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ICO Tokens as an Alternative Financial Instrument: A Risk Measurement

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Abstract:

Purpose: *This research aims to check the risk of investing in tokens and cryptocurrencies to show how much investors could lose and determine whether ICO and cryptocurrency return rates are persistent.*
Design/Methodology/Approach: *In the article, ICO tokens and cryptocurrencies were tested using VaR. Then a Shapiro-Wilk test was performed. Due to the appearance of long tails, in the next step, Renyi's entropy was calculated. Furthermore, R/S analysis was calculated (the Hurst exponent), and on this basis, Weron's bootstrapping was applied.*
Findings: *Many tokens have a VaR result between 20% and 30% (26.69% on average, median 21.94%). Renyi's entropy of 24 tokens is more than 0.5 and less than 1. Nineteen tokens have an entropy of more than 1. For cryptocurrencies, the entropy level is between 0.68 and 0.85. In 84% of cases, the Hurst exponent is more than 0.52. The Hurst exponent values of the return rates of five tokens are above the upper bound of Weron's intervals, and four out of five the Hurst exponent values of cryptocurrencies are above the upper bound of Weron's intervals.*
Practical Implications: *There are not many articles centering on evaluating risk in investing in ICO tokens. This approach may be of crucial importance for investors and financial markets managers.*
Originality/Value: *The development of cryptocurrencies led to the rise of ICO. Scientific papers focusing on these elements concentrate on the functioning of processes, raising capital, and volatility.*

Keywords: *Fractal dimension, crowdfunding, Renyi's entropy, Hurst exponent, Weron's bootstrapping.*

JEL classification: *G15, G23.*

Paper type: *Research study.*

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1. Introduction

The cryptocurrencies market is growing rapidly. In recent years, the capitalization of the whole market has achieved solid growth. There was a great opportunity to develop new forms of security papers and new paths to financing companies. Modern cryptographic techniques expand the development of modern currencies' whole environment, leading to new company financing tools like Initial Coin Offering (ICO).

Academic interest in communication, which is fully or partially based on decentralization already started in 1981 (Chaum, 1981). With the development of technology and the growing access to the internet, a virtual currency based on the blockchain technology—bitcoin—was created (Nakamoto, 2008). With the development of bitcoin, another currency was created—ethereum (Buterin, 2013). These are virtual currencies and the main platforms for performing transactions—executing contracts, smart contracts (Tikhomirov, 2018). The research in the field focuses on blockchain technology (Swan, 2015; Dorri *et al*., 2016; Pilkington, 2016) tied to peer to peer technology (Anderson *et al*., 2016) and programming issues (Venegas, 2017). These articles concentrate on bitcoin and other cryptocurrency values (Ametrano, 2016), the functioning of cryptocurrencies and legal aspects (Doguet, 2012; Kopyscianski and Srokosz, 2015). The development of cryptocurrencies led to the rise of ICO. Scientific papers focusing on these issues concentrate on the functioning of these processes (Kaal and Dell' Erba, 2017; Fenu *et al.,* 2018), the raising of capital (Ivaschenko *et al*., 2018), and volatility (Mulders, 2019).

Blockchain research has focused on currencies based on this technology (Katsiampa, 2017; Philip *et al.,* 2018) (Caporale *et al.*, 2018). To date, studies of token return rates resulting from ICO issues have not been carried out universally. The ICO field's main interest focuses on raising capital by ventures, and the available research deals with procedures that could be taken to attract capital (Fisch, 2019). Other articles show the main determinants of the ICO phenomenon (Reiff, 2018) and emphasize the role of presenting sets of project codes rather than information in unaudited white papers (Saman *et al*., 2018). ICO is a method of realizing projects and attracting capital in connection with issued tokens. Its risks have been recognized, and ICO is a challenge for regulators [1] around the world (Zetzsche *et al.,* 2018) (Deng *et al.* 2018) (Enyi and Le, 2017). Moreover, an ICO scheme may have a positive impact on business during the initial project phase. This idea may be developed to check whether using tokens maintains business attractiveness once sustainable growth has been achieved (Kim and Chung, 2018). What is more, token liquidity is at a high level, which is one reason that attracts investors ranging from traders to venture capital managers (Kastelein, 2019). From a practical point of view (fig. 1), the cryptographic revolution allowed many new ideas to be implemented, and many more may be implemented soon. This entails the preparation of ideas and then the foundation of start-up companies. The gap between the idea and real usage is quite narrow. New technology-

based on cryptography, new ideas of financing sources like ICO have emerged and are developing very quickly.

The motivation to write this article and prepare this research was to point out the level of risk in investing in ICO tokens. The development of ICO occurred firstly in the business arena, and then the dissemination speed into the world was surprising. This new item is becoming a useful instrument on an everyday basis in the financial market. In historical events, the observation and prediction of climate changes have led to indications that long memory in data exists. Data should constitute a time series in which the series' values are persistent (Morretin, 2011). This is the theoretical path from an effective market hypothesis (Fama, 1970) to a fractal market hypothesis (Peters, 1991) in chaos theory. It is linked to the return rates of financial instruments and their risk metrics.

The procedure used in performing this research was as follows: first, the VaR was calculated to estimate the risk level in investing in each of the fifty most liquid tokens (assumption of normality test). As an expansion of risk metrics and based on fractal dimension and chaos theory, the Hurst exponent was calculated to check the time series' persistence. The Hurst exponent is a method connected with the scientific research of Mandelbrot and Wallis Mandelbrot and Wallis, (1969) and Couillard and Davison (Couillard and Davison, 2005). The VaR and Hurst exponent provides information about the risk of investing in ICO tokens on a different basis. The combination of these methods may give a more complex risk assessment. Most of the tokens (66% of the sample) have a VaR result between 20% and 30%. In 78% of cases, the Hurst exponent is more than 0.52 (44% more than 0.62).

