FinToken

Token economy simulation[1]

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Important notice: **The FinToken is a 100% fictitious token**, created for the sole purpose of this document - showing an example token economy simulation. As such a lot of the figures in the document are also entirely made up and should not be used for any other purposes. The calculations on top of those fictitious numbers are however real with the goal of demonstrating the expected deliverables. Please note that the example outlined in this document is the simplest and most commonly encountered one. This is done for the purpose that the reader finds the text understandable and familiar. Many projects require more complex simulations, due to their specifics (multiple tokens, inflationary mechanism, token interactions).

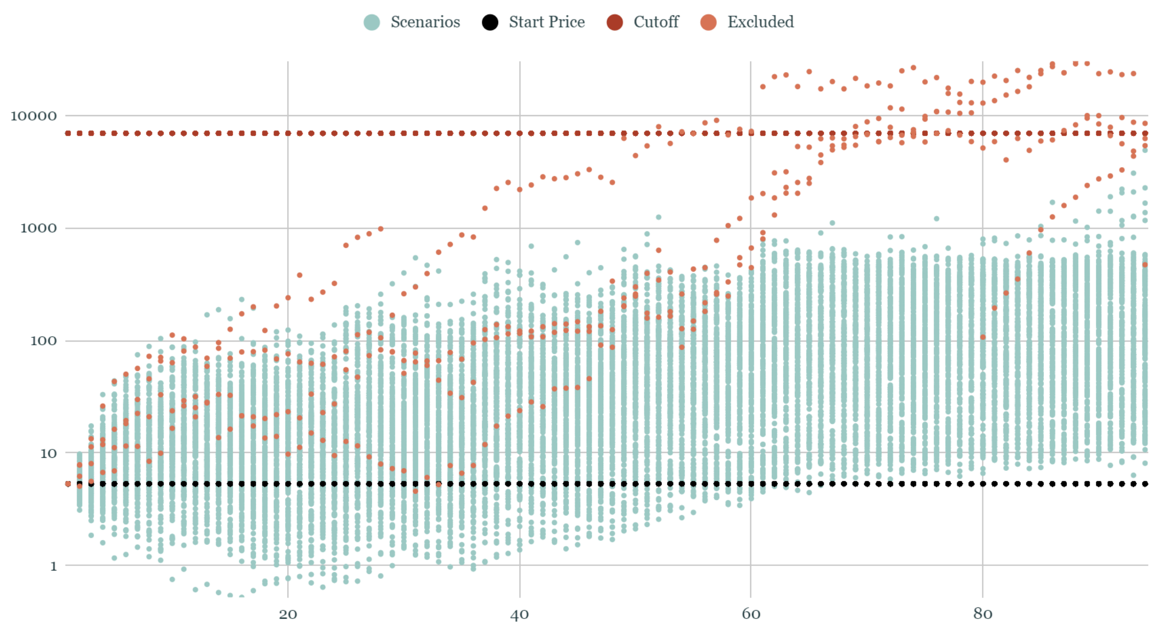
[1] By the FinDaS tokenomics team, tokenomics@findas.org; https://www.findas.org

Executive summary

Scope. The scope of the simulations performed was to examine the overall token economy setup of FinToken, as specified in its tokenomics whitepaper.

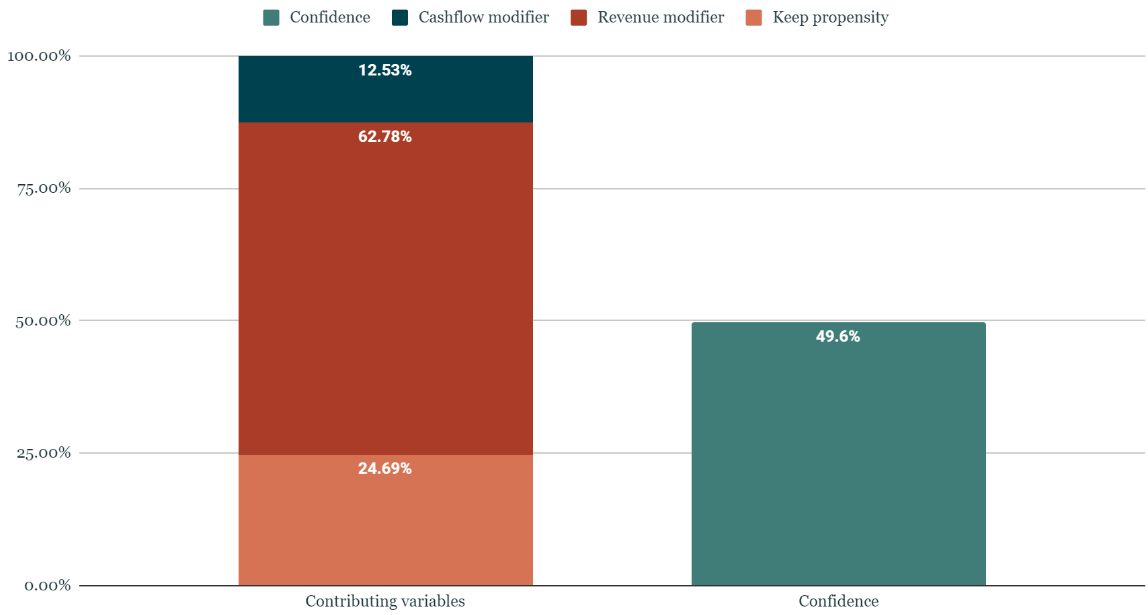
Goal. The goal was to assess edge case scenarios, and possible black swan events which could be detrimental to the overall token economy. Also to explore under what scenarios does the token price underperform

Summary Findings. Here we will present a short version of our findings, however we strongly recommend also examining the rest of the document (the Simulation section) for a more nuanced interpretation of the results.



Unfiltered data points (Price) out of all simulations (Log scale).

In almost all observed scenarios, the token price finished higher than the starting token price, which is a good sign. We will explore the best and worst performing scenarios further in this document.



Main contributors and confidence (R^2).

The main contributor to the token price is the revenue generated by the company and to a lesser extent, the propensity of people to keep the token in their wallets and the amount that the token was used for payment.

Recommandations. Decoupling a project's success from its revenue is almost impossible (except from meme-coins), it is a bit like decoupling a car from its engine. However due to the positive correlations that were found for keep propensity and cashflow modifiers, some economic levers that the project might want to explore are:

- During periods of low revenue, increase incentives for token staking
- During periods of low revenue, increase incentives for using the token as a payment method as opposed to FIAT

Simulation

Scope & goals

The scope of the current document is to provide the findings of the interactive token economy simulation performed based on the agreed upon scope here:

https://docs.google.com/document/d/1OmZF0Taro Hde2NWBUlj_3SJcnMdm7AEv2Or7wukN3M4

Aim

The token economy simulation offers several benefits for the project for which it is performed. These advantages include:

- **Enhanced Understanding:** The simulation provides the project with a hands-on learning experience, allowing them to develop a comprehensive understanding of the project's token economy. It helps grasp the intricacies and dynamics of the token-based ecosystem, which is crucial for making informed decisions and contributing effectively to the project.
- **Risk-Free Experimentation:** The simulation environment enables experimentation with different strategies and economy variables without real-world consequences. It can explore various scenarios and test hypotheses, gaining insights into the potential outcomes and refining their approaches before implementing them in the actual project.
- **Continuous Improvement:** By evaluating the outcomes of the simulation, project organisers can identify strengths and weaknesses in the project's token economy design. The feedback obtained from the simulation helps in refining the project's strategies, fine-tuning economic models, and improving the overall implementation plan. This iterative process facilitates continuous improvement and increases the project's chances of success.

