while following the ICO investor news. The financial group of the variables consists of a hard cap, minimum contribution size, and soft cap (determined or not). The initial ICO characteristics that might have a significant influence on the total funds raised are token type, the total supply of issued tokens, publicly available token supply (estimated in percentage), pre-sale existence, bonus scheme availability, and ICO duration. The last group of predictors includes white paper availability, open-source code availability, and criteria which determine whether a particular ICO accepts cryptocurrencies, fiat money, or both as a payment method. All independent variables are indicated in [Table 2](#).

The dependent variable, as well as the five predictors (hard cap, minimum contribution size, total issued supply, public supply, and ICO duration) are all continuous. The other 10 independent variables are the so-called categorical variables. The used information is collected from [Token data \(2019\)](#), [ICO Drops \(2020\)](#), and [ICO rating \(2020\)](#), while the open-source code was found in [Github \(2020\)](#).

2.3 Assumptions and hypotheses

In statistical models, parametric indices usually deliberate certain characteristics about the data, model suitability, and reliability. Any nonconformity of the assumptions obtained could cause an inaccurate interpretation of the findings. In some cases, exceptions might be made, but if so, they must be highly substantiated. In accordance with

the analyzed literature ([Pallant & Manual, 2010](#); [Whitcomb, 2012](#); [Zaid, 2015](#)), the assumptions tested in our research are as follows: correlation, normal distribution of errors, multicollinearity, and non-correlation between the dependent variable and error terms. The acquired assumptions are then checked and verified by using Descriptive Statistics, Scatter plots, Variance Inflation Factor and Tolerance levels, Kendall correlation matrix, R squared, and ANOVA test.

Moreover, the influential points can greatly affect the slope of the WLS regression function, therefore, it was important to detect and remove any outliers from the sample. The robustness regression model was at the time considered one of the solutions for a skewed data analysis. However, the latter proved not applicable due to the singularity issue, as many categorical independent variables are included in the analysis as predictors. Wherefore, the squared Mahalanobis distance approach was selected as the most suitable classical way for multiple linear regression models. The Mahalanobis distance is a multivariate distance metric that estimates the range between a point and a distribution. This distance is a highly applicable measure for not only insanity detection and classification of highly imbalanced datasets, but also other unfitted cases.

2.3.1 The hypotheses of the study

The general hypotheses are expressed in a theoretical way, to test what determines the value of the ICO project in the crowdfunding stage. The main aspiration is to identify how predictors influence the dependent variable: how much the variance in the

Table 2. Predictors of the regression analysis model. Prepared by the authors.

Variable	Description	Type
FINANCIAL		
HARD_CAP	Hard cap – the maximum amount that can be collected in ICO crowdfunding (USD)	Continuous
MIN_CONTR	Minimum allowed contribution in ICO crowdfunding (USD)	Continuous
SOFT_CAP	If the soft cap (minimum amount required to complete the project) of ICO is reached	Binary
ICO CHARACTERISTICS		
TYPE_TOKEN	Type of tokens issued in ICO (utility or other)	Binary
T_SUPPLY	Total supply of issued tokens in ICO (units)	Continuous
PUB_SUPPLY_PERC	Supply available for investors in ICO crowdfunding (%)	Continuous
PRE_SALE	Pre-sale availability in ICO	Binary
BON_SCH	Bonus scheme availability	Binary
ICO_DUR	ICO duration (time period between the start of token issue and end/listing stage)	Continuous
TECHNICAL		
WHITE_AV	White paper availability	Binary
OPS_COD_AV	Open-source code availability	Binary
OWN_BLOCK	If ICO is based on own blockchain or on an already existing one (usually Ethereum)	Binary
CRP_ACC	If ICO accepts cryptocurrencies	Binary
FIAT_ACC	If ICO accepts the cryptocurrencies and fiat money	Binary
BOTH_CURR_ACC	If ICO accepts both types of payment (cryptocurrencies and fiat money)	Binary

total funds raised can be explained by the chosen predictors. Since the dependent variable stands for how valuable the token sale project is, three hypotheses of the analysis are formed regarding the ICO crowdfunding stage and are presented below.

- 1) The first hypothesis refers to the first group of variables:
 H_1 : Financial determinants have a significant influence on the total funds raised.
- 2) The second hypothesis refers to the second group of variables:
 H_2 : The initial ICO characteristics have a significant influence on the total funds raised.
- 3) The third hypothesis refers to the third group of variables:
 H_3 : Technological aspects have a significant influence on the total funds raised.

