Janus

Whitepaper

Janus heralds the new era of inflation adjusted protocols, with risk adjustment, stability, and sustainability at its core.

Abstract

This whitepaper will provide insight into how the Janus protocol functions on a technical level while introducing new features unique to the Janus governance model. We aim to showcase the Janus protocol, governance model, its design function, and the mathematics employed.

Disclaimer

All of the information presented in this whitepaper is tentative and is subject to change at any time. None of the information herein should be construed as legal, accounting, or investment advice of any kind. This document does not represent a solicitation for investment, nor does it represent an offering or sale, public or private, of any kind of financial instrument, security or otherwise, in any jurisdiction. This whitepaper is provided for informational purposes only, with the intention to describe Janus's prospective protocol and governance model.

Introduction

Janus is an AI Powered, inflation-adjusted stability protocol that focuses on stability, transparency, user sovereignty, and risk adjustment.

Janus extends emerging flatcoin principles. It is a store of value represented by algorithmic semi-stablecoins that tracks changes in inflation and adjusts its value accordingly by leveraging a novel Algorithmic Finance (AlgoFi) concept that leverages advanced AI algorithms.

Janus combines AlgoFi, blockchain and AI to create a diverse range of dynamically managed assets that aim to deliver unprecedented risk/reward profiles. By extending emerging flatcoin principles, Janus creates an inflation adjusted store of value manifested through algorithmic semi-stablecoins.

Janus' key innovation lies in using a combination of advanced AI algorithms and DeFi innovations to maintain a stable growth rate. This creates the foundation for an ecosystem, enabling a new class of financial products and services

With "What you see is what you risk" (WYSIWYR), AlgoFi provides transparency that was lacking in DeFi 2.0, where excessive risk and opaqueness were common. Janus has sustainability and stability built into the protocol's core and is resistant to market volatility.

Similar to flatcoins, Janus tracks and adjusts to inflationary pressures and conserves its purchasing power; unlike flatcoins, Janus is unpegged to fiat and instead focuses on overall market optimisation.

Janus resists market spikes, ensuring stability for token holders. Through algorithmic checkpoints, Janus dynamically shifts demand between two tokens, tokenA, and tokenB, effectively preventing overheating and maintaining a smooth appreciation of value.

The protocol introduces the JANUS token to the Polygon ecosystem, along with the two core protocol tokens, tokenA, and tokenB. The JANUS token represents a combination of tokenA and tokenB, eliminating the need for users to manage these tokens separately while streamlining exchange offerings.

Janus is focused on achieving certain growth and inflation goals. This behaviour is enforced through the use of AI and governance. Achieving those goals provides rewards to the participants of the ecosystem.

The Janus design is similar to other algorithmic stablecoins, but with the major difference that instead of a peg, Janus aims to maintain a certain growth rate. Hence, Janus completely avoids the risk of catastrophic collapse that stablecoins have experienced in the past.

In turn, this stability is used to launch a new set of financial products while rewarding the agents assisting the ecosystem.

Inflation Adjustment and Flatcoin Principles

Flatcoins are algorithmic semi-stablecoins that adjust for the rate of inflation. This is an emerging token economics concept in which the token of interest, as a store of value, would adjust its valuation over time to track changes in inflation. The goal would be to conserve the purchasing power of its token holders and/or a specific group of interest (such as platform users).

Janus delivers a more sophisticated two-token system that tracks the overall market, the protocol's needs, and inflationary considerations. As flatcoins are semi-stablecoins at best, we jettison any considerations towards stablecoins in favour of overall protocol optimisation.

Janus takes what is good from flatcoins — their ability to track and adjust to inflationary pressure while conserving their purchasing power. However, Janus does not operate with stablecoins, like flatcoins. Janus is unpegged to fiat currency and instead focuses on maintaining a targeted growth rate within a certain statistical margin of error.

What is AlgoFi

AlgoFi (algorithmic finance) is the next evolution in the space of DeFi, and it picks up where DeFi failed to deliver. DeFi is focused on how mainstream finance will move into a blockchain.

AlgoFi, on the other hand, focuses on using blockchain's capabilities to create new asset classes based on a layer of trust. This is possible due to the three core properties of distributed ledger systems:

1. Algorithmic control mechanisms through the use of smart contracts.
2. Decentralized governance.
3. Transparency.

AlgoFi seeks to employ a blend of automation and governance to guarantee the achievement of specific financial goals within a defined confidence interval. Early innovations in this space can be considered the invention of algorithmic stablecoins. However, algorithmic stablecoins were an early and immature version of AlgoFi.

AlgoFi generalizes the vision behind algorithmic stablecoins. Whereas a stablecoin has a very specific job to do (maintain a peg), AlgoFi sets more flexible goals, which are guaranteed with a certain range of confidence. Hence, it does not suffer from the risk of catastrophic failure during stablecoins phase.

The latter part is crucial (the range of confidence), because AlgoFi is using this guarantee in order to launch a new set of financial products. Simply using algorithmic mechanisms to achieve a specific goal does not automatically classify a project as AlgoFi. It also needs to use the stability these goals induce to launch new financial products.

Examples of AlgoFi:

1) A protocol that aims at a specific inflation rate, contracting and expanding supply as required. The stability of the inflation rate is then used to launch a certificate of deposit.
2) A protocol that aims to keep its treasury pegged to the value of a specific index, e.g. the SPY. The treasury is used as collateral for loans, which are then invested to earn yield.

Example of what is not AlgoFi:

1) An algorithmically traded hedge fund is not AlgoFi, since there are no performance guarantees.
2) Rebase tokens are not AlgoFi, unless they provide guarantees of stability and use their token's relative stability to launch new financial products. In fact, some rebase tokens would be close to being considered AlgoFi, if they weren't so volatile.

Using AI to create Algorithmic Stability in Janus

The integration of AI into the Janus protocol is not just an enhancement but a definitive pillar. By amalgamating AI-driven insights with blockchain's inherent transparency, Janus ensures an ecosystem that is balanced, rewarding, and strategically poised against risks.
More specifically, AI is used in the following three areas.

1) Reward optimisation
2) Rebalancing between the two tokens
3) Risk minimisation

Optimization of Rewards: At the heart of the Janus protocol lies a sophisticated rewards mechanism designed to incentivize participation and seamlessly align the interests of all stakeholders. The AI system embedded within our protocol persistently monitors participant behavior, prevailing market conditions, and various external determinants.

Based on these multifaceted inputs, our AI will dynamically calibrate reward structures. This takes place through the issuance of new vaults (described in more detail in the next section).

For example, if tokenA overheats then the system will issue a new set of vaults to incentivise the burning of tokenA and use tokenB to calibrate the price.

More details can also be seen in the simulation section, which is mostly based on a stochastic model. In the final version of Janus, the protocol will heavily use forecasting and AI methods, such as deep learning and reinforcement learning.

Rebalancing of the Token Economy: Maintaining harmony between tokenA and tokenB is paramount to Janus's operational stability as a flatcoin. The AI integrated into the protocol enables instant monitoring and forecasting analysis, helping us anticipate market movements and the shifting demand for individual tokens.

The system will forecast potential imbalances, instigating timely interventions, such as issuing new bonds ensuring neither token overshadows the other. By actively preserving the balance, we sustain the protocol's inherent stability and its predefined growth trajectories.

Risk Minimization Strategy: Janus's foundational strength lies in its robust risk management framework, augmented significantly by AI. With its capability to assimilate and process vast datasets, our AI meticulously identifies patterns signalling potential risks.

For instance, unusual trading patterns or a sudden influx of a specific token will activate the AI's anomaly detection module. Similarly, the system is forecasting macroeconomic trends, taking pre-emptive measures if it deems there might be threats on the horizon. This forecasting ability empowers Janus to undertake preemptive measures, ensuring we remain a step ahead of potential threats and vulnerabilities.