In summary, the token economy simulation brings several benefits to the project by enhancing participants' understanding, enabling risk-free experimentation, providing decision-making insights, fostering collaborative learning, and facilitating continuous improvement. These advantages contribute to the project's overall success and help ensure a well-designed and effective token economy.

Methodology

In research, variables are any characteristics that can take on different values, such as stake rate, revenue variance, etc..

When performing a simulation, we manipulate or measure independent and dependent variables in studies to test cause-and-effect relationships.

- **The independent variable** is the cause. Its value is independent of other variables in the study. We refer to independent variables simply as **variables.**
- **The dependent variable** suffers the effect. Its value depends on changes in the independent variable. We refer to the dependent variables as **KPI**.

Variables. Variables are several simulation parameters, where we input random numbers (within a range) to observe the effect on Key Performance Indicators (KPIs). The variables used in this simulation are as follows:

- **Revenue variance** - a multiplier on the revenue of the projected company revenue taking on values between 10% and 300%. *Example: a revenue multiplier of 150% means the company would achieve 150% of their revenue projection for the specific month.*

- **Cashflow through the token** - a multiplier between 5% and 200% (the upper limit was chosen, due to the fact that the baseline cashflow through the token is 50%, this a 200% multiplier would result in a 100% CF through the token). *Example: a 150% cashflow multiplier, means that 75% (instead of the usual 50%) of all company revenue would be generated via the token.*

- **Keep propensity** - this multiplier is the **inverse** of the chance that 10% of the remaining users sell their tokens each month. We chose the inverse since we wanted all 3 independent variables to represent positive outcome when increased and negative outcome when decreased. Keep propensity is a multiplier between 10% and 300% (of a baseline 100%). The formula we used here is:

  Tokens sold = (Tokens held in wallets) * 10% / (Keep propensity)

  Example a keep propensity of 50% represents 20% of the remaining token holders selling their tokens. On the opposite side 200% represent only 5% of users selling their tokens each month.

fx Variables are shown as purple colour elements on the simulation Diagram.

KPI. KPI are simulation parameters that we observe as outputs. The KPI are based on the Variables as explained above and on calculation assumptions as listed below.

- The main, only observed KPI is the **token price** below). We determine the token price, by creating a fully functional simulation of a Constant Product AMM (automated market maker) and simulating supply and demand (using the independent variables above).

fx KPI are shown as orange colour elements on the simulation Diagram.

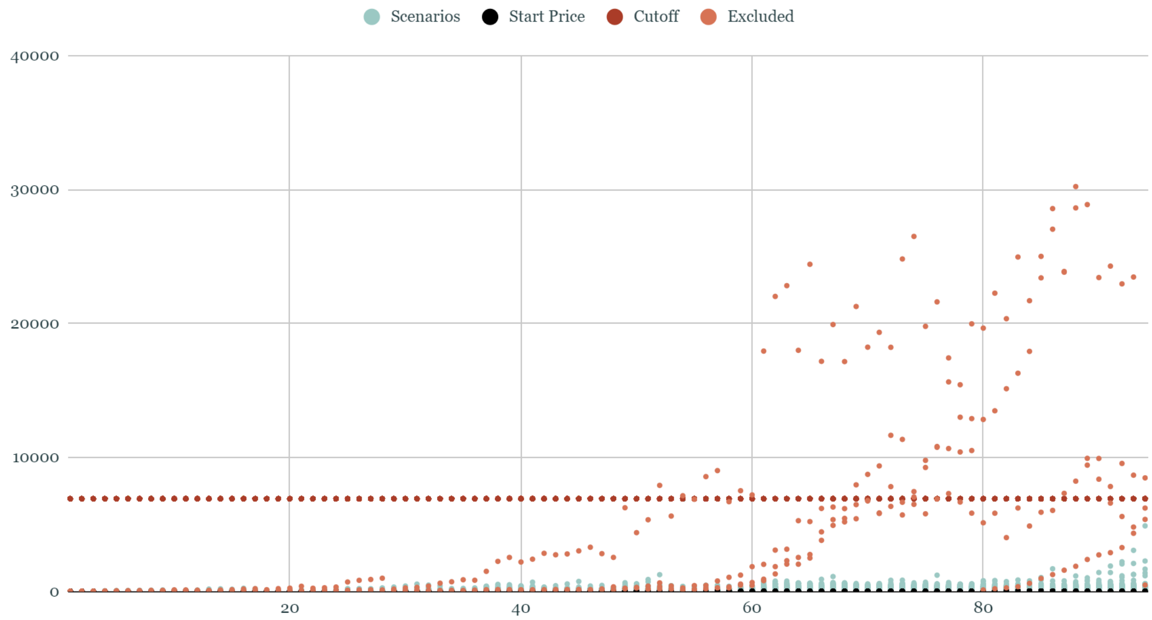
Summary findings

In this part of the document we want to provide you with a detailed overview of our findings. For more information on how the simulations were structured, why certain numbers were used, and overall understanding of the process, we strongly recommend that you review the implementation specifics of this document. The oversimplified takeaways of the Methodology section, in order to understand those summary findings are:

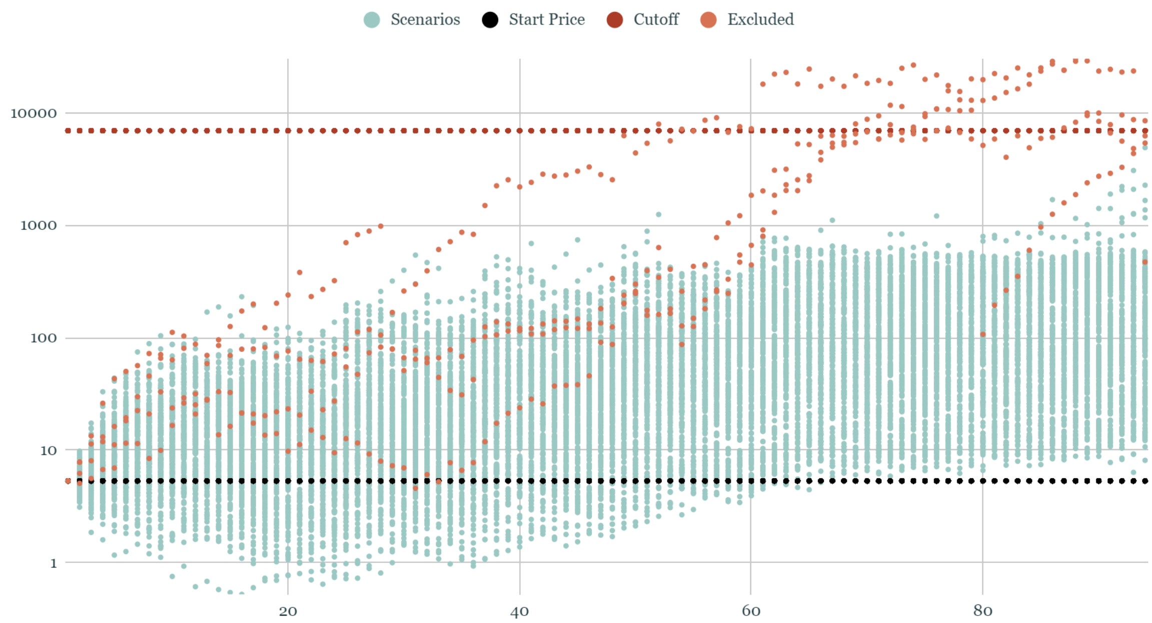
- We explore the effect of the project's monetary and fiscal policies on the token price.
- The simulations below focus on the variables that are out of control of the project and apply randomness to each one, over multiple iterations, in order to arrive as a set of scenarios for the token price. Our randomness process is based on a Random Walk. Random walk, in probability theory, is a process for determining the probable location of a point subject to random motions, given the probabilities (the same at each step) of moving some distance in some direction. Random walks are an example of Markov processes, in which future behaviour is independent of past history.
- The randomness is applied via multiples. E.g. taking a projected number (the company revenue for example) and multiplying it by a random number in order to simulate the unpredictability.