2. ICO in Social Financing

Obtaining financing for small and medium enterprises tends to be a challenge, but more ways of doing this are emerging. So far, traditional forms of financing have been complemented mostly, though not only, sources in the form of venture capital (VC) or private equity (PE). However, technology develops rapidly, and new forms of financing enterprises are emerging. One of them is ICO (Initial Coin Offering). It is related to social financing—crowdfunding—and to blockchain technology. ICO enables various projects in their conceptual stage to obtain financing that would not have a chance to receive financing aids from traditional sources.

Crowdfunding—social financing—consists of financing projects with the usage of tele-information technology. Initially, this type of financing was intended to support artists (Agrawal *et al*., 2013). The literature has presented different definitions of crowdfunding so far. It is sometimes described as an open project, usually on a website, for which one can transfer funds in the form of donations or exchange for a specific reward to support a given project execution (Schwienbacher and Larralde, 2010). Król (2013) claims that social financing denotes a type of collection and

allocation of capital transferred for the development of a specific enterprise in exchange for a specific service in return, that engages a wide group of capital investors, characterized by the usage of tele-information technologies, as well as by a lower entry barrier and better transaction conditions than those commonly available on the market (Król, 2013). Other theories show that social financing fills a niche facilitating the acquisition of capital for enterprises at their early stages of development (Hermer *et al*., 2011). As a result, financing is available via venture capital and - at a very early stage - from business angels and the company founders and their families (Moritz and Block, 2016).

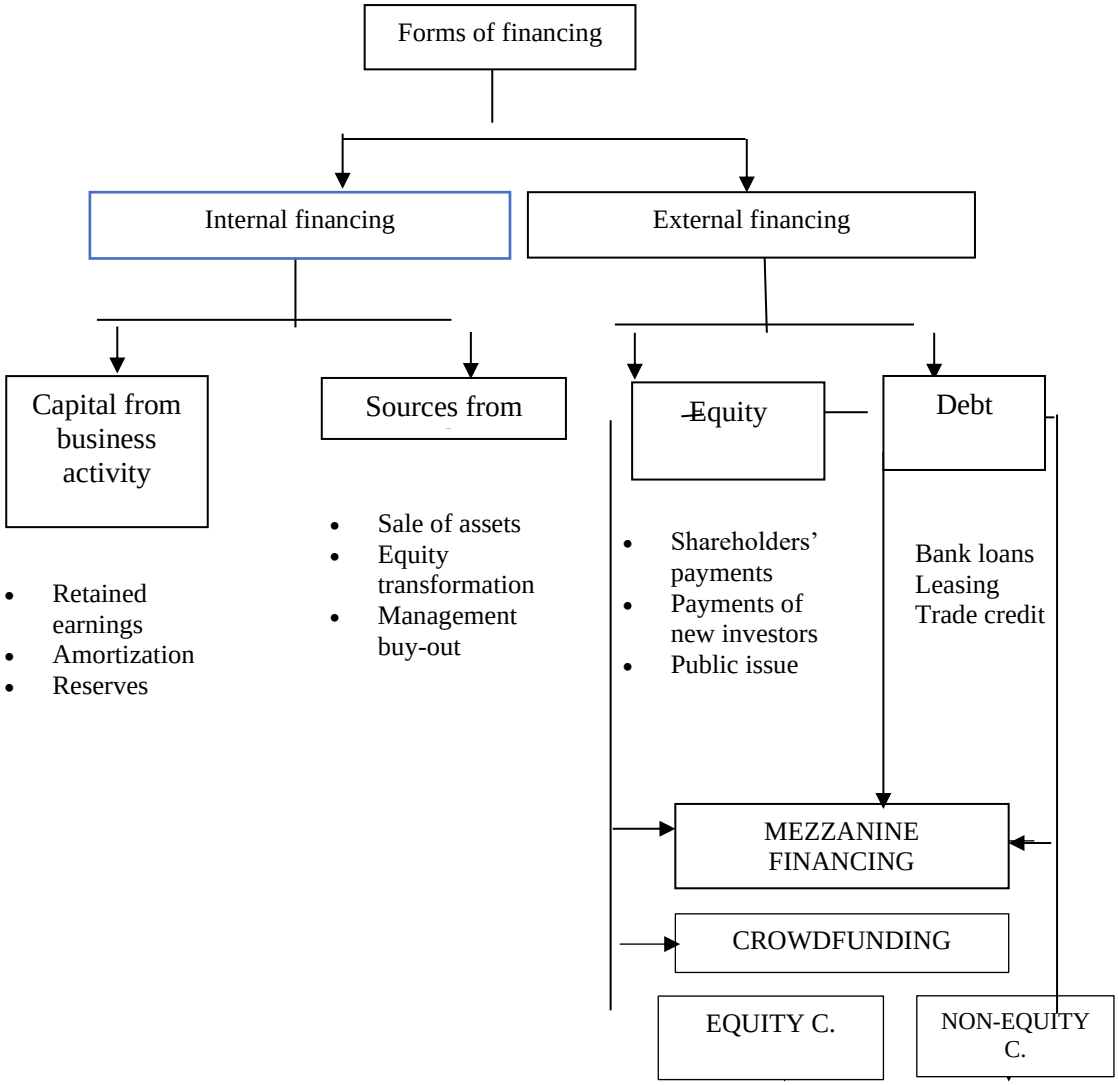
As a result of this situation, social financing supports creating projects that are not solely artistic ones, but also those from all types of businesses. Entry costs are very low or nonexistent. What enterprises need is a business plan or a detailed project description that will attract social investors and earn their trust. These investors are characterized by their willingness to pay a small amount, and if that applies to a large number of investors in the world, it becomes possible to collect an amount of even several million dollars this way. When considering financing enterprises' methods, social financing should include external financing sources, which, depending on their type, can assume characteristics of equity or debt (Figure 1).