The AI works hand-in-hand with governance and the community. The mission of the Janus protocol is to provide incentives and signals. The community's mission is to then take appropriate measures. However, the AI will take over if the community is lagging, thereby minimising the risk of inertia.

The Janus Core Protocol

The Janus two-token ecosystem is underpinned by a stability protocol that's designed to withstand market volatility and provide steady upward accumulation and growth.

Janus is based on the following ideas:

1) The goal is to maintain a certain growth rate and low volatility.
2) The guaranteed level of growth and volatility provides the foundation for a range of financial products that feed off the certainty provided.

The Janus Core Protocol (shown in Figure 1) is underpinned by the following principles:

- The supply and demand of the two tokens are always balanced.
- The system keeps accumulating and storing value.
- The system always preserves value.

- The system smooths out volatility using a two-token ecosystem.
- The system is adaptive and can respond to increased demand and supply, hence defending the price of the tokens.

The users and investors profit in the following ways:

1) Rewards for stabilising the ecosystem.
2) Yield through the financial products.

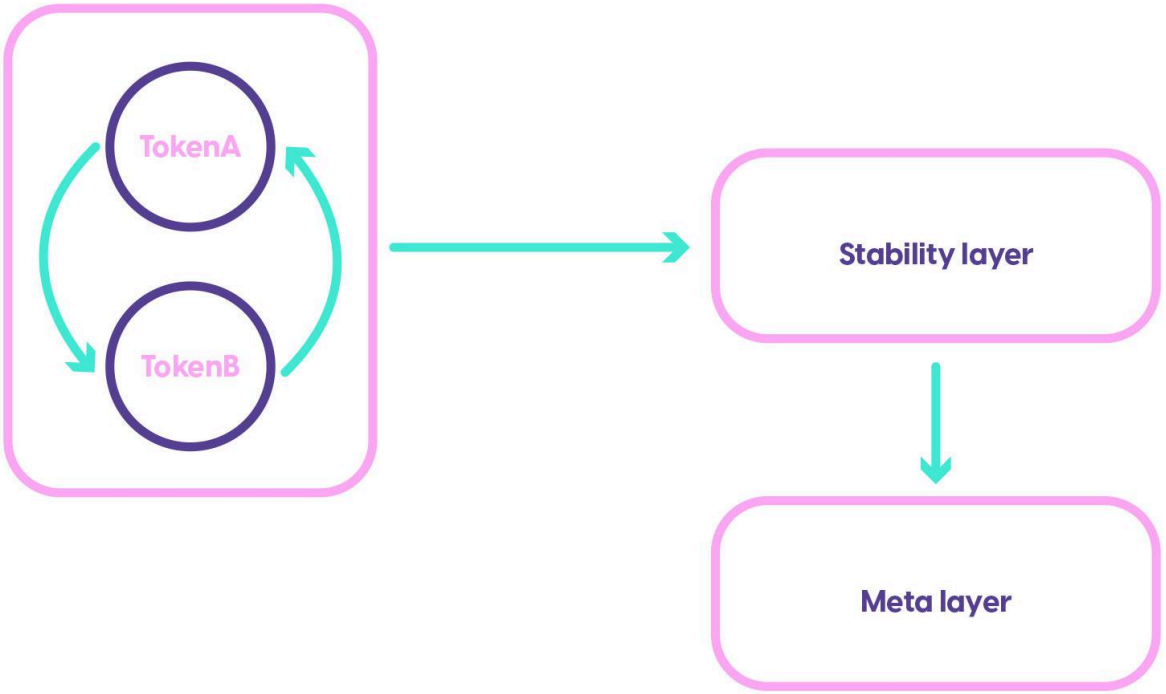

Figure 1 - Janus Core Protocol

Janus Flatcoin Principles

Janus aims to become the de facto flatcoin standard for Web3.0. Janus stability principles abide by the following standards:

1) The tokens (Janus A and Janus B) should appreciate in value according to the inflation target. Initially, the inflation target is going to be set to Truflation[1].
2) The Janus Decentralised Autonomous Organization (DAO) sets the inflation target.
3) Janus follows a model that rewards the whole community, depending on how low the error is between the desired and the real inflation rate.

The game-theoretic inflation-balancing stochastic equilibrium is at the core of Janus' design.

[1] https://truflation.com/

The algorithm works as follows:

Let F be the real inflation target. Let V be the real volatility measure.

Let $\widehat{F}$ be the desired inflation target. Let $\widehat{V}$ be the desired volatility measure.

Let the error be defined as

$$E = a(F - \widehat{F})^2 + b(V - \widehat{V})^2$$

With *a* and *b* being weights, which are initially set to 0.5 each.

Let T be the threshold of success.

We then calculate a reward score as follows:

Do every 24h:

Calculate the error E.
IF
E<T
THEN
Create reward coefficient R = T - E
ELSE
R=0

Distribute rewards R to veJanus token holders

veJanus tokens are tokens locked in voter escrow by the holder (further explained in the Governance and veTokens Section).

Reward distribution works as follows:

1) Every 24h, there is a rewards pool. This is denominated in USD, but paid for in Janus tokens from the rewards pool. If there are not enough tokens, then the protocol reserves the right to issue new tokens.
2) The exact amount available depends upon rules that make sure that the protocol doesn't overinflate and doesn't miss its targets.
3) The exact amount is defined as *R*P*, where *P* is the size of the pool, and *R* is the rewards coefficient. Again, the total amount R*P can't exceed a predefined constant.
4) The total amount is distributed amongst the veJanus holders using a lottery mechanism, where the probability of getting a reward is calculated based on an account's holdings.

Inflation sources and calculations

The Janus protocol recognizes the importance of accurate and up-to-date inflation data for its functionality. As such, it leverages the advanced metrics provided by Truflation, offering an enhanced alternative to traditional CPI inflation measurements. To bridge the gap between this external data source and our decentralized system, we employ the Goracle[2] protocol, which serves as a crucial intermediary.

We've opted for a reputable Oracle service, chosen for its reliability, security, and capability to fetch Truflation data efficiently. Integrating this Oracle service with Janus's smart contracts ensures a seamless flow of real-world data into our ecosystem.

Upon initiation by Janus's smart contracts, the oracle requests the latest Truflation metrics. It retrieves this information directly from the Truflation platform via a secure API or similar data access method. To guarantee data accuracy and resist any potential tampering, our chosen Oracle service employs a decentralized data-checking approach. Multiple nodes independently access and verify the Truflation data before achieving consensus on its value.

Once the Janus protocol receives the validated Truflation value, the AI, assisted by governance, uses this data to recalibrate the inflation target for its dual-token system. This process ensures our tokens remain attuned to real-world inflation dynamics, offering stability and trust to our users.

To maintain alignment with contemporary inflation metrics, the Janus protocol is designed to prompt the Oracle service for Truflation data at regular intervals. However, robust mechanisms are in place to manage unforeseen circumstances, such as data retrieval failures or inconsistencies. These mechanisms include secondary oracle services and provisions for community governance interventions.

Given the critical role of accurate Truflation data within the Janus protocol, continuous monitoring measures are established. These measures ensure the performance and integrity of the Oracle service and the security of the data integration process as a whole.

The Janus AI

Janus is utilising AI in order to assist with the calibration of the system, as well as governance.

The AI does not consist of a single mechanism or method, but rather a combination of modules, forming a “society of the mind”.

Such modules include, but are not limited to:

1) Forecasting the prices of Janus’ tokens

[2] https://www.gora.io/

2) Forecasting macrotrends
3) Simulating the effects of different interventions on Janus' economy
4) Digesting data from external sources (e.g. crypto-Twitter) to understand and predict new trends

The AI will not be a replacement for governance, but rather an assistant. The AI will be used to make automatic decisions for short time spans, ensuring that the token economy is never left ungoverned. However, when it comes to longer and more strategic timespans, human governance plays the most important role.