We ran several hundreds of simulations based on the scope & goals. The first few hundred were used to fine-tune the model, and below we show the output, once the simulation was fine-tuned.

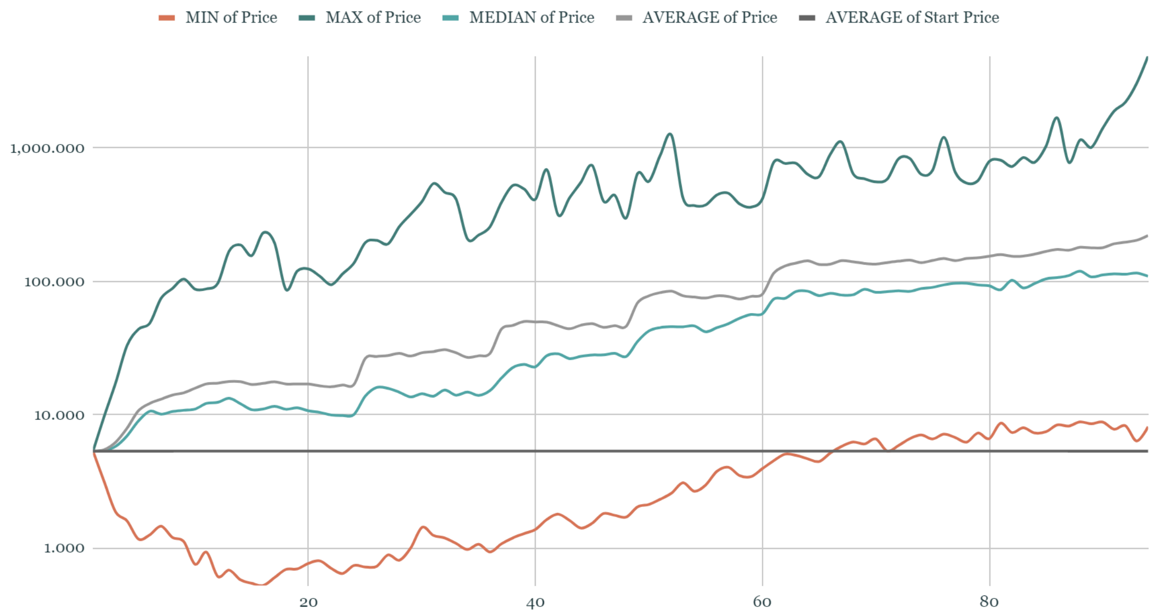
Most simulations produce extreme outputs. We filter those out, by setting a result cutoff for the exploited variable. In the simulations that we ran a total of 2% of the scenarios where excluded due to extreme values. The extreme value threshold was defined as 2 times the standard deviation from the mean.



Unfiltered data points (Price) out of all simulations (Normal scale).



Unfiltered data points (Price) out of all simulations (Log scale).



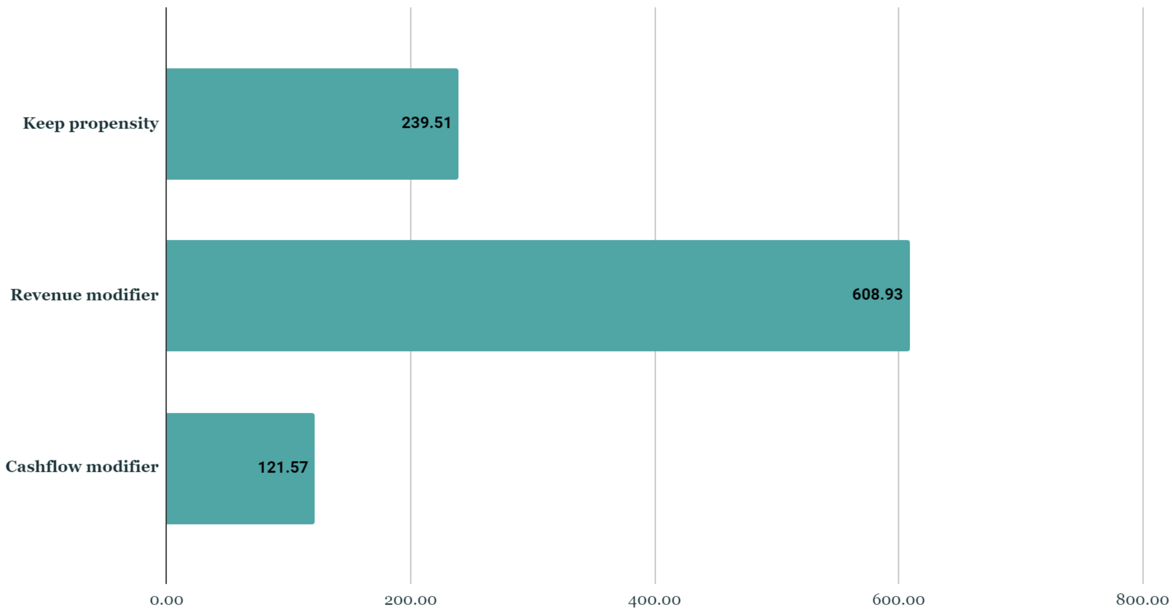
Filtered Price statistics (Log scale).

Correlations

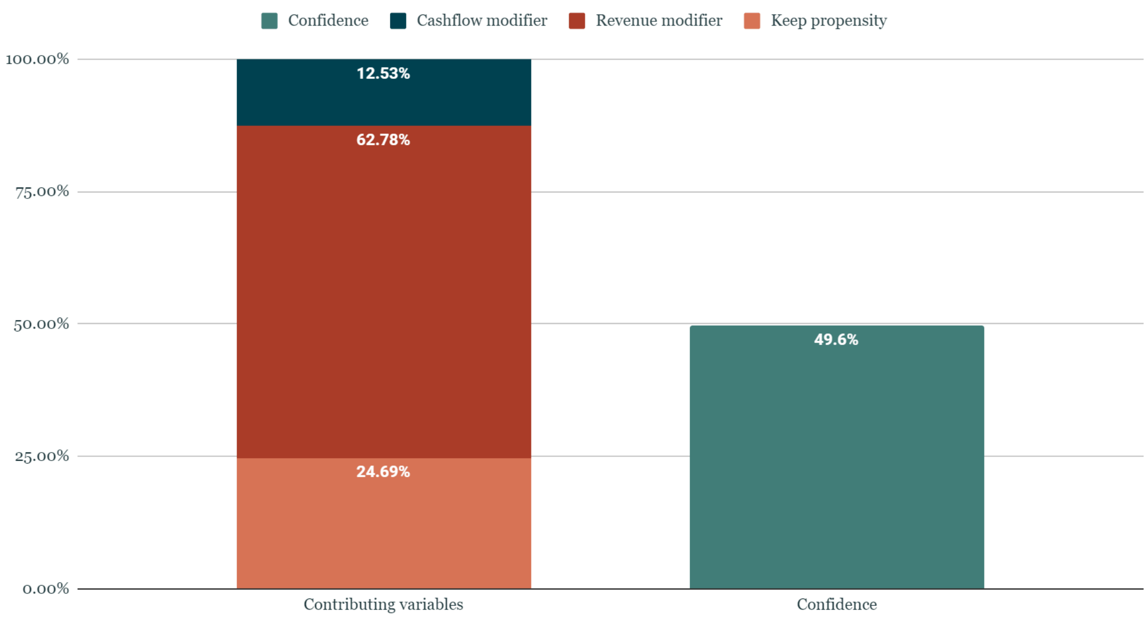
We explored collorelations of different variables and KPI:

Correlation coefficients				
	Price	Keep propensity	Revenue modifier	Cashflow modifier
Price		0.233	0.493	0.332
Keep propensity	0.233		0.033	0.094
Revenue modifier	0.493	0.033		0.034
Cashflow modifier	0.332	0.094	0.034	

We also ran a linear regression model, in order to find the biggest contributors, towards our main KPI(Price). In both cases protocol Revenue emerged as a clear driver of the token price. However the Keep propensity and Cashflow through the token were also significant. This means that certain monetary policies can used used during periods of low revenue in order to offset it.



