Project Twelve Economic Whitepaper v0.1

presented by P12 Team

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Abstract

Project Twelve, P12 in short, is a GameFi ecosystem with sustainable economy. It features the Editor, a full-featured Metaverse content engine for building game worlds; the Infra, a set of API/SDK and developer portals for bridging game content on-chain; and the Econs, a set of economic and governmental rules and mechanisms implemented in EVM smart contracts.

In this paper, we define key mechanisms and formulate auxiliary theorems and lemmas that derive from the definitions. As a principle, the P12 economy as discussed in the paper does not rely on forced or assumed behaviors from the individual game economy. All game worlds can have desired tokenomics, minting and burning mechanisms of their own. These game worlds will rise and fall as the ecosystem evolve. All of these will not affect the economic principles and objectives established in the paper and it goes to show that P12 ecosystem recovers from local flux.

This paper also goes to show how the P12 economic mechanisms facilitate and guarantee the design goals of true ownership, transparent price discovery, guaranteed liquidity, verifiable scarcity, and lastly enforceable governance. Overall, this paper aims to lay the foundation for the P12 ecosystem and establish the sustainability and viability of P12 economy.

Keywords: P12; GameFi ecosystem; Editor; Infra; Econs; GameMaster

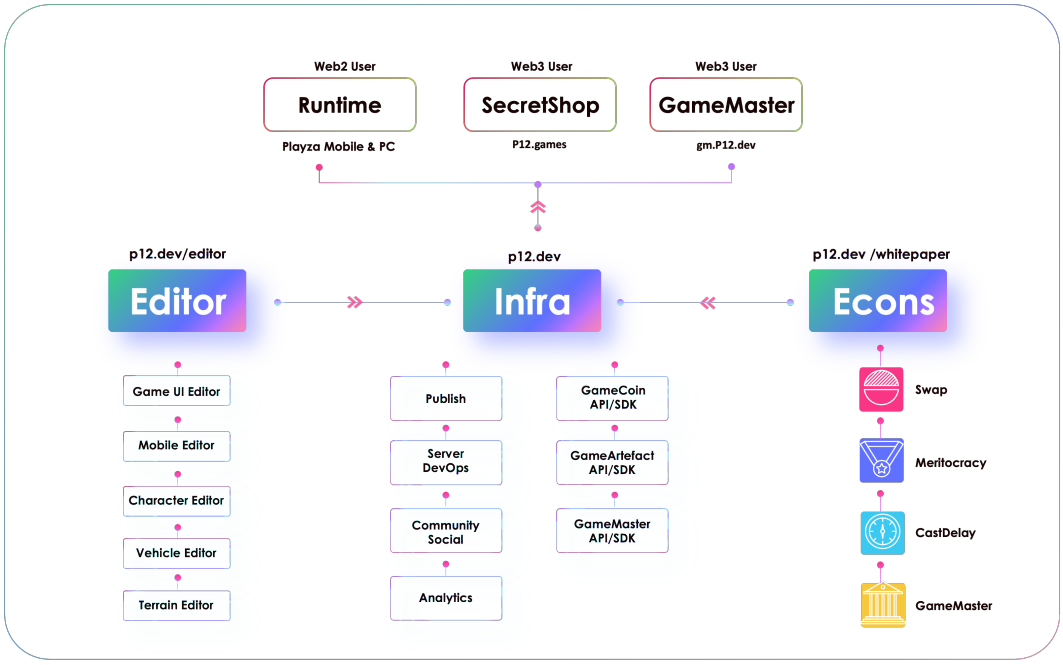

Figure 1. P12 Overview

1 Introduction

Project Twelve, P12 in short, is a GameFi ecosystem with sustainable economy. It features the Editor, the Infra, and the Econs. This paper discusses the economic and governmental mechanisms implemented in the P12 ecosystem. This discussion falls under the broader category of Virtual World Economy or Game World Economy.

1.1 10% Net Value of the World

All forms of virtual worlds and virtual experiences have taken up more than 10% of the awake time of the entire human civilization. However, virtual assets take up far less than 10% of the world's value, as measured in market capitalization. The authors of this paper attribute this mismatch largely to the fact that most virtual assets are currently centrally controlled by for-profit companies and horrendously underserved. When these obstacles were removed, the thesis is that virtual goods and assets would in the future take up more than 10% of the world's net value, demolishing the mismatch. This is held by many builders of virtual worlds (be it gaming, Metaverse, SocialFi, or NFT). We are seeing but the beginning of this 1000x paradigm shift for virtual assets.