Janus will integrate with the Ocean Protocol (https://oceanprotocol.com/) for data digestion and analysis.

The Janus Ecosystem

The unique characteristics of the Janus core protocol are leveraged to create an ecosystem of DeFi products ranging from Liquid Staking Derivatives (LSD) to Lending, Real World Asset (RWA) derivatives, and Treasury management. As such, Janus can be viewed as a platform or an enabler of new product classes.

There are three layers to Janus. The final layer (the meta-layer) takes advantage of the unique fact that Janus is a self-balanced and self-calibrated economy, creating high-yield, low-risk financial products.

- Algorithmic Vaults (frequent automated balancing).
- Governance-based vaults (macro-trend stabilisation).
- The meta-layer: Janus-based derivatives that are using the stability of the protocol in order to create new financial products. This includes (but is not limited to) delta neutral options, bonding/lending and token swap services.

There are two types of users

- Stabilisers: Users who are actively balancing the protocol, either through open vaults or other actions, and extracting rewards.
- Passive income users: Users who participate in the vaults with the objective of receiving some form of yield, without caring about the protocol's objectives.

Janus Vaults

Vaults in Janus are primarily a combination of certificates of deposit (CDs) and bonds. There are some other forms, such as open vaults, and competition vaults, which are reserved for more sophisticated users.

Users provide collateral in crypto (ETH or some other crypto, e.g. DAI) in addition to tokens (*A* or *B*, depending on the vault). Users receive interest in Janus tokens. In exchange, they get back their principal and interest earnt.

The two-token ecosystem allows balancing supply and demand so that volatility is reduced and value always appreciates.

Vault contracts by Janus are issued as NFTs. This allows contracts to become liquid and tradeable. NFT contracts can be combined into larger contracts and sold as one. Janus calls this **semi-liquid lending**.

The NFT contract gives rights to a user to claim back the ETH, along with any accumulated rewards. The benefit of this approach is that it reduces risk by minimizing the probability of a potential flash crash.

Vaults are also further segmented in two speeds: fast and slow. Fast vaults are primarily governed through AI and are focused on smoothing out market fluctuations. Slow vaults are governed through human governance, and are focused on helping Janus achieve its strategic objectives.

Vault Types

Vault is Janus's terminology for different investment products.

The vaults optimize the relationship between risk and reward so that users can find something that suits their particular profile, while also aiming at hitting specific inflation and volatility targets.

The vault types are shown in Table 1.

Table 1 - Janus Investment Products

Financial product	**Risk level**	**Rewards**	**Type of rewards**
CDs	Super low	Very low	Token only
Bonds	Low	Low	Token only
Borrowing/Lending	Medium	Fluctuating, potentially high	Token+collateral token
OpenVault	High	Fluctuating, very high	Token + collateral token
Competition Vault	depends	depends	Token + collateral token + governance token

Certificates of Deposit
These are the fundamental blocks of Janus. They are the lowest risk and lowest reward instruments. The certificates of deposit have the following characteristics:

1) They require longer lockup periods.
2) The return is a function of the lockup period.

3) The collateral is 100% guaranteed.
4) In case Janus can't cover the original collateral, it will issue Janus tokens to cover it.

Bonds
Bonds are the next step in terms of risk and reward after the certificates of deposit. Bonds are very similar to CDs. Their differences are as follows:

1) The collateral is guaranteed by at least 80%.
2) Bonds promise higher returns, and they can get these returns through activities like yield farming.

Borrowing/Lending
Peer-to-peer borrowing/Lending will take place with Janus as a separate service. Janus tokens are required to pay for any associated fees. The actual risk and reward depend on the specifics of the loan.

Open Vault
An open vault is a type of vault that is high risk and high reward. An open vault has a minimum guaranteed collateral of 50%, and the vault can use trading (manual or algorithmic) to extract profit.

Competition Vault
Competition vaults are vaults that are trying to achieve a certain objective, e.g. an inflation rate. The users can participate in this competition by making trades, and getting governance rewards, and tokens as the result of their performance. Participating in these competitions requires using tokens as a form of fee. The users can submit their proposed strategies, and then the protocol decides which ones to use.

The Janus metalayer

Janus is in the unique position to be a token economy that is self-balancing and self-regulating in a way that its economics are very predictable, enabling the goal of being the de-facto flatcoin for Web3.0.

This provides the possibility to create a set of derivative products that feed off this predictability, similar to delta-neutral options.

These are packaged and sold at a separate layer from the vaults. Accessing these products requires a combination of tokenA/tokenB and governance tokens. The objective of the metalayer is to generate additional yield from the stability of Janus' ecosystem. Given that tokenA/tokenB are focused on stability and smooth appreciation, this limits the potential to achieve high returns over a period of time, which many investors want.

However, the meta-layer provides the possibility to achieve higher returns in two ways:

1) Some of the products themselves are higher-volatility and higher-return, without exposing Janus' ecosystem to the downsides of volatility.

2) The metalayer creates additional demand for the governance tokens, increasing their value.

Reward Options and Payout

Price Locking

Users have two options as to the type of vault they can choose:

1. Locked price and fixed date payout
2. Floating price and variable date payout

When choosing a locked price, the user receives rewards as a % of the total value locked at that particular point in time.

For example, let's say a user provides 1 ETH, and the price of 1 ETH at that point in time amounts to a total value (denominated in $USD) of $1000. Let's assume that the rewards are issued using JanusB, and the price is $0.1. Also, the user is locking their ETH for one month, and this provides a reward of 10%.

Janus rewards are minted and issued at evenly spaced time intervals, e.g., 100 intervals across the lifetime of a vault. This ensures a constant supply of the opposing Janus A/B token, gradually moving the vault options from one token to the other. In this case, the total number of tokens rewarded would be 1000/0.1=10000.

When choosing a floating price, the user's reward is calculated every 24h, maximizing the amount of token rewards received.

However, if the token price has dropped below a certain percentage, the vault defers payment, exposing the user to market risk.

The percentage figure is vault specific, determined at vault creation, depending on the current market conditions and volatility. The default percentage figure is 10%. When payment is deferred, it is re-calculated 24h later. This means that in the case of a market crash, a user might wait much longer to receive their reward.

Floating price vaults have a defined lifespan; additionally, users can exit the vault for a minimal fee once the vault expires. The fee is subject to governance and encourages more significant investments. It currently stands at 0.1% for over $1000, 0.5% for amounts between $500 and $1000, and 1% for amounts below $500.

As the treasury accumulates its reserves, subsequent evolutions of vaults will also provide rewards in ETH or BTC. Making Janus an even more attractive investment option.

Interest Rate

The protocol performs calculations to adjust interest rates up or down depending on market volatility, treasury reserves, and overall demand. The interest rate the user receives is calculated based on the lock-up period. As the community grows, this will be determined through governance.

These calculations ensure that rewards are sustainable based on the network's growth rate.

Token Lock Requirements

When users lock assets in a vault, a minimum token deposit is required for vault activation. The total amount of tokens required is 1% of the total value locked (denominated in $USD) and at an initial token price of $0.01. Should the token price falls below $0.01, the minimum $0.01 price is still used, hence putting a floor on the internal token price.

The initial batch of users will be airdropped JanusA tokens, and they can participate in vaults that will provide only JanusB tokens. Hence, these users can provide collateral and get free interest in JanusB tokens.

Once the vault is fully redeemed, the system locks 50% of the Janus tokens and adds them to the treasury, or they are burnt. This percentage is subject to governance. The tokens are drip-fed to the user's wallet 72h after the redemption of the contract to avoid a sellout event.