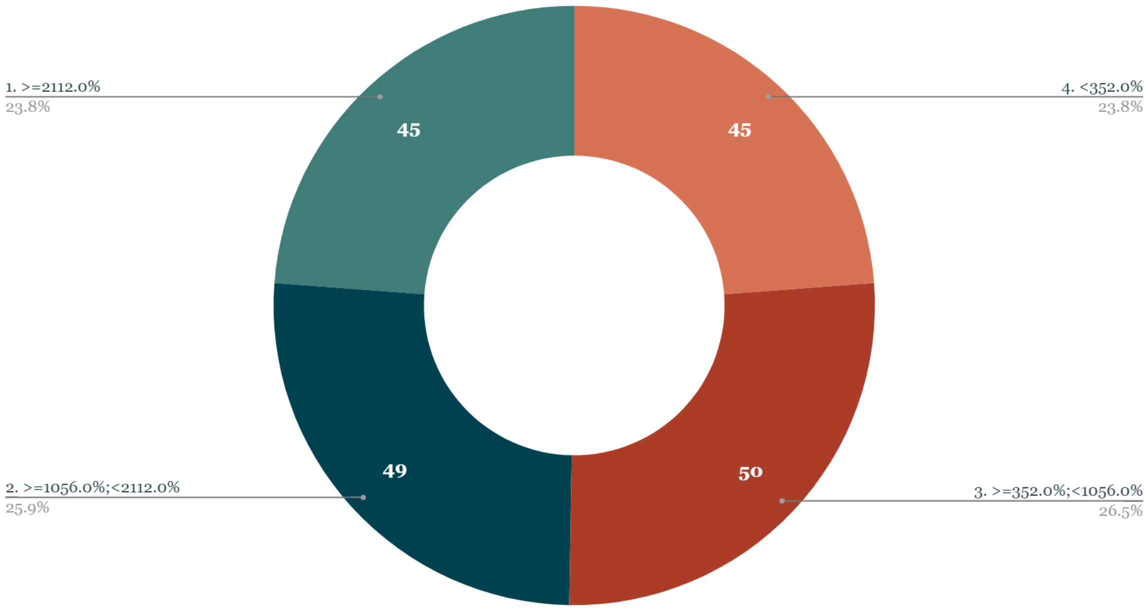
Weights and their direction.



Main contributors and confidence (R^2).

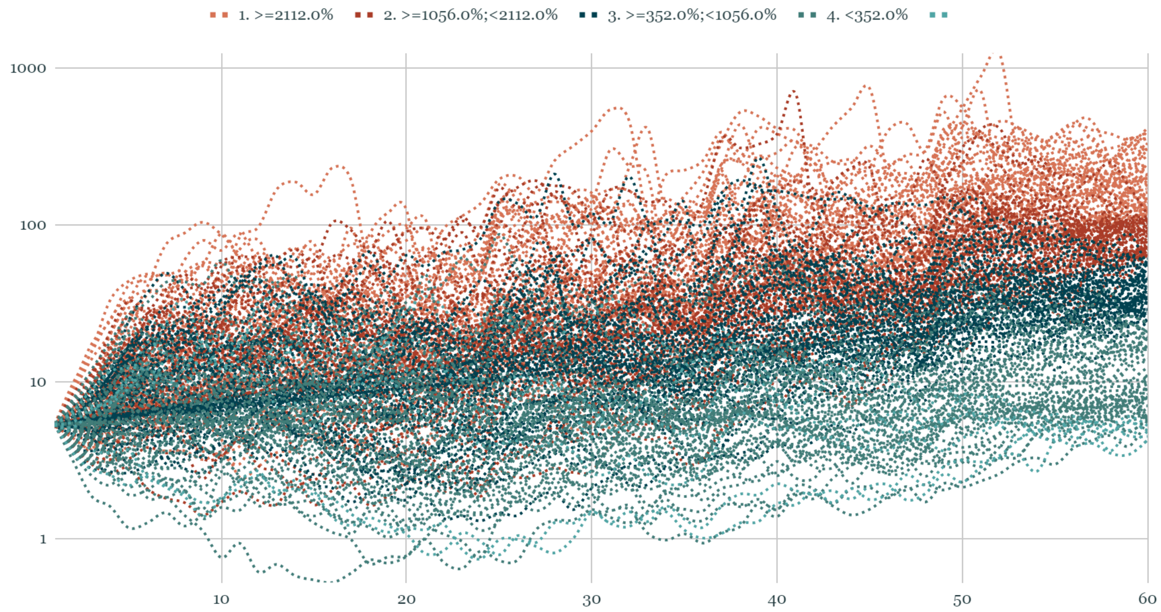
Groups

In order to better explore the best and worst performing scenarios, we have grouped them together into several groups. The groups were chosen not only on significant target variable thresholds, but also on cutoffs that ensure that each group has enough members to be representative.

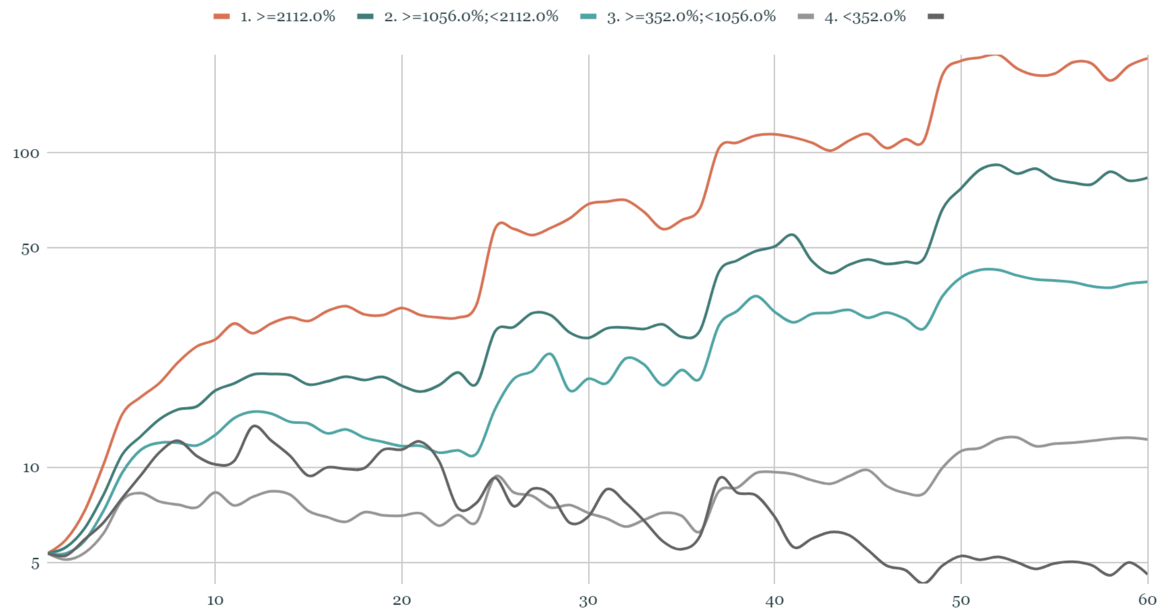


Distribution of price groups

Summary statistics (average)					
	1. >=2112.0%	2. >=1056.0%;<2112.0%	3. >=352.0%;<1056.0%	4. <352.0%	Grand Total
Price	81.7	37.6	22.4	8.5	36.3
Keep propensity	157.9	136.5	122.9	105.9	132.0
Revenue modifier	215.5	160.7	105.8	48.5	129.6
Cashflow modifier	136.5	105.1	97.9	89.0	105.8