As the methodology used in the research has already been discussed in the paper, the implementation of the WLS Regression analysis for the token value examination in the ICO crowdfunding stage is presented together with the results in the following chapters.

3 Results

The WLS Multiple Regression analysis was chosen in order to check how well the group of the selected independent variables (financial, technical, and predetermined ICO characteristics) were able to predict the stress levels of the explained variable (total funds raised). The main aim of using the regression model was to investigate how much unique variance of each of the predictors was explained in the dependent variable over and above other predictors. In the first place, overall 217 observations were gathered, however, some data points were excluded from the sample during the assumptions check, which left us with an estimated sample size of 110. The first tested assumption was the normal distribution and linear relationship between the dependent variables and predictors. A Scatter plot was employed at this point to check, if data were linearly related and normally distributed. The result shows that the sample was following a linear relationship, however, some points were in a great distance from the rest of the data, which reveals that some outliers exist in the data sample. After the Mahalanobis distance was applied, 16 observations were identified as influential points. Therefore, outliers were eliminated from the dataset and the regression equation was estimated without the influential points. A Scatter plot without

influential points shows that the linear relationship between the variables does exist but is not perfect, as observations of the model are spread near the line, with some deviations here and there. The skewed points specify that the data set had some discrepancies, which identify non-normality. Nevertheless, in real life, data are not usually normally distributed, and this dataset was well suited for the chosen regression method. Moreover, as the data of the dependent variable have a huge variety of values, the Weighted Least Squares Regression analysis with the standard deviation function was chosen in order to avoid heteroscedasticity bias. As discussed in the theoretical part, this method is well applicable for moderate datasets and provides an optimized estimation and different types of statistical intervals (Croarkin et al., 2006).

3.1 Descriptive Statistics and dataset adjustments

Table 3 describes variables by involving mean, standard deviation, and the total number of observations used in the model. The model consists of 201 observations in total. The mean is the estimated central value of a group of numbers (the average), while the standard deviation quantifies the variation (or dispersion) of the dataset.

Table 4 shows just how well the gathered dataset fits the analysis, as it indicates the relationship between the model and the dependent variable. The explained variable's total variation is estimated by its variance. This proportion is expressed by the adjusted R squared, standing at 0.308, and shows the corrected value of the R Square, which provides

Table 3. Weighted Least Squares Regression: Descriptive Statistics. Prepared by the authors (R software output).

Descriptive Statistics	Mean	Std. Deviation
T_FUND_RAISED	18149509.50	1.713
WHITE_AV	0.94	0.000
ICO_DUR	29.28	0.000
T_SUPPLY	4.3496730	2.9825170
PUB_SUPPLY_PERC	0.5295	0.00000
OWN_BLOCK	0.15	0.000
OPS_COD_AV	0.76	0.000
TYPE_TOKEN	0.95	0.000
BON_SCH	0.67	0.000
PRE_SALE	0.52	0.000
FIAT_ACC	0.14	0.000
CPRV_ACC	1.00	0.000
BOTH_CUR_ACC	0.14	0.000
HARD_CAP	16936498.22	1.784
SOFT_CAP	0.38	0.000
MIN_CONTR	97.3752	0.00003

Table 4. Model Fit: Weighted Least Squares Regression. Prepared by the authors (R software output).

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.653	0.346	0.308	1.476109

better estimates for the true dataset. The number indicates that 30.8% of the variance in the total funds raised are explained by the regression equation of this model. And even though the result is not very high, the model is assumed valid as the correlation between the predictors and the explained variable exists.

After the elimination of some predictors, the ANOVA test was selected to check the significance of the results. Before completing the test, the hypotheses set were concluded, meaning that the null hypothesis indicates that all β_j are equal to zero and that there is no statistical significance in the model.

$$H_0 : \beta_1 = \beta_2 = \dots = \beta_n = 0$$

$$H_A : \beta_j \neq 0; j = 1, 2, \dots, n$$

As seen in Table 5, the ANOVA test shows that the analysis reached the required level of significance ($p < 0.05$), thus rejecting the null hypothesis.

As evident from the table, the high correlation coefficient between the explained variable and predictors has only two inputs: OPS_COD_AV (0.370; condition: >0.3) and HARD_CAP (0.419, condition: >0.3). Consequently, only two variables are assumed to have an impact on the total funds raised, and it is the same variables that explain the 30.8% variance independent variable.