Early Walk-out and Late Redemption Penalty Fees

When a user exits early, they incur early redemption fees. Redemption fees are calculated based on a vault's expiry date as a percentage of the days remaining in the contract, with a maximum of 10% of the total deposit. So, for example, if 30% of a user's contract has expired, with 70% remaining, the total fee would be 0.7*0.1=0.07 of the total assets locked, and the total rewards would have been received had the contract matured to fruition.

There is a minimum lockup period, subject to governance, initially set to a default of ⅓ of the vault's lifetime.

Once the vault contract has expired, users must exit their position or buy into another vault. There is a 72h grace period for the crypto-assets and an additional 72h period for reward tokens once the contract has expired. Once the grace period has expired, users incur a fee of 0.01% for each day they leave their assets in the system. Late walk-out fees may also be incurred.

The system allows users to auto-compound to the most similar vault available once the contract expires. This protects against late redemption penalties.

Interest Rate and Reward Calculations

Interest rates are calculated using formulas subject to governance. In the initial version of the Janus protocol, the following algorithm will be used to determine the average interest rate.

Parameters:

1. The minimum yield achieved through yield farming vault assets.
2. Yield retrieved from the treasury.
3. The expectation of fees accrued due to early walkouts or late redemption.

The system targets an interest rate of over 10% and is optimized for a 20%-30% return.

Demand Drivers

The main demand driver derives from the requirement to lock tokens to accrue rewards. A secondary demand driver is derived from governance and fee collection. Therefore, the demand primarily depends on game theory and expectations of the system's growth and circular tokenomics.

For this reason, the system commits to defending the price of the tokens through the use of its treasury. As the treasury grows through yield farming, a certain % allocated will be used to perform token buybacks if the price decreases.

Vault Generation

Vaults are created automatically depending on the supply and demand drivers of JanusA and JanusB. Generally, when a vault for JanusA matures, vaults for JanusB become available.

Vaults adapt to demand and become available on a first-come-first-served basis, and the parameters change as more users lock up their assets.

This is easier to describe using an example.

Let's assume that a user has recently successfully redeemed a vault and received the amount of 1000 JanusB and 100 JanusA remaining.

The system immediately creates two vault options, one that requires JanusA and one that requires JanusB.

Users can choose how much ETH they lock up and for how long. The system encourages lockups of over 365 days. Larger amounts, and higher locking periods, provide higher rewards in a non-linear fashion.

Users who submit ETH and Janus tokens sign new contracts (which are awarded as NFTs and are tradeable), but the total amount of Janus tokens is exhausted.
Therefore, there comes the point where the vaults are no longer available, and new users have to wait for the old users to redeem their contracts or buy their contracts as NFTs.

Obviously, in the case of high demand, Janus reserves the right to provide liquidity through an Initial DEX Offering (IDO) and open new vaults.

Liquidity Ownership

Janus encourages the ownership of its liquidity. The users can stake LP tokens and receive rewards in Janus tokens. Rewards are not fixed and are updated every 24h based on the supply and demand of JanusA and JanusB.

Governance and veTokens

Users can stake their Janus, either JanusA or JanusB depending on algorithmic checkpoints tokens in exchange for veTokens. The veTokens can be used for governance and also fee sharing.

As we've discussed, JANUS token holders inform the Janus protocol by means of their virtual allocations in their vaults. Additionally, JANUS token holders can lock their JANUS tokens and create voter escrow JANUS tokens or what we refer to as veJANUS.

Users that opt to lock their JANUS tokens in return for veJANUS tokens receive three benefits:

1. Up to 20% boosted rewards on the performance of their vaults depending on the lock period.

2. A share from a pool equal to 10% of the total circulating supply as a reward for locking their JANUS.

3. Governance rights in which veJANUS token holders can issue and vote on Janus Improvement Proposals (JIPs) to improve the protocol Rewards and voting power are higher for longer locks. Voting Power decays over the term of the lock, thereby incentivizing users to extend their lockup periods.

Users have the option to relock their JANUS in order to reset and again increase their boosted rewards and voting rights, thereby offsetting the decay. In this way, users express long-term confidence and support in the protocol and are rewarded for doing so.

Governance Architecture

Let's take a closer look at how this works in the contracts:

1. When a User locks up their JANUS to create a vault, the protocol issues them veJANUS tokens that they can use to govern the Janus DAO. They can set the lockup period for any amount of time, with a minimum of one week and a current maximum of 4 years. You can learn more about the issuance schedule in the Supply Control section of this whitepaper.

2. The longer a User's lockup period, the larger the boost to their reward issuance while still adhering to the supply limit curve.

3. The User's veJANUS tokens are non-transferable ERC-20s and represent the User's voting rights. Voting rights and the boosted rewards decay over the period of the lock. i.e.,

users must continue to extend their lock-ups in order to maintain higher levels of boosted rewards and increased voting power.

Rewards

Concerning boosted rewards for Users that lock up their JANUS in return for veJANUS, the boosted rewards are a percentage of the increase to the rewards they've earned. The boost or extra rewards are received when rewards are claimed.

That is when Users rebalance or close their vaults. Further, the rate of the boost decays in line with the decay associated with voting rights over the term of the lockup. As more JANUS tokens are locked, the rate of JANUS rewards that will be issued decreases. Lastly, the protocol extends veJANUS token holders to rewards similar to staking.

That is, as new JANUS is minted, veJANUS token holders will get, as a reward, a share from a pool of tokens equal to 10% of the total circulating supply. This way veJANUS token holders get less diluted compared to others if the supply is inflationary and end up with an even bigger share if the supply is deflationary.

Voting Rights

The veJANUS tokens empower Users with voting rights. Rather than using the amount of tokens locked as voting power, the Janus DAO assigns the voting power in relation to the amount of time that the user will be committed to the platform after voting for a proposal. That is, a user should be willing to confront the outcomes of the proposals for which they are voting.

Voting power is designed to be a combination of the amount of JANUS tokens locked and the remaining time in the lockup for those tokens. This represents and directly models the level of commitment that users with voting rights have when it comes to governing the protocol. This idea stems from the Aragon Minime Token, later modified by the Curve team for their protocol:

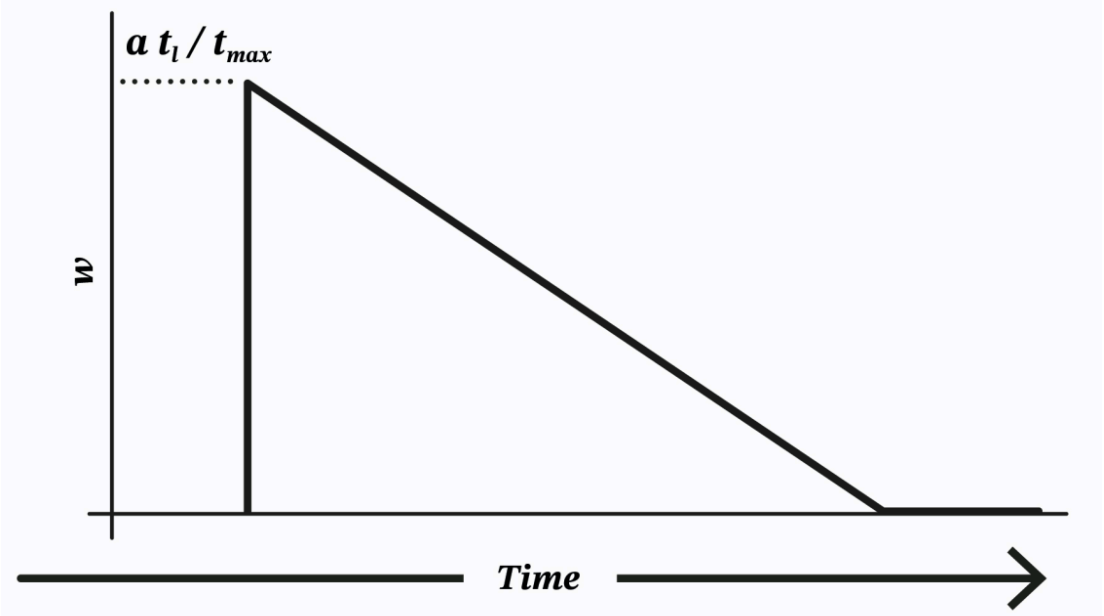

Figure 2 - Voting Power Over Time

The curve in Figure 2 shows the voting power (w) decreasing linearly with time such that the less time left in a User's lockup, the less voting power they have. Users have the option to extend lockup periods at any time to retain as much voting power as they can.