Price dynamics by group (all)

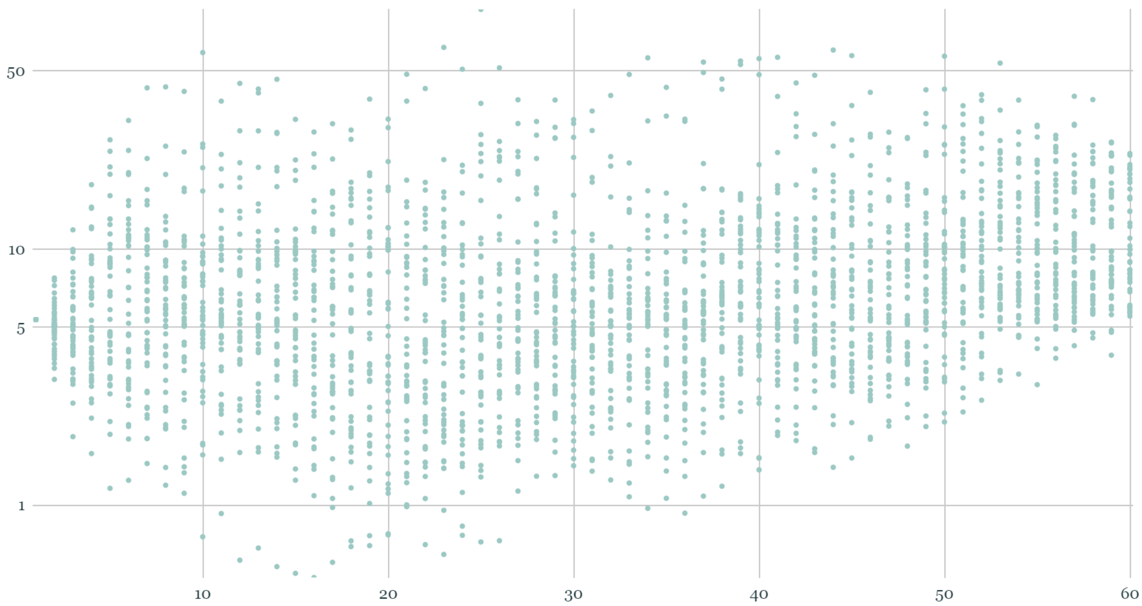


Price dynamics by group (average)

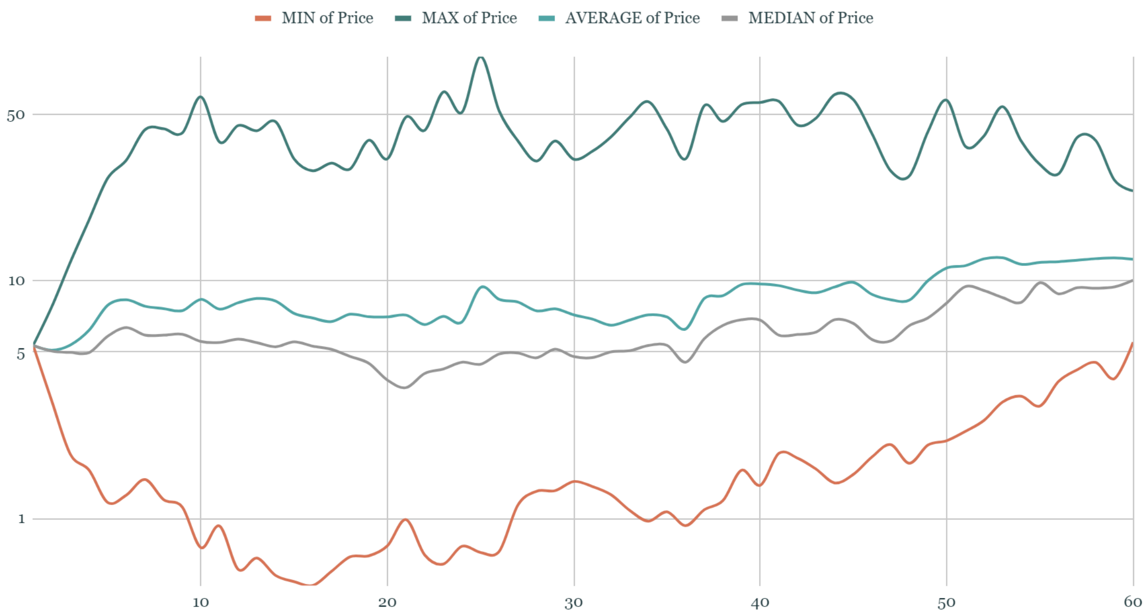
Below, we further explore individual groups of interest and how they differ from the average.

Lowest value (Group 4)

Group 4 was the worst performing of all groups. It also has the lowers Revenue modifier, which collaborates with the other findings in the report.



Group Price dynamics

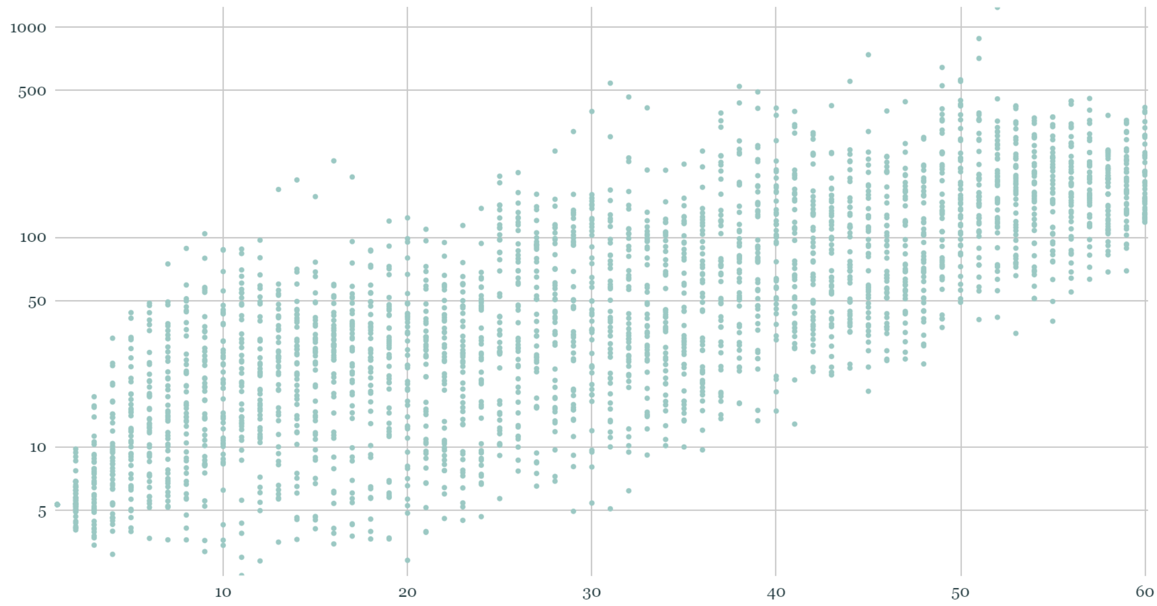


Group Price statistics (Log scale).