Hybrid external financing has become more popular over the years. Investors and financial institutions are looking for new financing methods and new opportunities focusing on mezzanine capital and crowdfunding. This could lead to a change in corporate financing, moving from standard senior debt to a combination of debt and equity, which may also include finance from many sources using the internet and new technologies like blockchain. Many investors and internet users could pay a small amount of money to finance projects that could be realized in the future. A project's description is critically important because money acquirement in the fast-paced crowdfunding process needs to be transparent; a project should be interesting and show the know-how to attract potential investors who believe that it will be realized successfully. The standard forms of financing are well developed nowadays, and new financing paths are becoming available on the financial horizon.

It is assumed that investors are rewarded according to the type of crowdfunding. This type of financing can take the form of debt-based crowdfunding or be characterized by rewards in the form of a share in equity or a specific product or service.
Thus, crowdfunding can be divided into (Motylska-Kuzma, 2015):

- Donation/Charity-Based Crowdfunding – with a donation agreement applying,
- Reward-Based Crowdfunding – an investor receives a specific reward,
- Pre-Sale Crowdfunding – based on a sales agreement,
- Debt-Based Crowdfunding – a loan or credit agreement,
- Equity Crowdfunding – by acquiring shares or assets.

Figure 1. *Social financing among the sources of financing enterprises*

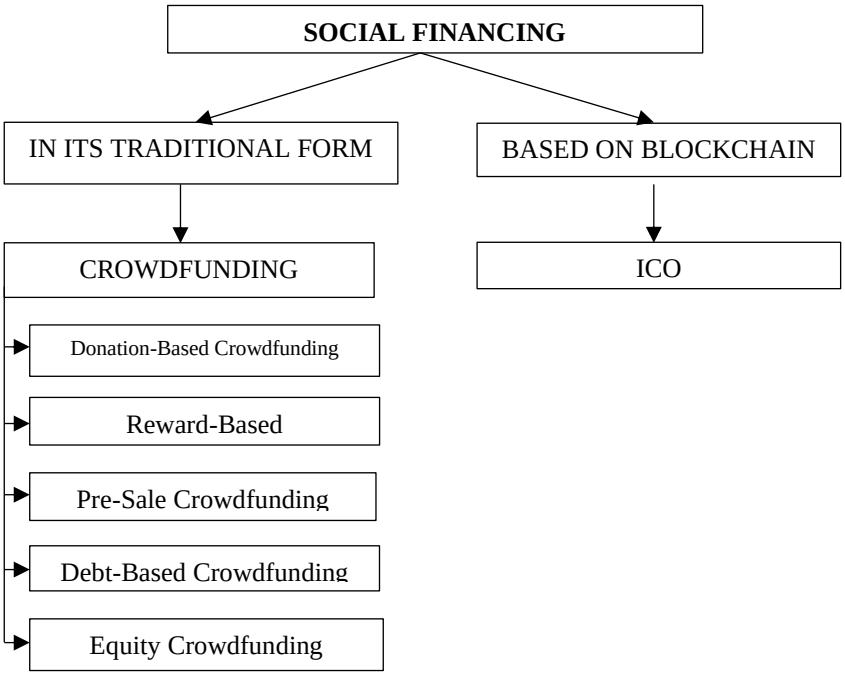


Source: *Author's own analysis based on: Mezzanine finance – A Hybrid Instrument with a Future, Economic Briefing No. 42, Credit Suisse Economic Research, 2008: 5.*

Social financing can assume different forms (Figure 2). The traditional form of crowdfunding focuses on capital from investors; it is mainly composed of many investors who raise some sums of capital in return for a promise of project implementation (symbolic reward) or participation in the project's future earnings. Other social financing forms are rooted in blockchain technology based on cryptocurrencies. Within this environment, ICO was invented, is a form of financing projects where capital is raised using cryptocurrencies. As a social financing method,

ICO has become a form of financing projects or enterprises in its seed stage (Figure 2).

Figure 2. *Types of social financing*



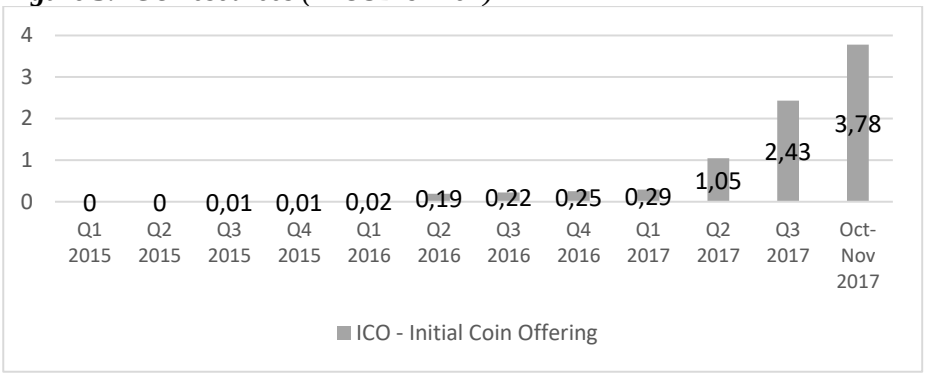
Source: *Author's own analysis based on Raport Crowdfunding, Kancelaria Wardyński i Wspólnicy, Warszawa 2014: 8.*

3. ICO Functioning and Engineering

ICO has recently become an attractive, advanced technology-based form of financing projects or newly established enterprises. It can provide capital for projects in their seed stage, similar to the other known forms of financing, such as venture capital or business angels. Performing a comparative analysis of resources provided in recent years in the form of ICO, we conclude that the share of this financing method has significantly increased (Figure 3).