Vault Options and User Actions Summary

Users have the following options for interacting with the system. In the following table, JanusA and JanusB are interchangeable.

Table 2 - Vault Options

Type	**General description**
Vaults - locked price	Provide ETH and JanusA, get drip-fed rewards in JanusB
Vaults - flexible price	Provide ETH and JanusA, get drip-fed rewards in JanusB
Staking LP tokens	Provide LP tokens for JanusA or JanusB, and receive rewards in JanusB
Stake Janus tokens in exchange for veTokens	Self-explanatory

Mathematical Analysis

Proof of Constant Oscillating Appreciation

The two-token system is designed in a way that so that value cyclically appreciates over time. When one goes up, the other goes down, spreading volatility. The proof of this is given below.

Let the supply of tokens A and B be symbolized as S_A, S_B.

Let the total money transacted in exchange for tokens be T_A, T_B (for tokens A and B respectively), and let it be denominated in $USD.

The demand is primarily driven by the requirement to lock tokens to participate in vaults. Let the requirement for tokens to be locked be D_A, D_B. There is also a demand for governance rights, but this can be considered an add-on, which works in the system's favor and can be excluded from this analysis.

Let the total value locked in the protocol be L and is denominated in $USD.

The total value locked in the protocol breaks into two parts. The first one is the principal, which needs to be repaid and can be used only for a certain period to accrue rewards through yield farming. The second part is the treasury.

Let the holding time be H, and let's assume that the average holding time is the same for both tokens.

The unit of time is a day.

Let the total rewards that are going to be issued in tokens A and B be denominated as R_A, R_B

The true value of the price of the tokens can be determined as:

$$P_A = \frac{H T_A}{S_A}$$

$$P_B = \frac{H T_B}{S_B}$$

Without loss of generality, let's assume that $S_A > S_B$. The same holds in reverse.

The system always generates enough vaults so that the following relationships hold:

$$D_A > D_B$$

$$R_B > R_A$$

Hence, at time t+1 the following will happen

$$P_A^{t+1} > P_B^{t+1}$$

Because:

$$\frac{H\,(T_A+D_A)}{S_A+R_A} > \frac{H\,(T_B+D_B)}{S_B+R_B}$$

The vaults are created to ensure that the average holding time between the tokens is constant or, in general, increases over time. The longer the holding time, the more beneficial for the system.

Simulations

Preliminaries

We conducted extensive simulations to verify and confirm the system's stability, strengths, and weaknesses.

Variables:

Time: The simulated unit of time is a month. We have been simulating the system for 5 years.
H: The number of months that someone is holding a token on average
M: The number of tokens in circulation
T: The total transaction volume expressed in $USD
S_a, S_b: Supply for tokens A and B. The supply then expands as more rewards are released into the system. It's set to 1 million for each initially.
P_a, P_b: The price for JanusA and JanusB. Initially, it's set to $0.001

Price mechanics

We are using an adaptation of the equation of exchange for price estimation.

We assume that the price from one iteration to the next is determined in the following steps

1. Calculate price $P_{t+1} = \frac{T\,H}{M}$
2. Calculate the moving average $P'_{t+1} = (a-1)P_{t+1} + aP_t$
3. If $P'_{t+1} > P_t$ then $P'_{t+1} = 2P_t$

This process adapts the equation of exchange to include price anchoring and limits the appreciation potential. The equation of exchange can cause feedback loops, but in practice, we know that the price of an asset is anchored to previous prices and that volatility is limited to a specific value. Therefore, we have accommodated a 100% appreciation potential from one iteration to the next, but not beyond that.

Modelling demand

In this simulation, we didn't model individual vaults. We assume that demand is a percentage of the total availability of vaults.

More specifically, we define the following quantity as the Demand Satisfaction:

$$D_s = 1 - X$$

Where $X \sim |N(\mu, \sigma^2)|$

The variable D_s, is 1 minus a half normal distribution. Using the parameters 0.1 for the mean and the std, we get a distribution that looks as shown in Figure 3 (simulating 10000 samples).

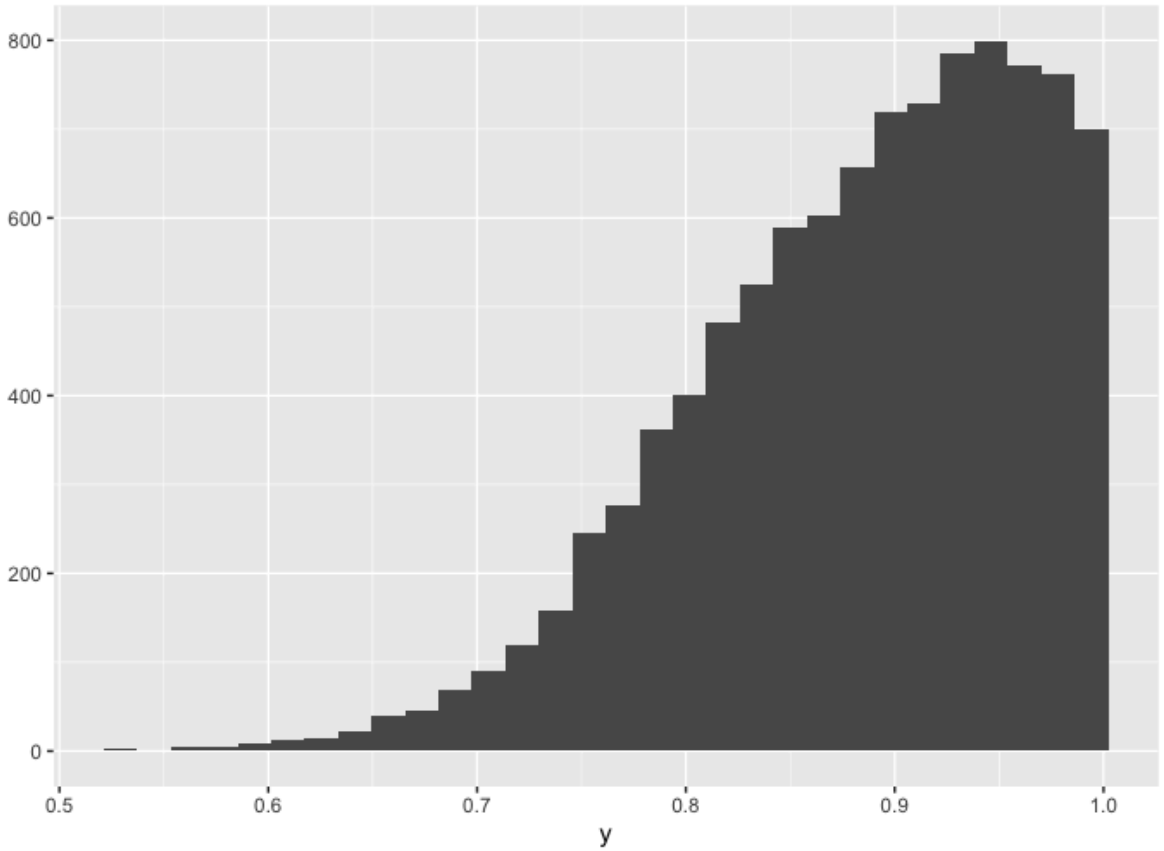

Figure 3 - Demand Simulation Results

The variable D_s stands for “demand satisfaction”. If we symbolize the total demand as *D* (measured in tokens), then the total demand that is satisfied is

$$D_r = D * D_s$$

We call D_r the “realized demand” which is simply a percentage of the total demand that can be satisfied by the open vaults.