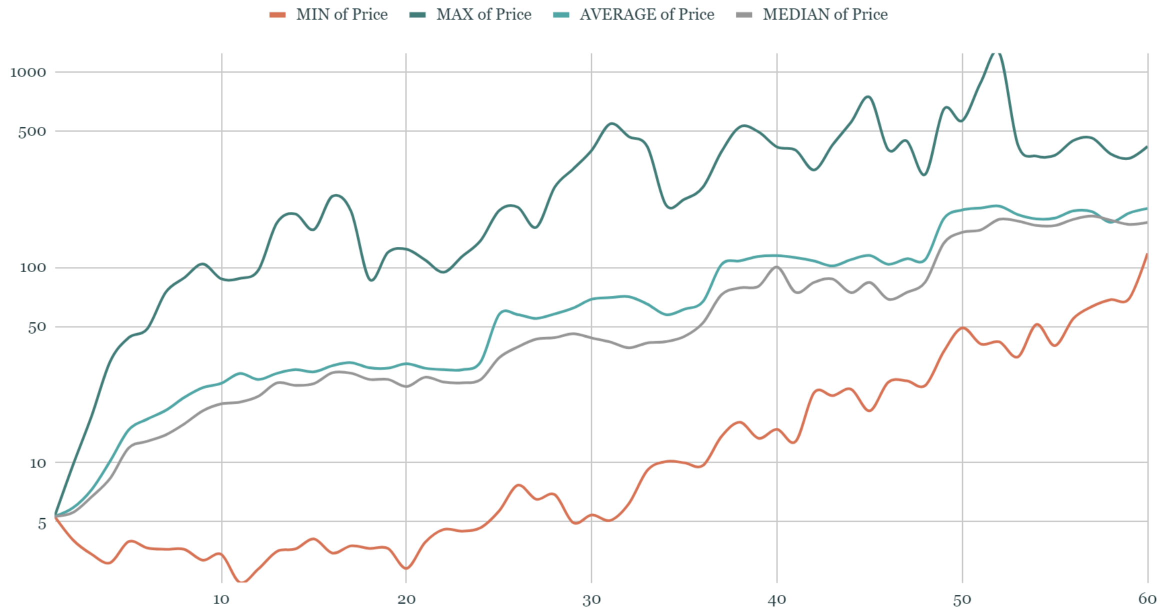
Averages			
	Group	All data	Delta
Price	8.50	36.3	-76.55%
Keep propensity	105.91	132.0	-19.78%
Revenue modifier	48.52	129.6	-62.57%
Cashflow modifier	89.01	105.8	-15.90%

Highest value (Group 1)

The best performing group was group 1, and not surprisingly it is also the group with the highest average revenue multiplier.



Group Price dynamics



Group Price statistics (Log scale).

Averages			
	Group	All data	Delta
Price	81.71	36.3	125.36%
Keep propensity	157.86	132.0	19.58%
Revenue modifier	215.47	129.6	66.22%
Cashflow modifier	136.48	105.8	28.95%

Implementation specifics

Diagram and simulation file

The interactive simulation file can be found here (please note that this is not the simulation file used to produce the output above, but rather a simplified one for example purposes):
https://my.machinations.io/d/findas-token-economy/d8ef816d9a7e11eeab890abc680be4d3

Due to restrictions of the tool, the diagram will be achieved after 2 weeks. If you want to obtain a copy of the archived simulation, please reach out to us:
tokenomics@findas.org

Importing the diagram into your own Machinations account

If you want to have the diagram into your own account, there are two ways to do that:

- Copy it from the diagram link we have provided above.
- If the link has expired and the diagram is archived, reach out to us to give you a copy of the archived diagram (it comes in the form of a Google Sheet). You can then import this diagram into your own Machinations account, by:
    - First making a copy of the Google Sheet into your own Google Drive.
    - Connecting your Machinations account with your Google Drive
    - The in Machinations go to Menu -> Open -> Diagrams -> Google Drive

Please note that:

- If you want to import (instead of simply copy) you will need a paid account. You can see which plans support imports here: https://machinations.io/pricing
- If you go with the Free Machinations account, your diagram will be Public and everyone will be able to view/copy it. Private diagrams are only available to paid plans.
- The ability to run Simulations on the Diagram is only available to the high Tier Paid accounts (without this you will only be able to do 1 run at a time).

If you decide to go for a **paid Machinations account**, please reach out to us, as we might be able to get you a better price for your plan!

Numbers nomenclature

Numbers in the file fall in 3 categories:

- **Basis points** - a basis point is a percentage divided by 100. So for example 1% = 100 basis points.
- **Percentage points** - percentage points are a fraction of a whole. So for example 1 = 100 percentage points.
- **Regular numbers** - unless otherwise specified in the labels, the numbers shown are regular numbers.

Timing

Timing - one step in the simulation represents a period of 1 month. Due to the way machinations work, the first several steps are "diagram warm up". The actual action begins when "Time elapsed" - " Months" shows 1.

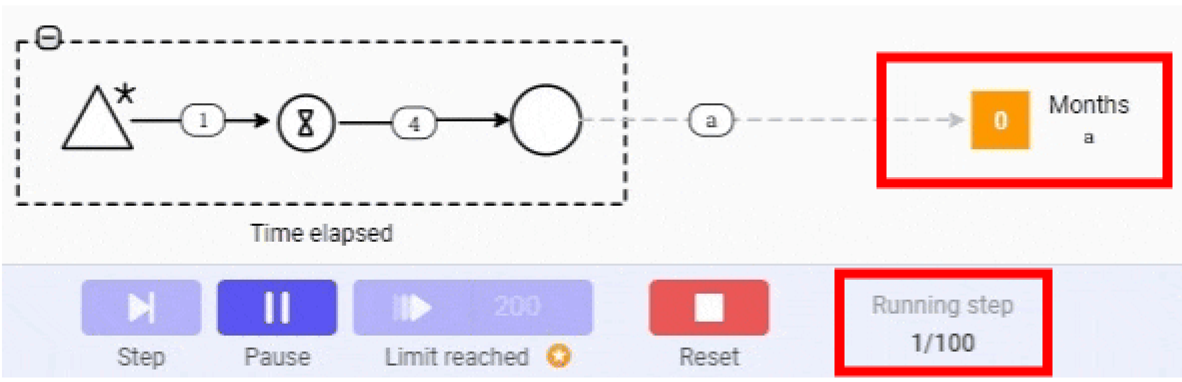


Diagram grouping

The diagram of the simulation is broken down into several colour coded components which we will explain below.

Some complex components with a lot of elements (such as the allocations) are grouped in order to simplify the diagram. You can expand them using the [+] sign on top of them.