Investors can purchase tokens due to the token issue within ICO, resulting in investors acquiring certain benefits from project execution in the future. Such benefits can include a share in a project or preferred access to offered products or services. These can include rights to asset components (security tokens), among which we can distinguish an equity share (equity token). This also applies to tokens issued by new companies with an idea for a business or a prepared project—companies that are starting their operation.

Figure 3. *ICO resources (in USD billion)*



Source: *EY Research: Initial Coin Offerings (ICOs).*

The second type of tokens (utility tokens) can provide access to products or services offered by a company when they have been introduced and have started to function, which means at the stage of using obtained funds in a business manner specified earlier in a document showing how the product works (white paper).

4. Research Methodology

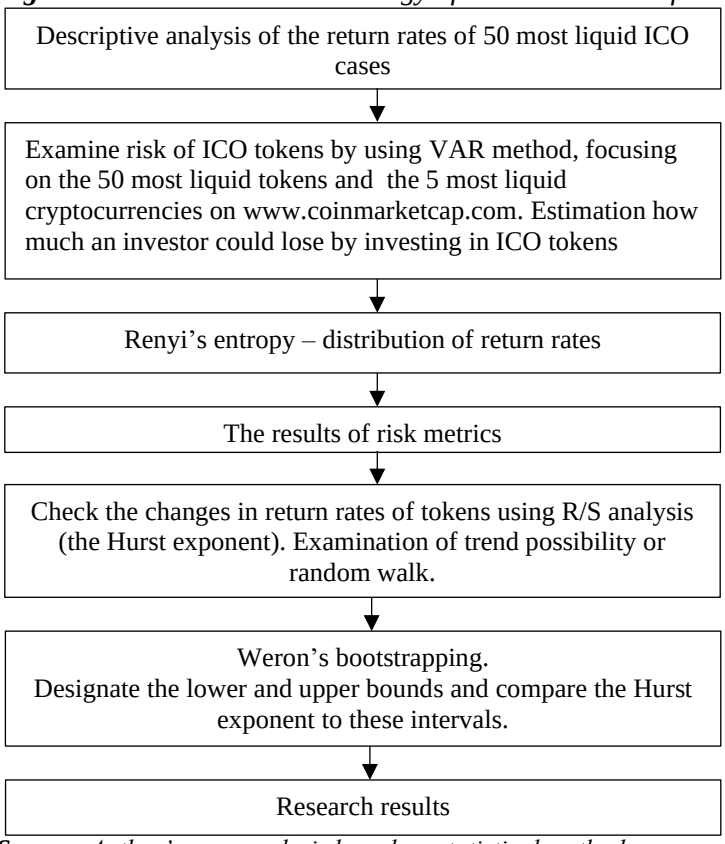
This research (Figure 4) focuses on ICO financing and cryptocurrencies, including a descriptive analysis of the 50 most liquid projects and their return rates. Statistical measures like mean, median, standard deviation, and coefficient of variation have been performed (Table 1). A time horizon includes daily return rates depending on the token from 2014 to 2019. This research paper checks the return rates of the most liquid tokens and most liquid cryptocurrencies, using the VaR method for each value. Before VaR was calculated, a normality test for return rates was executed using a Shapiro-Wilk test (annex 1 and annex 2). The distribution of tokens and cryptocurrencies return rates are not normal. Excluding the VaR values, the return rates tend to show significant variability – long tails. Due to this fact, in the next step, Renyi's entropy was calculated. The return rates in the VaR method were calculated as logarithmic return rates, using the model:

$$\mathrm{Ln}\left(\frac{R1}{R0}\right)$$

Methods of determining VaR are as follows (Kuziak, 2003):

- Variation and covariation approach,
- Historic simulation,
- Monte Carlo simulation,
- An approach for determining a quantile of any distribution,
- An approach based on extreme value theory,
- An approach based on using values from the distribution tail.

Figure 4. *The research methodology of the return rates of ICO tokens*



Source: *Author's own analysis based on statistical method*.

For token research (ICO), the study focused on a variation and covariation approach to estimate the risk of token value drops. Each instrument was considered separately, although no token portfolio was verified. The variation and covariation approaches assume that a normal distribution characterizes return rates. The formula is as follows (Kuziak, 2003):

$$R_\alpha = \mu - k\sigma$$

μ – return rate distribution average
σ – standard deviation of the return rate distribution;
k – a constant, dependent on the likability, e.g. when $1-\alpha=0.95$, $k=1.65$; when $1-\alpha=0.99$, $k=2.33$.

Thus: $VaR = (k\sigma - \mu)W_0$

The last stage was to check whether the return rates followed a trend, using R/S analysis (the Hurst exponent). The Hurst exponent (H) (Hurst, 1951) was determined based on this formula:

$$r = a^h$$

In this case, when $H \in (0;0.5)$ – there is a significant variation and unordered progress, when $H = 0.5$ – changes are of random nature, and when $H \in (0.5;1)$ – there is an ordered progress.

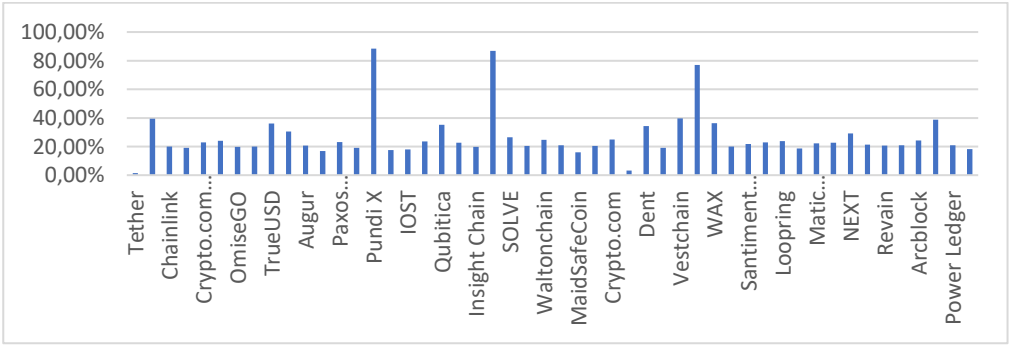
4.1 Research Data

The study was conducted based on data regarding as many as 50 most liquid ICO tokens and five most liquid cryptocurrencies, coming from 2014-2019. The next part of the risk study concerning VaR and R/S analysis (the Hurst exponent) was conducted based on the daily return rates for fifty most liquid tokens on the market since their issue until 22 May 2019. Data for calculations was obtained from www.coinmarketcap.com

5. Results

The VaR level was calculated in order to determine a possible loss level for individual tokens (Figure 5). The VAR level, excluding four tokens, does not exceed 39.77%, and the average VaR level for fifty most liquid tokens is 26.69% (a median value of 21.94%).