1.2 Challenges for Virtual Assets

Most virtual assets are currently centrally controlled by for-profit companies. Some companies are building Metaverses under the same company-town paradigm. These companies thus have arbitrary and unvetted power over virtual assets in their respective virtual worlds or game worlds. This has led to a range of negative consequences in the past in the gaming sector, such as game currency inflations, shadow nerfs, fake scarcity and manipulations, and eventual server shutdown and database drop. As virtual assets are unprotected and underserved, their value is enormously impaired.

GameFi projects have employed Blockchain to eradicate this problem. However, most if not all of the current GameFi projects have unsustainable economic models, causing them to pump fast and crash faster. This leads to further consequences such as a lack of long-term R&D commitments as most GameFi projects have short lifespans. A most important design goal for P12 is to create a GameFi ecosystem with sustainable economy.

1.3 Sustainability and Other Goals of P12 Economy

Through economic and governmental rules and mechanisms, P12 seeks to achieve several design goals, including true ownership, transparent price discovery, guaranteed liquidity, verifiable scarcity, and enforceable governance. All these design goals revolve around and contribute to the central purpose of sustainability for the P12 economy. The above goals are defined mathematically for more precise examinations. Overall, this paper aims to lay the foundation for the P12 ecosystem and establish the sustainability and viability of P12 economy.

1.4 A Case for the Bits

To conclude the introduction section we briefly discuss the inevitability of virtual worlds, and present an unbiased, first-principle argument for bits over atoms. Virtual worlds and digital simulations are the cheapest and fastest way to run experiments. This holds for entertainment and scientific use cases. Consider two scientific fields, one digital and one physical, that start at the same time and are given the same resources. The digital one will always iterate faster, evolve faster, and thus grow bigger to attract and absorb future resources, including capital and brain, for its own use. In any random walk, the digital side wins. In our current incarnation, bits are winning over atoms, and it will keep doing so. As bits are winning, virtual assets will continue to grow. We are witnessing but the very beginning of the 1000x for virtual assets.

2 Mechanisms

The income earned in "Play to Earn" games usually has no real value support. When the rate of return declines and there are no more newcomers, such games will usually be eventually caught in a death spiral.

P12, however, is a GameFi ecosystem with a sustainable economy.

What we want to build is a long-standing, economically prosperous Game World. Game assets are truly owned by players, and liquidity and transaction history are publicly visible. You can see each player's collections and rare assets in the player's warehouse. In the game creation set, you can glimpse the thrilling story of Game World development from a wasteland into a thriving economy. The governance of the Game World is also kept open where players can participate in deciding the future direction of the game, resolving guild disputes, or impeaching developers for their evil deeds. Players become asset owners and masters of the Game World.

Players who invest the most time and effort in the game and put up high-quality content will be rewarded meritocratically with the help of the economic mechanisms of P12.

To realize this vision, P12 has designed the following important mechanisms:

- **Swap** P12 has its high-liquidity swap based on multiple automatic market making models. Game developers mint *GameCoin* and provide initial liquidity for $P12-GameCoin$ Swap. A player can use $P12$ to exchange *GameCoin* for gaming.
- **CastDelay** CastDelay prevents developers from minting new *GameCoin* or removing liquidity without advance notice, to protect the interests of gamers. The mechanism delays a transaction by several blocks that are linearly positively correlated to the size of the transaction.
- **Meritocracy** Meritocracy is an important mechanism aimed at promoting sustainable economic growth of the P12 ecosystem. Meritocracy rewards high-quality content within the platform and behaviors which are beneficial to the platform. Rewards are given according to Usage Statistics, Economic Activities, and Keynesian Policies, and the mechanism ensures that there is no "reward fraud" behavior.
- **GameMaster** The GameMaster is the governance system of the P12 ecosystem. The voting power of GameMaster is measured by the number of $veP12$ obtained after staking $P12$. The GameMaster can implement fiscal and monetary policies similar to real economic systems, including taxes and transfer payments. Meanwhile, GameMaster also has a fine mechanism, which allows game players to initiate fine proposals for game developers who harm players, by effectively giving players the right to supervise.

Chapters 3-6 of this whitepaper introduce the four mechanisms of Swap, CastDelay, Meritocracy, and GameMaster respectively. Chapter 7 introduce the policy and vision of the P12 ecosystem's economic growth.