Controller Variables

A mechanic used within the simulation was the notion of controller variables. These determine the maximum deviation one token can have from another in terms of quantities like the price or the supply. The system adjusts supply and vaults accordingly if they deviate beyond a certain point.

1. Supply controller: Was set to 1%
2. Price controller: Was set to 100%
3. Rewards controller: was set to 50%

If the supply or the price deviates beyond the controller, then the system will do the following:

1. Increase the number of vaults (and satisfy latent demand) for the weaker token (JanusA or JanusB).
2. Decrease the rewards of the weaker cryptocurrency, and hence the supply that is being released into the market.

The rewards controller works independently and restricts the rewards, so they can only deviate up to 50% for each token.

There is also something which is called the “secondary price measure”. In this case, vaults from the stronger token are erased and are moved to the weaker one. If the vaults in the higher priced currency are *Db*, and the weaker ones are *Da*, we have. If the deviation in the price is more than 3, then the system is considered erroneous.

$$D_a = D_a + (D_a + D_b)/4$$
$$D_b = D_b - (D_a + D_b)/4$$

In practice, many of these decisions would take place through centralized governance in the beginning and decentralized governance later on. An algorithm can be used to prevent extreme cases from arising through the automated adaptation of rewards and vaults.

Simulation Results

The results of an indicative market run are demonstrated below in Figures 4, 5, and 6. We can observe the following:

1. We observe steady price appreciation with oscillating behavior.
2. Rewards rise and oscillate, depending on the needs of the system and the controllers.
3. “Demands” (the total amount of tokens requested by vaults) rise and oscillate.
4. The system is sensitive to the holding time. It requires an average holding time of above six months to demonstrate good behavior. Holding times below this can cause a crash. Holding times above that figure can cause rapid price appreciation. Both scenarios (crash or sudden spike) can be solved via governance intervention or additional measures. These are some open risks that any DeFi protocol would suffer from and can be remedied through carefully considered actions.
5. The simulation didn’t consider active treasury management, which would provide an additional stability mechanism for the price.
6. The simulation also didn’t consider governance tokens, which would create additional demand.
7. In this simulated market run, the price appreciation is 30x. In reality, a market run could cause a multiple of this, going up to 100x or more, as we have observed with many cryptocurrencies.