Figure 5. *The VaR level for 50 most liquid tokens*



Source: *Author's own analysis based on data from www.coinmarketcap.com.*

For VaR calculation, an average return rate was calculated from daily return rates (www.coinmarketcap.com) of 50 most liquid tokens (Table 1). The result of VaR shows the risk of investing in the ICO token. Most of them (24) because of between 20% and 30%. On average, investors will not lose more than 26.69% (using VaR, confidence level 0.99).

The Shapiro-Wilk test shows that ICO tokens' return rates have a different distribution from the normal distribution. Thus, the next step of the research was to determine Renyi's entropy to check the distribution density. The formula used for Renyi's entropy of the ith order of a random variable from a distribution with a density function f(x) can be expressed using the value of the expected variable f^{β_x-} (X) (Brzozowska-Run and Dziubdziela, 2006):

$$R_2(f) = \frac{1}{1-ln} \int f^{\beta_x}(x)dx = \frac{1}{1-\beta} lnEx[f^{\beta_x-1}(X)]$$

We are considering a special case where ith = 2

$$R_2(f) = -\ln Ex[fx(X)]$$

The return rates of ICO tokens and cryptocurrencies have different scales because of different standard deviations. Comparing Renyi's entropy results using different scales is not permissible. This is why Renyi's entropy results were calculated after rescaling using kernel estimation (Tables 1 and 2).

Table 1. *Renyi's entropy for ICO tokens after rescaling*

ICO Token	Renyi's entropy	ICO Token	Renyi's entropy	ICO Token	Renyi's entropy
Tether	-0.199711	Enjin coin	0.949985	WAX	0.579964
Maker	0.403381	Qubitica	0.320732	DigixDAO	0.935176
Chainlink	1.131084	Aurora	1.017216	Santiment Network Token	0.988973
Basic Attention Token	1.169352	Insight Chain	0.780819	Decentraland	0.953598
Crypto.com Chain	0.930785	ThoreCoin	0.073171	Loopring	1.039057
USD Coin	0.646079	SOLVE	0.942335	Loom Network	1.089141
OmiseGO	1.025384	KuCoin Shares	1.003084	Matic Network	0.899659
Holo	1.051604	Waltonchain	1.001277	Populous	0.963661
TrueUSD	-0.182842	Status	0.937736	NEXT	0.899525
BitTorrent	0.793954	MaidSafeCoin	1.099592	Orbs	1.106614
Augur	0.989839	Golem	1.042268	Revain	1.050502
Zilliqa	1.121253	Crypto.com	0.878064	LATOKEN	1.043693
Paxos Standard Token	0.549462	Dai	0.968164	Arcblock	0.821064

0x	1.114804	Dent	0.868003	Maximine Coin	0.513542
Pundi X	0.006462	aelf	1.073921	Power Ledger	0.993240
Huobi Token	0.980822	Vestchain	0.521672	Kyber Network	1.079785
IOST	1.036215	Mixin	0.068885		

Source: *Author's own analysis based on data from www.coinmarketcap.com.*

The entropy of only two tokens is below zero (Table 2). Five tokens have an entropy of more than 0 and less than 0.5. The entropy of 24 tokens is more than 0.5 and less than 1. Nineteen tokens have an entropy of more than 1. The higher the entropy, the more scattered the data is. For cryptocurrencies, the entropy level is between 0.68 and 0.85.

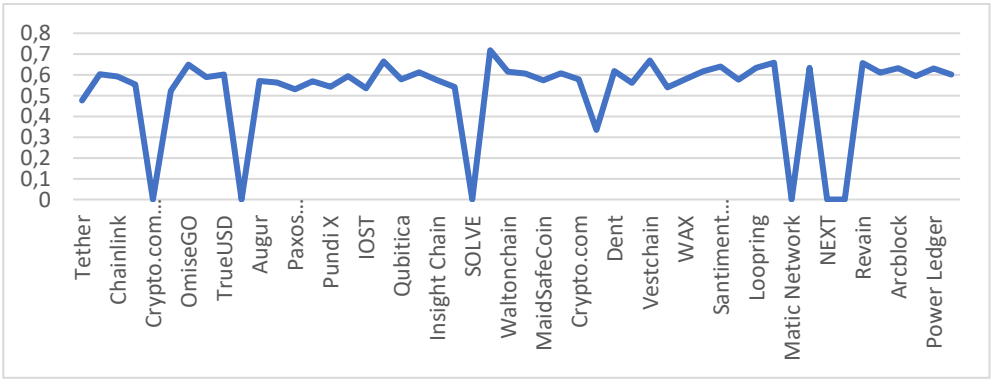
Table 2. *Renyi's entropy for cryptocurrencies after rescaling*

Cryptocurrency	**Renyi's entropy**
Bitcoin	0.846361
Ethereum	0.852367
XRP	0.680152
Bitcoin Cash	0.929555
Litecoin	0.715285

Source: *Author's own analysis based on data from www.coinmarketcap.com.*

For the fifty most liquid tokens (six had insufficient data), the Hurst exponent varied between 0.3356 and 0.7182 (Figure 6). This means that most token return rates could behave in an ordered manner (Appendix 1).