3 Swap

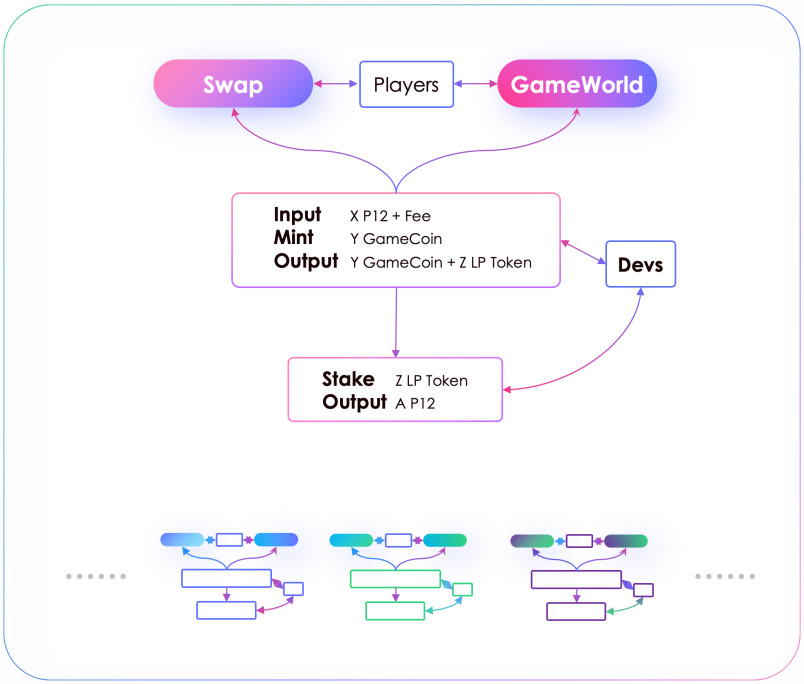

Figure 2. P12 Swap

3.1 P12 Swap

P12 is a GameFi ecosystem, there is an ecosystem token $P12$ and many kinds of *GameCoin* as game currency in every single game.

If a game player wants to play a game listed in the $P12$ ecosystem, of course, the player needs some *GameCoin* used in the specific game, which is the ticket to the Game World. How can a player get the specific *GameCoin*? Can the player acquire those coins directly on decentralized Exchanges like Uniswap or Curve? If trading pairs exist, that would not be a problem. However, the P12 ecosystem has its Swap system specially designed for swapping between ecosystem token $P12$ and each *GameCoin*, which provides the largest amount of liquidity between these pairs and introduces a mechanism to protect the interest of game players. So we recommend that game players get ecosystem token $P12$ from other swaps and then swap $P12$ for *GameCoin* they need in P12 Swap.

The transaction between $P12$ and *GameCoin* is conducted through an automated market maker (AMM). Our Swap would support multiple AMM models, including Constant Product Market Maker (CPMM), such as Uniswap; Hybrid Function Market Makers (HFMM), such as Curve Finance; and, weighted math AMM, such as Balancer.[1,4,6,11] And we will introduce other appropriate models to the Swap if needed.

In the first stage, we use CPMM in the Swap for its conciseness and proven success.

In a CPMM market of P12 ecosystem, liquidity providers create a liquidity pool by depositing traded assets (e.g. *GameCoin* and $P12$) into a trading pair contract. For instance, suppose that the pool reserves x tokens of $P12$ and y tokens *GameCoin* before a trade. If a trader buys δ amount of *GameCoin* by paying $p\delta$ amount of$P12$, the trader subtracts the corresponding value of *GameCoin* from the pool

$$y' = y - \delta \tag{3.1}$$

and adds the price-adjusted value of $P12$ to the pool

$$x' = x + p\delta \tag{3.2}$$

triggering a change in the liquidity pool from (x, y) to (x', y'). The algorithm of constant product market-making requires the (squared) geometric mean of the liquidity pool, net of trading fees, to be constant, $k = xy = x'y'$ with some k. This single equation derives the execution price p for this order.

3.2 Swap Mechanism

The P12 ecosystem supports different kinds of AMMs to choose from.

In addition to the widely adopted CPMM, P12 Swap also supports Stable Swap for developers who want to keep *GameCoin* pegged to $P12$. If a game has more than two in-game coins or developers want to provide liquidity in different proportions, they can choose Weighted Pool.

3.2.1 Constant Product Market Maker

People in Web 3.0 are already familiar with Constant Product Market Maker (CPMM). This part shows web3.0 newcomers how CPMM works, and the P12 ecosystem welcomes those who are or have not yet been involved in web3.0 games.