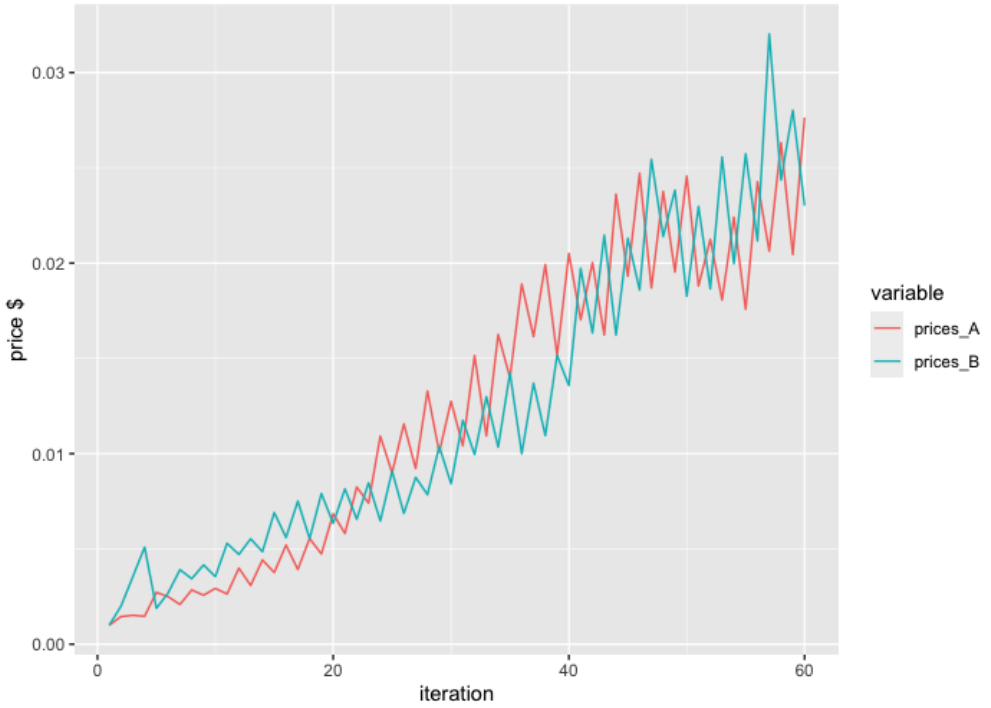

Figure 4 - Price Simulation Results

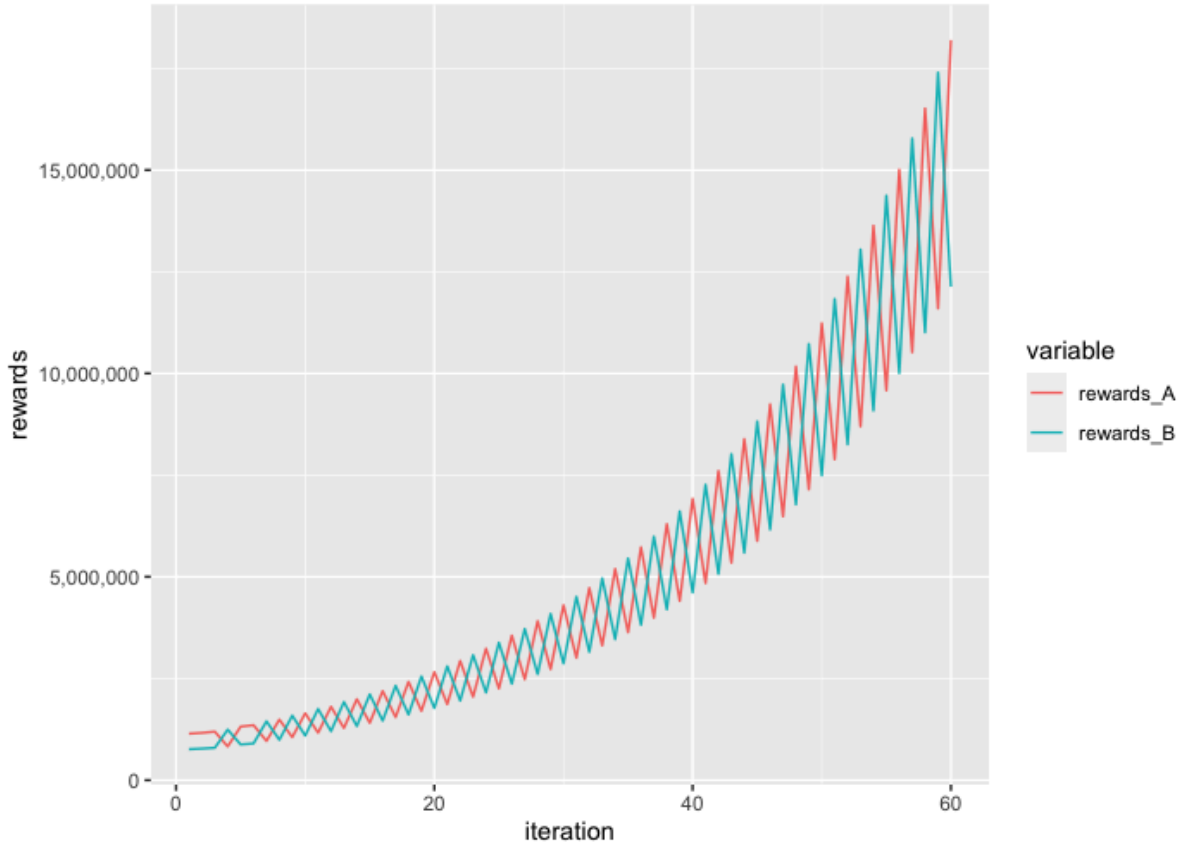

Figure 5 - Rewards Simulation Results

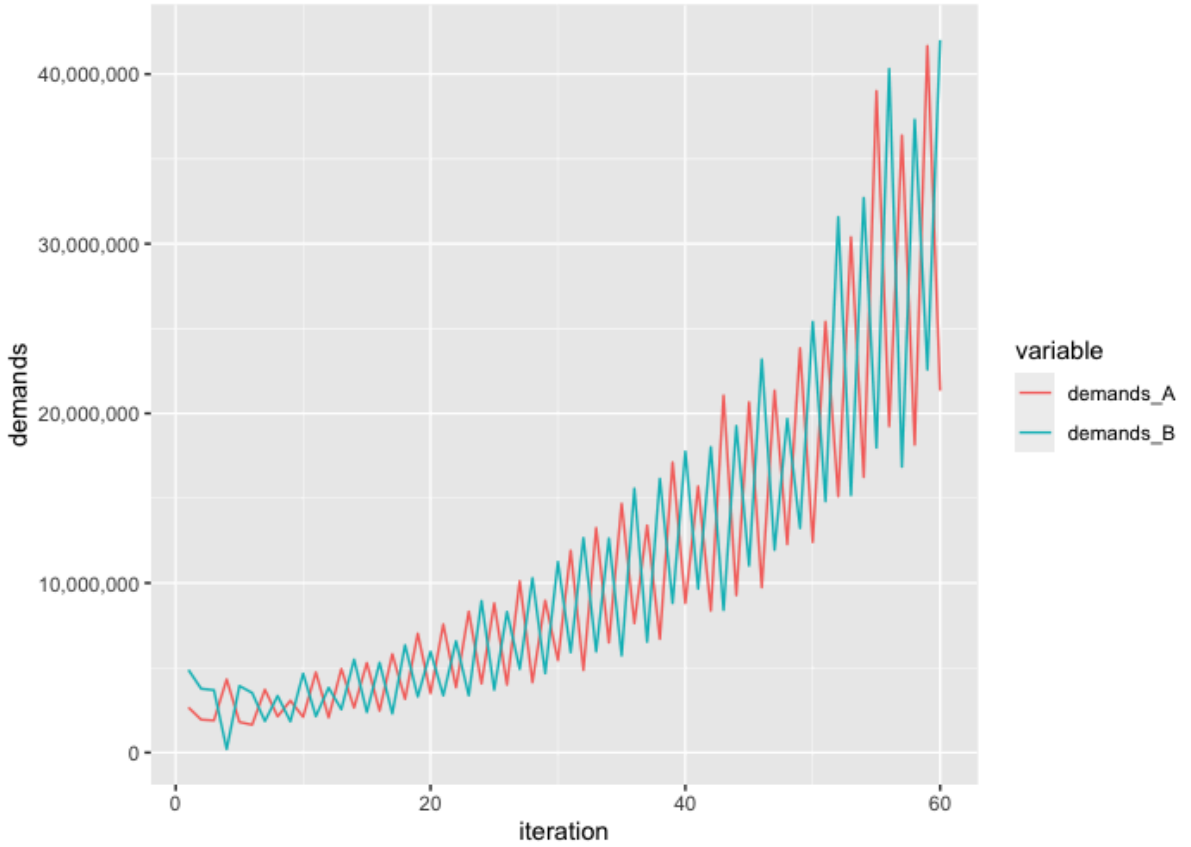

Figure 6 - Demand Simulation Results

The Janus Roadmap and Ecosystem

The unique characteristics of the Janus core protocol are leveraged to create an ecosystem of DeFi products ranging from Liquid Staking Derivatives (LSD) to Lending, RWA derivatives, and Treasury management, which are expanded upon in this section of the whitepaper. As such, Janus can be viewed as a platform or an enabler of new product classes.

The Janus project roadmap outlines the key milestones that the project plans to achieve as it moves towards its long-term goals of creating a DeFi 3.0 ecosystem that prioritizes stability, transparency, and user sovereignty. Here are the key stages of the roadmap:

Stage 1: Janus Genesis

The first stage of the Janus project was focused on the launch of the Janus Core protocol, community growth, and economic stability. During this stage, the team focused on building out the core protocol and laying the foundation for the project's future growth. The team also engaged with the community, building relationships and gathering feedback on the protocol's development.

Stage 2: Janus Ecosystem

The second stage of the Janus project is focused on the development and launch of the Janus Ecosystem, which will include a range of DeFi products and services. These products

will be built on top of the Janus Core protocol, leveraging its unique stability features to provide users with a safer and more secure investment option. The ecosystem will include products such as Liquid Staking Derivatives (LSD), lending, RWA derivatives, and treasury management.

Stage 3: Janus Network

The third stage of the Janus project is focused on the development and launch of the Janus Network, which will enable the seamless and secure transfer of value across different blockchains and networks. The Janus Network will be interoperable with other blockchains and will support a wide range of assets, including Janus tokens and other cryptocurrencies.

Stage 4: Janus DAO

The final stage of the Janus project is the creation of a Decentralized Autonomous Organization (DAO) that will govern the future development and growth of the project. The Janus DAO will be community-led, with Janus token holders having a say in the decision-making process. The DAO will be responsible for managing the project's funds, allocating resources, and making strategic decisions that will shape the future of the Janus ecosystem.

Overall, the Janus project is focused on creating a DeFi 3.0 ecosystem that prioritizes stability, transparency, and user sovereignty. With its unique stability features, risk-adjusted investment options, and transparent approach to risk management, Janus has the potential to be a game-changer in the world of decentralized finance.

Project Stages

The project is split into four different stages.

Stage 1: Janus Genesis
In the first stage, the Janus Core protocol launched, the focus is community growth and economic stability.

Stage 2: Growth and Accumulation
Once stability has been achieved, and Janus is now a store of wealth, the system's goal is to achieve growth. The key here is steadily growing the community, the Total Value Locked (TVL), and the treasury.

Stage 3: Treasury Diversification and expansion
The Janus protocol is designed for steady wealth accumulation. The Janus treasury is composed and governed by two distinct components:

- A core treasury reserve to be leveraged as an emergency reserve, the threshold of which is calculated on-chain as part of the protocol design.

- A DAO is leveraged to manage and invest excess reserves to a treasury of strategic assets owned and governed by veJanus token holders in perpetuity. The focus of this investment fund is growth, diversification, and profitability.

Stage 4: Ecosystem Rollout
The Ecosystem and Roadmap rollout phase comprise of three products; further grants, investments, and incentives will be provided to build on the Janus platform:

- Liquid Staking Derivatives (LSD)
- The Janus Lending Protocol
- RWA 'real world assets' Asset Management
- Treasury DAO

Janus Liquid Staking Derivatives (LSD)

Liquid staking derivatives allow users to trade and use their staked Ethereum assets as collateral for other financial activities without having to unstake their tokens from the underlying protocol. This can increase liquidity for staked assets, allowing users to earn staking rewards while still having the ability to use their assets for other purposes.

The process for liquid staking derivatives on Ethereum typically involves a third-party platform that creates a derivative token representing the value of the staked assets. The third-party platform will typically hold the staked assets and issue the derivative token to the user. This derivative token can then be traded on other platforms or used as collateral for other financial activities.

By definition, all assets which are locked on Janus can also be used as LSDs, in two ways:

1. First, the actual contract (e.g. a bond) that Janus has between a user and an asset is tradeable.
2. Secondly, the assets someone has locked in a vault can be converted into liquid assets if the user wishes to. However, in that case, getting access to the original assets locked requires that the user submits back the liquid assets and is the holder of the original contract in order to avoid artificially creating an overleveraged position.