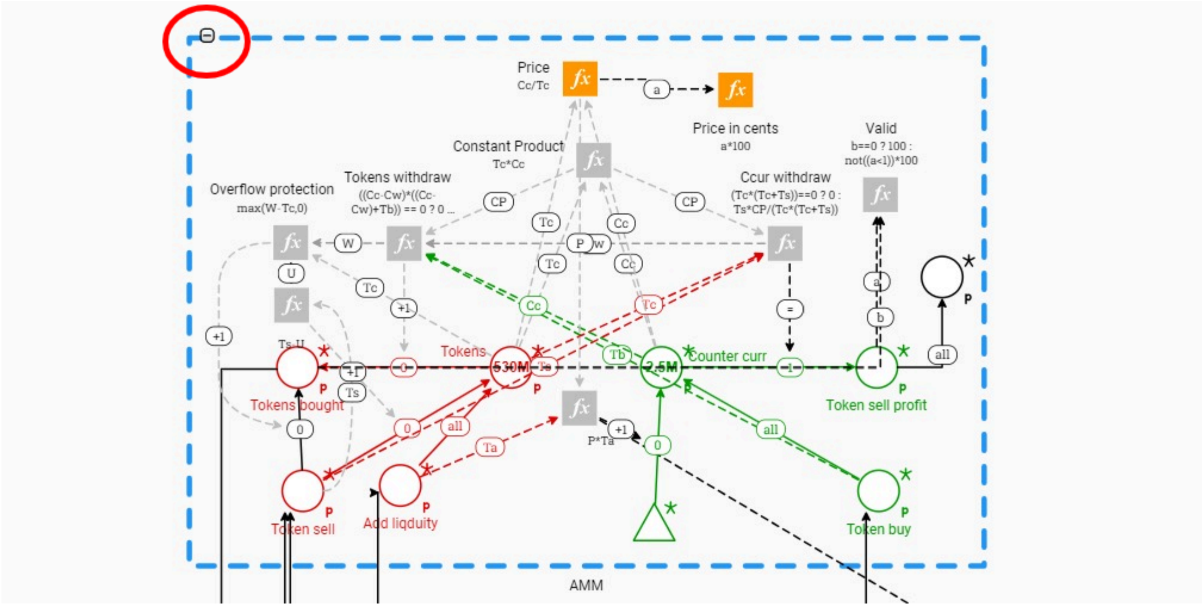


Diagram colour coding

In order to make the diagram more readable, we have colour coded the main elements, for easy readability.

Variables are several simulation parameters, where we input random numbers (within a range) to observe the effect on Key Performance Indicators (KPIs)Variables are shown as purple colour elements on the simulation Diagram.

KPI are simulation parameters that we observe as outputs. The KPIs are based on manipulating the Variables. KPIs are marked in blue.

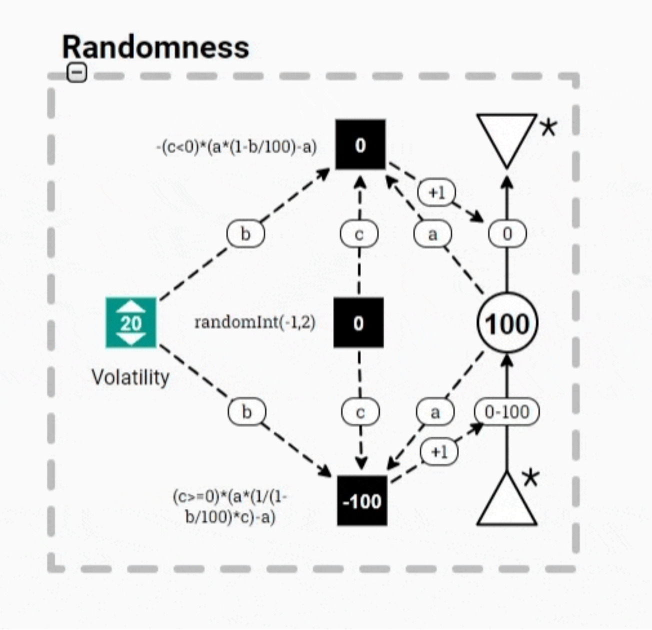
Red elements, text and flows, represent tokens and their movement

Green elements, text and flow, represent flow of value in another currency in the system (typically FIAT/USD).

Orange elements and text, represent other important diagram elements. For example - the time elapsed.

Gray (or black) elements text and flow are technical components that we use for calculations and counting. You can ignore those.

Random walk implementation



For all of our independent variables, we implement **a random walk** that varies the independent variables within the range as explained in the previous section.

This way we test various scenarios for the token supply and demand and the end effect on the token economy.

What is a **random walk?**

In mathematics, a random walk, sometimes known as a drunkard's walk, is a random process that describes a path that consists of a succession of random steps on some mathematical space.

An elementary example of a random walk is the random walk on the integer number line {Z} which starts at 0, and at each step moves +1 or −1 with equal probability. Other examples include the path traced by a molecule as it travels in a liquid or a gas (see Brownian motion), the search path of a foraging animal, or the price of a fluctuating stock and the financial status of a gambler. Random walks have applications to engineering and many scientific fields including ecology, psychology, computer science, physics, chemistry, biology, economics, and sociology. The term random walk was first introduced by Karl Pearson in 1905.

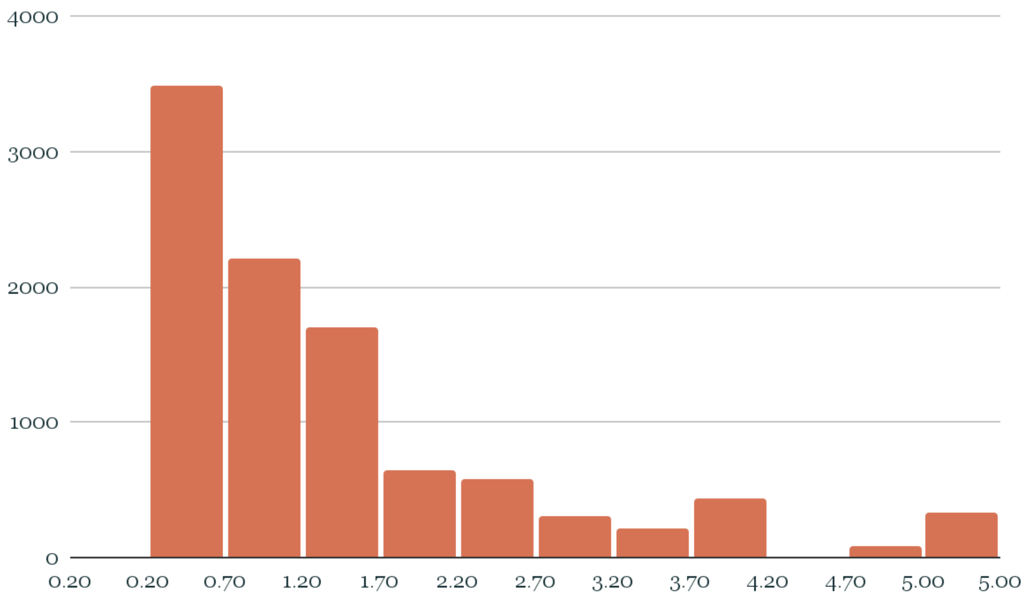
Realisations of Random Walks can be obtained by [Monte Carlo Simulations](#).