3.2 Hypotheses verification

Finally, all assumptions of the regression analysis are met and the model is confirmed as trustworthy and reliable. Provided that the analyzed measures indicate the statistical significance of the model, the set hypotheses should be revised. Considering that only the operational code availability and

Table 5. Weighted Least Squares Regression: ANOVA Test. Prepared by the authors (R software output).

ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Regression	179.526	13	13.81	6.338	0.000
Residual	407.454	187	2.179		
Total	586.981	200			

predetermined hard cap were highly correlated with the dependent variable, only the first and third hypotheses can be confirmed (see below).

H_1 : Financial determinants do have a significant influence on the total funds raised.

H_3 : Technological aspects do have a significant influence on the total funds raised.

Regarding the ICO specialties, the hypothesis had to be rejected, which indicates that there is neither any statistically significant influence of the ICO characteristics for total funds raised, nor that the financial and technological aspects are more influential than the ICO characteristics, i.e. in this particular model of the collected dataset.

3.3 Coefficients and formula

After the hypotheses of the model were sorted out, the final WLS equation could be written. Table 6 specifies the coefficients (β), which show how much of a unique contribution is provided by each predictor in explaining the dependent variable, as well as establish the strength and direction of each independent variable's influence. Table 6 reveals that the standardized coefficient (β_1) of Hard Cap is 0.3630 (Sig. = 0.0000) and has a positive relation with the total funds raised of the ICO in the crowdfunding stage.

Hard Cap is considered to have the highest influence on the dependent variable, as it has the highest correlation coefficient. As a result, the equation that is useful for predicting the value of the dependent variable (Y) for given values of predictors (X) is concluded below.

$$Y = 22190184.5087 + 0.3630X_1 + 3492349.7696X_2 \quad (5)$$

where:

- the intercept is (β_0) = 1.473, which indicates the value of the explained variable, when all predictors (Operational code availability and Hard cap) are kept equal to 0.
- X_1 is a Hard cap with β_1 equal to 0.3630, which shows how much the total funds raised vary in the model, when X_1 changes by one unit.
- X_2 is Open-Source Code Availability with β_2 equal to 3492349.7696, which shows how much the total funds raised increase, when the open-source code of the ICO project is available to investors.

The standardized coefficient (β_2) of Open-Source Code Availability is 3492349.7696 and has a positive

Table 6. Weighted Least Squares Regression: Coefficients. Prepared by the authors (R Software Output).

Coefficients	Unstandardized Coefficients		Sig.	Correlations		
	B	Std. Error		Zero-order	Partial	Part
(Constant)	22190184.5087	9623698.1168	0.0222			
WHITE_AV	−7391564.2501	5569121.0518	0.1860	−0.0470	−0.0966	−0.0809
OPS_COD_AV	3492349.7696	3174827.9942	0.0000	0.2696	0.2762	0.2395
T_SUPPLY	0.0001	0.0000	0.0516	0.1324	0.1418	0.1194
PUB_SUPPLY_PERC	−9620550.8425	5916369.6641	0.1056	−0.1784	−0.1181	−0.0991
OWN_BLOCK	−1461779.3060	3779001.3703	0.6993	0.0159	−0.0283	−0.0236
ICO_DUR	−174082.5643	44293.6652	0.2727	0.0607	0.0802	0.0670
TYPE_TOKEN	3559002.4226	5967758.5339	0.5516	0.0932	0.0436	0.0363
BON_SCH	−2663318.9048	2921045.7834	0.3631	−0.0762	−0.0665	−0.0556
PRE_SALE	875031.8973	2732378.6350	0.7491	0.1103	0.0234	0.0195
BOTH_CUR_ACC	6926504.6785	3885129.5238	0.0762	0.1696	0.1293	0.1086
HARD_CAP	0.3630	0.0622	0.0000	0.4185	0.3926	0.3557
SOFT_CAP	3146585.1148	2799608.3856	0.2625	0.1159	0.0819	0.0685
MIN_CONTR	139.2003	4484.1943	0.9753	0.0791	0.0023	0.0019

relationship, just as β_1 . The latter predictor had a lower correlation with the explained variable than the Hard Cap. Nevertheless, a unique contribution of the variance in the dependent variable proves highly important and has statistical significance (Sig. = 0.000).