Figure 6. *The Hurst exponent for 50 most liquid tokens*



Source: *Author's own analysis based on data from www.coinmarketcap.com.*

The Hurst exponent for 42 tokens is above 0.52. The Hurst exponent for 21 tokens is above 0.60 (Table 3).

***Table** 3. The Hurst exponent results for the return rates of tokens*

Hurst exponent interval	Results – quantity of tokens	Sample %
Sample is too small / outliers	6	12%
Below 0.48	2	4%
Between 0.48 – 0.52	0	0%
Between 0.52 – 0.60	21	42%
Above 0.60	21	42%

***Source:** Author's own analysis based on data from www.coinmarketcap.com.*

The research's development was to check the VaR and the Hurst exponent for the five most liquid cryptocurrencies to compare the risk and persistence of tokens with cryptocurrencies (tab. 4). The lowest VaR result belongs to bitcoin. Other currencies have a VaR result between 15.40% and 20.39%.

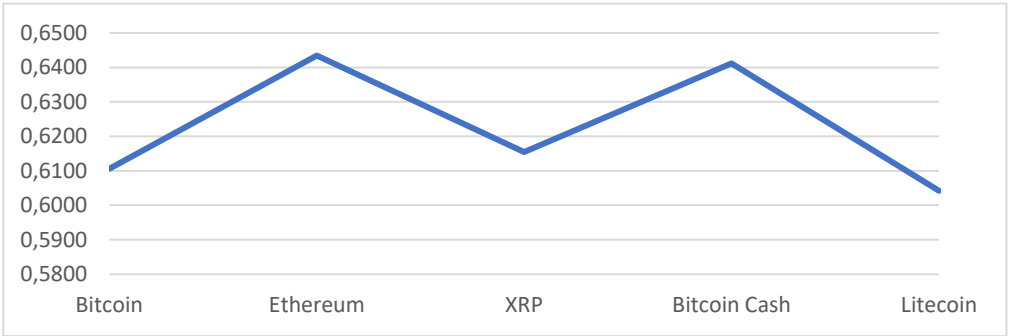
***Table 4.** The VAR for the five most liquid tokens based on data from www.coinmarketcap.com*

Cryptocurrency name	Order ar per capitalization	Mean	Standard deviation	Coefficient of variation	Confidence level	No. Of standard deviations	VaR	Hurst exponent (calculate in Gretl)
Bitcoin	1	0,18%	4,32%	4,26%	0,99	2,326	10,04%	0,6106
Ethereum	2	0,32%	7,52%	4,31%	0,99	2,326	17,50%	0,6434
XRP	3	0,20%	7,56%	2,61%	0,99	2,326	17,58%	0,6154
Bitcoin Cash	4	0,00%	8,77%	-0,03%	0,99	2,326	20,39%	0,6411
Litecoin	5	0,14%	6,62%	2,06%	0,99	2,326	15,40%	0,6042

***Source:** Author's own analysis based on data from www.coinmarketcap.com.*

The Hurst exponent (Figure 7) for the five most liquid cryptocurrencies is above 0.60. The highest is for Ethereum (0.6334).

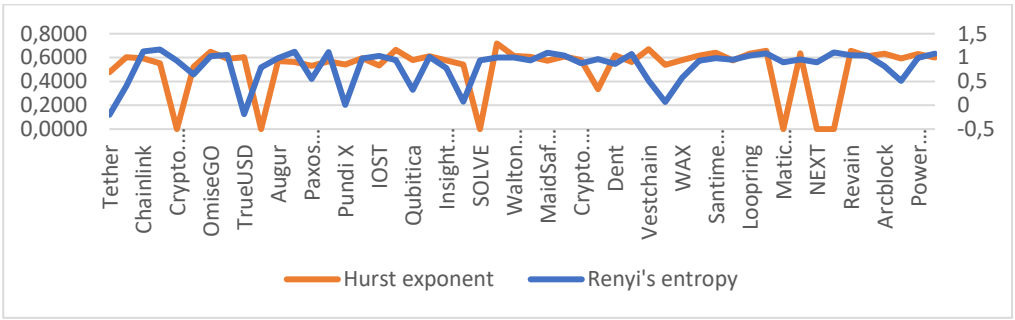
***Figure 7.** The Hurst exponent for five most liquid cryptocurrencies*



***Source:** Author's own analysis based on data from www.coinmarketcap.com.*

Renyi's entropy and the Hurst exponent for the return rates of ICO tokens and cryptocurrencies in many cases have the same trend (Figures 7 and 8).

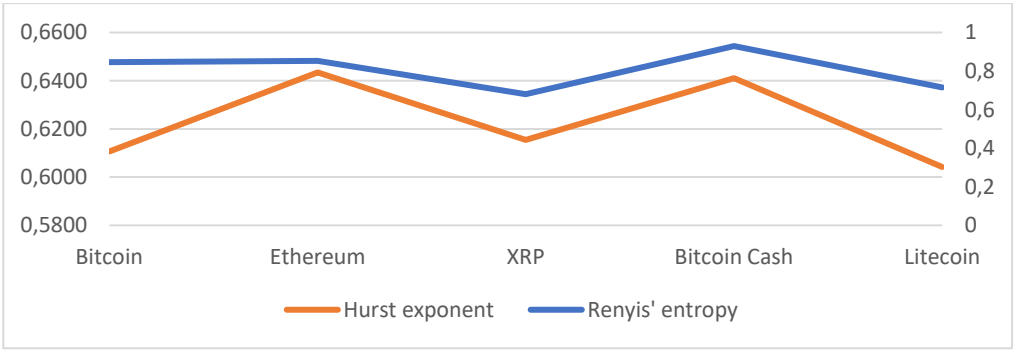
Figure 8. *The Hurst exponent versus Renyi's entropy for the return rates of ICO tokens*



Source: *Author's own analysis based on data from www.coinmarketcap.com.*

Only for ethereum, the Hurst exponent and Renyi's entropy display a different trend (Figure 9).