–*[Wikipedia](#)*

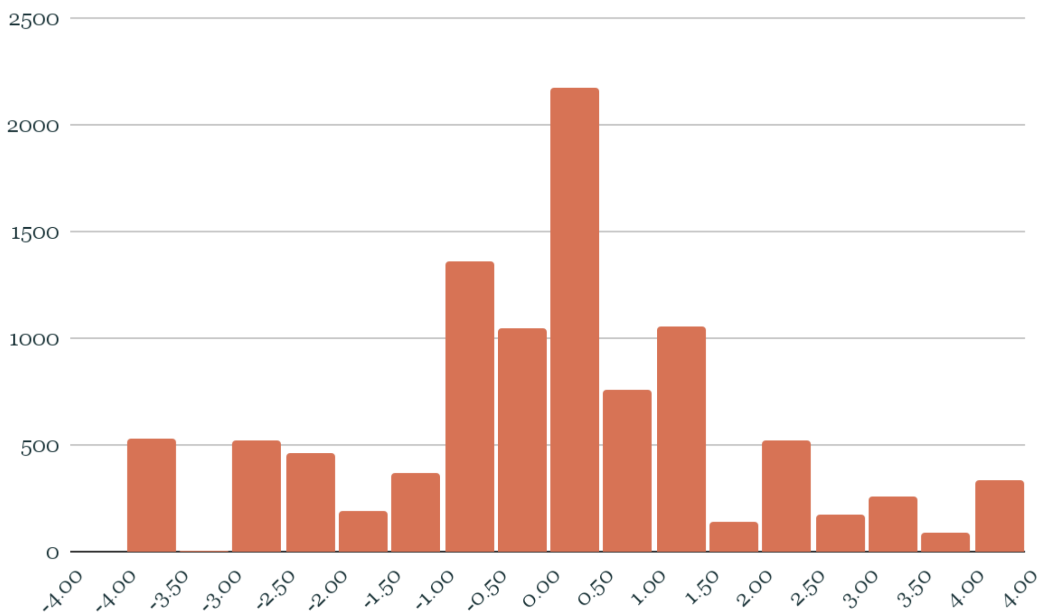
If we define a truly random variable, for the company revenue, in the range [10%;300%] for example, we could have a situation where the company achieves 10% of the projected revenue in one month, and a 300% in the next. This would represent a 3000x increase in revenue between two months (from 10 000 to 30 000 000 in the span of 30 days), which is unrealistic.

To avoid that our randomness functions vary cumulatively. For example, if the revenue for month X is 150% of the projected value, then for month X+1 it would either be 130% or 170% of the projected value for the month. The step with which this is changed is controlled by the volatility parameter of each randomness function. For most of them we use a 20% step, which is based on experiments carried out based on the number of steps in the diagram and the goals set.

Over a 10 000 iteration set, a random variable, capped in the range 20% to 500% (5x decrease or 5x increase), with a 20% step, would typically have a distribution similar to this one (data from a randomised sample).



When represented as an X times increase/decrease, focused around a baseline value of 0, we see that the distribution resembles a bell curve:



Random walks are an example of Markov processes, in which future behaviour is independent of past history.

Markov process

A Markov process is a mathematical model used to describe a sequence of possible events where the probability of each event depends only on the state attained in the previous event. Imagine playing a complex version of hopscotch, where each square on the ground represents a different state or condition in a system. These states could be anything: the weather conditions (sunny, rainy, cloudy), the health status of a patient (healthy, sick, recovering), or the stock market status (rising, falling, stable).

In this sophisticated hopscotch, the rule for hopping from one square (state) to another is determined solely by your current position, not by the path you took to get there. This is known as the Markov property, which states that the future state depends only on the present state and not on the sequence of events that preceded it. Each time you're ready to make a jump, you consult a set of probabilities that are unique to the square you're standing on. These probabilities are like a set of instructions that tell you the likelihood of hopping to each of the other squares (states) from your current location.

Mathematically, this process is described using a transition matrix if the states are discrete or transition probabilities in more continuous settings. The elements of this matrix (or the probabilities in continuous scenarios) represent the likelihood of moving from one state to another in a single step. The beauty of a Markov process lies in its simplicity—the system's future behaviour can be predicted solely based on its current state, without needing to consider its past history.

This "memorylessness" is what characterises Markov processes and makes them incredibly useful in a wide range of scientific and engineering disciplines. By employing Markov processes, researchers and analysts can simplify the modelling of complex systems, making it easier to predict future states or to understand the dynamics of transitions between states. Whether it's forecasting weather patterns, modelling the progression of diseases, or predicting stock market trends, Markov processes provide a powerful tool for analysing systems where the history of states influences the future in a probabilistically independent manner.

Limitations

"The only function of economic forecasting is to make astrology look respectable."

John Kenneth Galbraith (economist, bestselling author)

It is important to note that the blockchain and cryptocurrency areas are still very new. There is little to no historical data, past performance results, and academic research on the topic of cryptocurrencies, let alone on the tokenization, economics, and long-term valuation of those asset classes. Stocks(equity) have been around since the early 1600s, but it is only in the past 100 years that we have begun to have more comprehensive and widely accepted valuation models. However, they are still subject to bias and interpretation and suffer from the quality of their inputs. On the other hand, cryptocurrencies have been around since 2008, with a broader recognition around 2016 and an explosion in the number of tokens in 2017. As such, it is way too early to evaluate or comment on the performance, monetary policy, or models behind any of them. As a result, we prefer to rely on sound economic principles backed by data and reasonable assumptions.

Furthermore, any financial projection should generally be treated as a target rather than a prediction. Their purpose is to ensure that the project has sensible and achievable goals, and upon reaching those goals, the rest of the numbers will add up and make sense. On the other hand, they cannot predict the future, nor account for all possible variables and scenarios with any reasonable degree of certainty.

About the authors

The FinDaS tokenomics team We are a team of crypto professionals with over 250+ crypto projects behind our backs and overwhelmingly positive feedback from our clients. Our team has a wide array of token economy specialists in various aspects - DeFi, CeFi, NFTs, and DAOs. We help design projects in a financially feasible and fiscally responsible way.

Hristo Piyankov - Lead Economist Hristo has over ten years of experience in analytics, data science, machine learning, big data, and AI with a financial background. He was an Analytics Director for one of the largest consumer finance companies in the world's largest consumer market (China). During this time, he led several complex international projects to fruition. He is an expert in data modelling of all kinds (financial, forecasts, estimations, budgeting, machine learning, statistical).

Now he is working with various blockchain startups, helping them figure out their token economies and data problems. He is passionate about making sure that data works for the business and not the other way around. Hristo is an expert in Blockchain, Solidity, Python, and algorithmic trading, not to mention Excel/Google Sheets.

Token economy next steps

We would like to emphasise that this document serves as an initial step towards establishing an effective token economy and should be treated as a foundation rather than a final solution.

A token economy is a dynamic and evolving system that requires continuous monitoring, analysis, and adjustments to meet the changing needs of your project and its stakeholders. While we have endeavoured to create a comprehensive token economy paper based on our expertise and understanding of the project, it is crucial to recognize that market conditions, user behaviour, and regulatory landscapes can change over time.

To ensure the long-term success and optimal performance of the project's token economy, we strongly recommend the inclusion of a permanent in-house token economy expert within the project's team. This expert should actively participate in business meetings, collaborate with relevant stakeholders, and regularly monitor the token economy's performance. Their role would involve gathering feedback from users, analysing market trends, and identifying areas for improvement.

Having an in-house token economy expert provides several advantages. They possess an in-depth understanding of the project's intricacies, goals, and user base, enabling them to tailor the token economy to suit specific requirements. They can proactively identify potential bottlenecks, risks, or opportunities and propose adjustments accordingly. By participating in business meetings, they can align the token economy with the broader business strategy, ensuring that it remains in sync with the project's evolving needs. They can closely collaborate with developers, community managers, and other relevant team members to implement necessary changes or introduce new features to enhance the token economy's functionality and value proposition.

Please bear in mind that tokenomics is not a one-size-fits-all solution. It requires constant evaluation and adaptation to maintain its relevance and effectiveness. This document covers the initial setup, but the presence of a dedicated in-house expert is strongly advised to ensure the ongoing success of the project's token. In conclusion, this document serves as a valuable starting point for the project's token economy; however, it should be recognized as a living framework that will evolve over time.

Please note that the information provided in this document is based on our knowledge and understanding up until the date of this document. It is essential to stay updated with industry best practices, regulatory guidelines, and market trends to ensure the continued success of your token economy.

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