4 Conclusions

This research model uncovers the characteristics that are most valued by the ICO investors and predetermine higher funds that are raised in the blockchain-based projects. In accordance with the first research model, the key factors are the open-source code availability and the preset hard cap, meaning the greatest amount of money that can be collected during the ICO crowdfunding. Unlike the already concluded analyses, this research includes variables that are broken down into different groups, where the selection of the projects is done by using a stratified sampling technique. The econometric analysis therefore discloses that the amount raised during the ICO is not affected by the availability of white paper. Investors might not value white paper, as it does not have any certification and requirements on how it should be composed, nor is it audited. In the event of that, transparency and the quality of information are not ensured, leaving the white paper a medium for spurious interpretations and falsification. On the contrary, a set of codes of blockchain projects is highly and positively valued by the ICO contributors. Even the availability of a partial set of code is assumed to be a proof-of-concept. However, code availability is more valued by the professional ICO investors, while non-professionals depend mostly

on white paper. Besides, the type of blockchain of the project is not considered an important characteristic in the ICO mechanism, as the major part of the existing blockchains are Ethereum, with only a few of them being unique (created on own blockchain). Moreover, our research also reveals that the predetermined total supply does not have an influence on the total funds raised, still, the part of the supply that is available for the public investors does have marginal importance. Due to the analysis, the ICO project contributors appreciate more those projects that have a greater token supply, available for the public in crowdfunding, although project funds raised do not rely on any pledged growth in the supply during a particular period.

Furthermore, a bonus scheme is a part of marketing in the ICO campaign, used as a way to attract contributors. The effect of different bonus schemes should be examined separately, since within the research, in the pool together with other elements, bonus schemes did not have a statistically significant impact on the total funds raised. Pre-sale also did not have significant (only modest) affection in this analysis, however, other researchers, for instance [Adhami et al. \(2018\)](#), have identified pre-sales as highly and positively important in the blockchain-based early funding. Pre-sales are described as a valuable strategy to raise funds in an ICO by checking the market's readiness. Nevertheless, as duration is also not one of the main characteristics that prescribes token success, as token value relies on demand during a sole period of time, it can be assumed that marketing strategies have a major part in the ICO project performance and should therefore be examined individually. Additionally, the first model of this research proves that

the hard cap helps investors to measure and foresee the ICO success. Accordingly, contributors tend to invest more in those projects that have a pre-determined maximum goal of an investment. On the contrary, based on the research results, the soft cap does not influence investors' decisions on whether to invest or not.

It turns out that the type of token (as the major part of tokens is utility), both (cryptocurrency and fiat) currency acceptance, and minimum contribution have no effect on the total funds raised. However, many other aspects must be taken into consideration as well, when analyzing ICOs, for example, the idea of the project, market conditions, timing, team qualification, quality of disclosure channels, and more. One of the main aspects in cases when ICOs fail is that, while developing blockchain-based projects, founders sometimes lack understanding of the economic part and dimension of creating long-lasting projects. In addition, ICOs face many risks, among them most often hacker attacks due to a security flaw, but also for being spuriously recognized as a fraud by the online community, and more.

Finally, ICOs have prevailed very quickly by bringing a new way of financing to early stage companies. 2017 was the most prosperous year for the ICO market. However, in the mid-2019, ICO volumes started to decrease. This decline most likely occurred as a consequence of the regulations that policy-makers started to undertake and the uncertainty of future restrictions. Nonetheless, the already initiated projects have demonstrated that they have in fact created strong lasting businesses. It is therefore logical to conclude that ICOs might actually help the cryptocurrency market improve further, as the prevalence of ICOs has obviously brought about many benefits for business. This phenomenon has a potential to change the way of funding for companies, by reducing intermediation, providing secondary market liquidity, lowering costs and giving more control to initiators. Whatever the case, it will take a lot of time to adopt new technologies in order to replace or improve the existing conventional infrastructures.

5 Limitations of data and research model

The analysis model has a couple of limitations, mostly related to data collection. Since there is a lack of official websites, where aggregate ICO information is stored, the data were collected from 4 different sources. The main sources are [Token data \(2019\)](#) and [ICO Drops \(2020\)](#), which are the most valued by the ICO contributors and founders.

However, not being possible to disclose all ICO projects through these two sources might affect the random selection of the dataset.

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