Figure 9 *The Hurst exponent versus Renyi's entropy for the return rates of cryptocurrencies*



Source: *Author's own analysis based on data from www.coinmarketcap.com.*

In the next step, Weron's (Weron, 2002) bootstrapping is used to designate the lower and upper bounds.

The lower bound is calculated using the formula (level 90%):

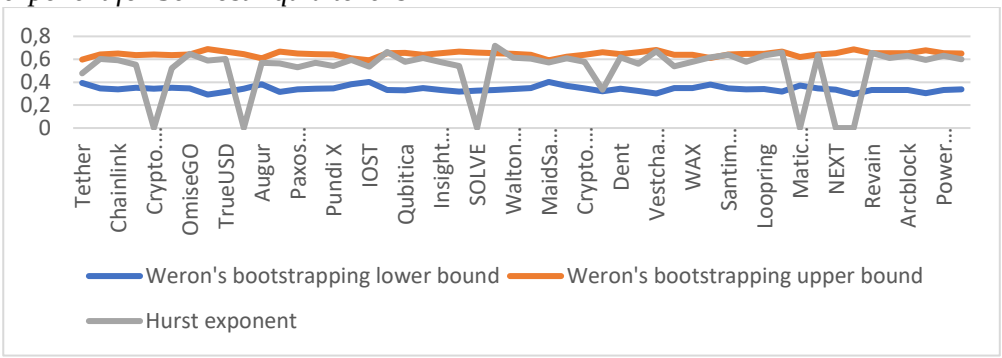
$$0.5 - \exp(-7.35 \log(\log M) + 4.06)$$

The upper bound is calculated using the formula (level 90%):

$$\exp(-7.07 \log(\log M) + 3.75) + 0.5$$

$M=\log_2 N$, N – series length

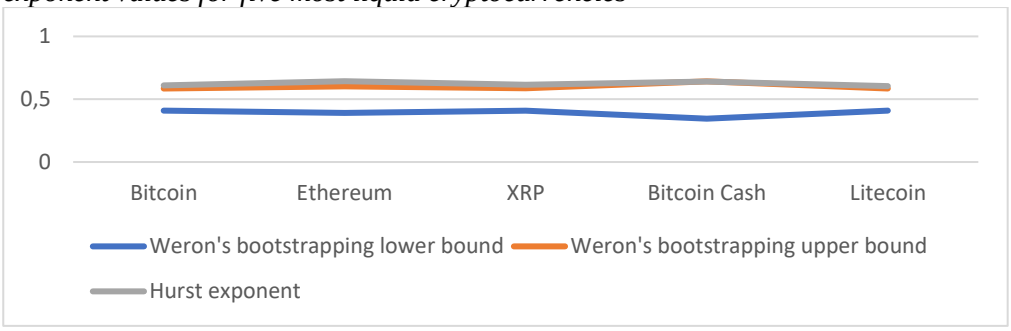
Figure 10. *The lower and upper bound (Weron's bootstrapping) and the Hurst exponent for 50 most liquid tokens*



Source: *Author's own analysis based on data from www.coinmarketcap.com.*

The Hurst exponent values of the return rates of five tokens are above the upper bound (Figure 10), and four out of five the Hurst exponent values of cryptocurrencies are above the upper bound (Figure 11). When the Hurst exponent is outside the interval, it means that the token is real - that return rates are different from 0.5 (random walk). The most liquid cryptocurrencies' return rates are more persistent than the return rates of the most liquid ICO tokens.

Figure 11. *The lower and upper bound (Weron's bootstrapping) and the Hurst exponent values for five most liquid cryptocurrencies*



Source: *Author's own analysis based on data from www.coinmarketcap.com.*

6. Discussion

This article aims to show the risk level in investing in the most liquid ICO tokens. It is sometimes emphasized that mechanisms based on blockchain, especially in the initial stage of their development, can be rather speculative (Cheah and Fry, 2015).

However, in studying the risk of fifty most liquid tokens measured for VaR, this value oscillates around 26.36% on average, and for five most liquid cryptocurrencies, it oscillates around 16.18% on average. However, it should be noted that there is a risk involved with no possibility of reporting the loss to any central body. ICO does not have such a body, as it works via a decentralized and dispersed system.

This research has focused on the 50 most liquid tokens; other limitations are linked to the time span because ICO tokens appeared on the market only recently; and only one variable, the return rate, has been examined. In the future, the research could be continued on a larger sample. Another challenge is to compare the correlation between the return rates of ICO tokens and cryptocurrencies. What is more, the comparative analysis or correlations of ICO tokens and venture capital investment return rates should be checked using research methods. Using the VaR method, a few of them are below 10%, but in many cases, the VAR is between 20% and 30%. The VaR and the Hurst exponent show the level of risk focusing on the most liquid tokens, which are well recognized in the blockchain market. The VaR level of tokens was calculated to be: mean 26.69% and median 21.94%, and the VaR of cryptocurrencies is: mean 16.18%, median 17.50%. It is worthy of note that the return rates of only five tokens have a Hurst exponent outside the upper bound of Weron's bootstrapping, whereas four out of five the Hurst exponent values of the most liquid cryptocurrencies are above Weron's bootstrapping.

The 50 most liquid tokens are quite stable according to their VaR results, but extremes exist, and only five are above Weron's bootstrapping. There are still certain limitations, but the most liquid ICO tokens' risk level has been presented.