This ensures the following:

1. Janus takes advantage of modern innovations in DeFi, which increase liquidity.
2. It avoids feedback loops which can cause an implosion of the system.

Janus Lending Protocol and Real-World Assets

If a user repays a borrowed position (or is liquidated), the JLP protocol burns that user's JLP. Users must supply collateral in Janus A/B (at a specific collateral ratio) to be able to mint JLP.

The interest payments will be sent to the protocol's Decentralized Autonomous Organization (DAO), generating revenue for the community and allowing the DAO to bolster its treasury for funding future products or tools.

Janus will also allow lending against real-world tokenized assets, unlocking a considerable market, following the paradigm that AAVE has set, and others are due to follow.

Self-repaying Loans

Janus will enable users to get self-repaying loans. This platform combines yield farming, algo-trading, and other innovative methods to generate sufficient returns to repay the loan amounts, making it a groundbreaking initiative in decentralized finance.

Once the loan is approved, Janus automatically allocates the collateral into different yield farming and algo-trading strategies to generate profits. The platform uses sophisticated algorithms and market data analysis to determine the best investment options, including staking, liquidity provision, and other strategies.

The profits generated from these investments are then used to repay the loan amount and the agreed-upon interest rate automatically. The user can also monitor the investment performance in real-time and withdraw the excess profits the platform generates beyond the loan repayment amount.

Janus is uniquely positioned to create this type of protocol simply because the tokenomics are designed for steady appreciation, which is also part of the core repayment strategy.

Following the principles of transparency, Janus provides different options to the users in terms of risk and interest rates. The lowest risk level allows the users to avoid liquidation altogether in exchange for the Janus protocol being able to use their assets to repay the entire loan in case the user cannot do so.

Treasury DAO

Treasury DAO is a DAO that is leveraged to manage and invest excess reserves to a treasury of strategic assets owned and governed by veJanus token holders in perpetuity. The focus of this investment fund is growth, diversification, and profitability.

It employs a liquid democracy model and is governed by Treasury DAO members and veJanus token holders.

DAO Membership is denoted by an ERC-721 (Soulbound) token. An internal token is minted and distributed to members to establish voting power for governance activities, employing a linear curve distribution applied to members.

Token distribution and, therefore, voting power is segmented with the initial segment on an increased slope to reward early members, with 12.5% of the internal token distribution allocated to Activity Mining rewards.

Activity Mining uses governance participation and AUM appreciation as key metrics to reward DAO members and governance participants.

The DAO has control over all the different assets and the strategies followed, from the open vaults to the CDs.

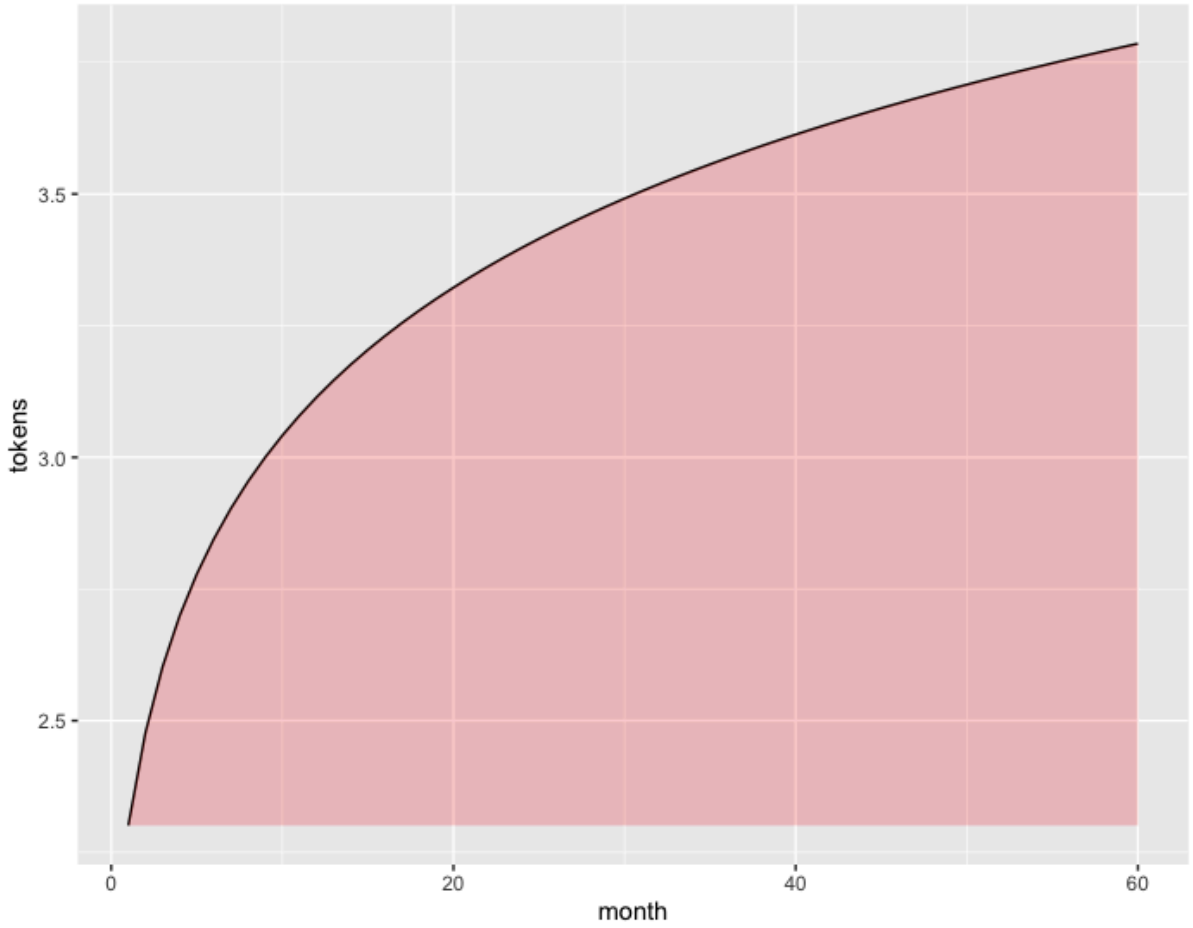

Figure 7 - Janus Lending Protocol

Conclusion

Janus is a pioneering AI powered, inflation-adjusted stability protocol that introduces Algorithmic Finance, emphasising transparency, user autonomy, AI innovations, and rigorous risk management. At its core, Janus introduces the JANUS token into the thriving Polygon ecosystem, strategically engineered to foster risk management, ensure user privacy, and drive long-term growth.

The groundbreaking feature of Janus is its ability to withstand market spikes, ensuring stability for token holders. By dynamically adjusting demand between tokenA and tokenB through algorithmic checkpoints, Janus prevents overheating and maintains a smooth appreciation of value.

Janus, like flatcoins, monitors and adapts to inflationary pressures to preserve its purchasing power. However, it deviates from the typical stablecoin model by not being pegged to fiat currencies, focusing instead on optimizing its performance within the broader market.

This protocol addresses the shortcomings of DeFi 2.0: extreme volatility, inadequate risk management, and lack of transparency. Janus prioritises stability, long-term growth, and user control, providing a balanced approach to crypto asset investment.

With the "What you see is what you risk" (WYSIWYR) principle, AlgoFi offers a level of risk management and transparency absent in DeFi 2.0, mitigating excessive risk and opaqueness. Janus is designed to be sustainable, resistant to market volatility, and serve as a reliable store of wealth.

By merging mainstream finance with decentralized finance, Janus paves the way for a new era in DeFi's evolution. The project aims to leverage the Janus stability protocol to offer a diverse range of products, further empowering users in the decentralized financial landscape.

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