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Annex 1. *Shapiro-Wilk test for ICO tokens*

Token name	Shapiro-Wilk test	Token name	Shapiro-Wilk test
Tether	0.0995919, with p value 6.78319e-65	Status	0.840549, with p value 8.94983e-26

Maker	0.372095, with p value 8.53778e-43	MaidSafeCoin	0.965057, with p value 7.66301e-19
Chainlink	0.963909, with p value 4.40882e-11	Golem	0.945436, with p value 7.24406e-18
Basic Attention Token	0.972414, with p value 2.087e-10	Crypto.com	0.82846, with p value 1.66001e-26
Crypto.com Chain	0.861549, with p value 1.12067e-23	Dai	0.920541, with p value 9.07564e-16
USD Coin	0.547467, with p value 2.11993e-39	Dent	0.873311, with p value 1.60634e-22
OmiseGO	0.910719, with p value 1.68285e-19	aelf	0.956487, with p value 3.2197e-11
Holo	0.930265, with p value 1.82898e-12	Vestchain	0.445949, with p value 4.1789e-34
TrueUSD	0.0581139, with p value 2.91619e-43	Mixin	0.138337, with p value 1.14171e-48
BitTorrent	0.783283, with p value 1.34185e-28	WAX	0.449929, with p value 5.18386e-42
Augur	0.88956, with p value 1.75974e-28	DigixDAO	0.816612, with p value 5.43646e-34
Zilliqa	0.963917, with p value 1.69311e-09	Santiment Network Token	0.921899, with p value 2.86743e-18
Paxos Standard Token	0.538681, with p value 4.62347e-37	Decentraland	0.84997, with p value 1.21122e-23
0x	0.957035, with p value 9.03501e-13	Loopring	0.905637, with p value 2.68742e-19
Pundi X	0.118472, with p value 3.23774e-48	Loom Network	0.95652, with p value 7.79277e-11
Huobi Token	0.861843, with p value 3.06116e-31	Matic Network	0.8135, with p value 3.72637e-32
IOST	0.873273, with p value 1.19518e-33	Populous	0.823687, with p value 1.18171e-26
Enjin coin	0.839725, with p value 1.82134e-23	NEXT	0.852694, with p value 6.14511e-23
Qubitica	0.351833, with p value 4.90485e-40	Orbs	0.966164, with p value 5.84903e-08
Aurora	0.910795, with p value 9.87745e-20	Revain	0.936871, with p value 9.22202e-15
Insight Chain	0.577315, with p value 7.65373e-35	LATOKEN	0.939923, with p value 1.83514e-14
ThoreCoin	0.280568, with p value 9.14317e-40	Arcblock	0.63896, with p value 7.84213e-33
SOLVE	0.861913, with p value 1.77115e-21	Maximine Coin	0.424478, with p value 5.85978e-35
KuCoin Shares	0.885451, with p value 3.19196e-20	Power Ledger	0.884341, with p value 3.59788e-20
Waltonchain	0.890397, with p value 8.45795e-21	Kyber Network	0.955068, with p value 1.27238e-12

Source: *Author's own analysis based on data from www.coinmarketcap.com.*

Annex 2. *Shapiro-Wilk test for cryptocurrencies*

Cryptocurrency	Shapioro-Wilk test
Bitcoin	0.883196, with p value 5.69142e-38
Ethereum	0.790634, with p value 6.50565e-39
XRP	0.764323, with p value 6.80863e-48
Bitcoin Cash	0.8921, with p value 3.10421e-21
Litecoin	0.783172, with p value 2.31191e-47

Source: *Author's own analysis based on data from www.coinmarketcap.com.*

Annex 3. *R/S analysis (the Hurst exponent) for the most liquid tokens*

Token	Order by liquidity	R/S analysis (Hurst exponent)	Token	Order by liquidity	R/S analysis (Hurst exponent)	Token	Order by liquidity	R/S analysis (Hurst exponent)
Tether	1	0.475948	Enjin coin	18	0.665161	WAX	35	0.578298
Maker	2	0.602893	Qubitica	19	0.577789	DigixDAO	36	0.616679
Chainlink	3	0.59198	Aurora	20	0.611985	Santiment Network Token	37	0.640155
Basic Attention Token	4	0.552983	Insight Chain	21	0.575199	Decentraland	38	0.577389
Crypto.com Chain	5	not all data available	ThoreCoin	22	0.541993	Loopring	39	0.633947

USD Coin	6	0.523265	SOLVE	23	not all data available	Loom Network	40	0.657791
OmiseGO	7	0.648414	KuCoin Shares	24	0.718189	Matic Network	41	not all data available
Holo	8	0.588571	Waltonchain	25	0.61453	Populous	42	0.634153
TrueUSD	9	0.601912	Status	26	0.606461	NEXT	43	not all data available
BitTorrent	10	not all data available	MaidSafeCoin	27	0.573224	Orbs	44	not all data available
Augur	11	0.570385	Golem	28	0.607533	Revain	45	0.656458
Zilliqa	12	0.56357	Crypto.com	29	0.578969	LATOKEN	46	0.610123
Paxos Standard Token	13	0.530961	Dai	30	0.335642	Arcblock	47	0.631378
0x	14	0.569171	Dent	31	0.617915	Maximine Coin	48	0.593462
Pundi X	15	0.542066	aelf	32	0.56181	Power Ledger	49	0.6308
Huobi Token	16	0.593834	Vestchain	33	0.669191	Kyber Network	50	0.600684
IOST	17	0.534634	Mixin	34	0.539006			

Source: *Author's own analysis based on www.coinmarketcap.com.*

Annex 4. *R/S analysis (the Hurst exponent) for the most liquid cryptocurrencies*

Cryptocurrency	Order by liquidity	R/S analysis (Hurst exponent)
Bitcoin	1	0.610632
Ethereum	2	0.643438
XRP	3	0.615429
Bitcoin Cash	4	0.641119
Litecoin	5	0.604209

Source: *Author's own analysis based on data from www.coinmarketcap.com.*