Liquidity providers inject tokens into an exchange which generate a pool of tokens (i.e., a liquidity pool). Consider $P12$ and *GameCoin*. Suppose that the exchange reserves of x amount of $P12$ and y amount of *GameCoin*. The constant product market-making requires the geometric mean of the liquidity pool (before fees) to be constant. That is, with some constant k, it holds that

$$k = xy \tag{3.3}$$

If a trader wants to buy Δy of *GameCoin* by selling $\Delta x = p\Delta y$ of $P12$ at price p, the trader adds Δx of $P12$ to the pool and withdraws Δy of *GameCoin* from the pool. Without transaction fees, it triggers the following change in the pool:

$$x' = x + \Delta x \tag{3.4}$$

$$y' = y - \Delta y \tag{3.5}$$

Note that the price of $P12$ in terms of *GameCoin* is

$$p = \frac{\Delta x}{\Delta y} \tag{3.6}$$

Since the geometric mean of the pool must be constant, it holds that

$$k = x'y' = (x + p\Delta y)(y - \Delta y) \tag{3.7}$$

Thus, the above equation determines p as a function of the current state of the pool (x', y'), and the trading quantity Δy. Also, by taking the derivative of the above equation concerning Δy, and by considering a small trading volume

$$\Delta y \to y' \tag{3.8}$$

the execution price for an infinitesimal trade is given by

$$P = \frac{x}{y} \tag{3.9}$$

Figure 3 shows a change in the pool's state caused by the above transaction: the exchange rate for one unit of trade is determined by the slope of the curve specified by

$$k = xy \tag{3.10}$$

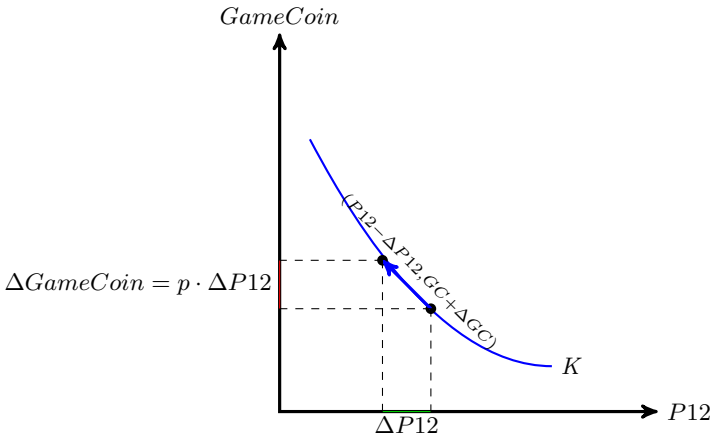

Figure 3. CPMM Model

When the exchange charges a transaction fee, the post-trade geometric mean of the pool, $x_f y_f$becomes higher than the pre-trade constant of k. To understand it, suppose that the pool takes a fraction f of traded assets as a fee and adds it to the pool. In this situation, (I)The execution price for a trade is determined by using the pre-trade state of the pool$k = xy$, as in the case with no fees; (II)A trade adds fees to the pool so that the post-trade pool has the larger geometric mean; (III)The execution price for the next trade is determined by using the updated state of the pool $k_f = x_f y_f$. With the fee, a trader who seeks to buy

$$\Delta x = p\Delta y \tag{3.11}$$

value of *GameCoin* must pay

$$(1 + f)\Delta x \tag{3.12}$$

for a trade. The execution price is determined by

$$k = (x + \Delta x)(y - \Delta y). \tag{3.13}$$

but it causes the following update to the pool state:

$$X \to x_f = x + (1 + f)\Delta x \tag{3.14}$$
$$Y \to y_f = y - \Delta y \tag{3.15}$$

Thus, the updated constant becomes

$$k'_f = x'_f y'_f = f\Delta x(y - \Delta y) + k > k \tag{3.16}$$

Figure 4 shows the transition of the pool from the pre-trade state to the post-trade state. With k constant updates, the curve that represents $y = \frac{k}{x}$ shifts upward. Then, the execution price for the next trade is determined by the updated equation

$$k'_f = x'_f y'_f \tag{3.17}$$

and so on. Since the pool is liquidated and reimbursed to liquidity providers, an increase in k can be seen as protocol fees.

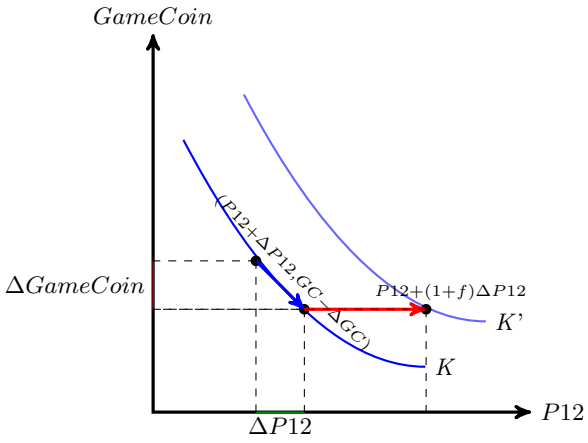

Figure 4. Change of pool liquidity

3.2.2 Stable Pools

Stable Pools in P12 Ecosystem are designed specifically for *GameCoin* that are expected to be pegged to $P12$. Stable Pools use Stable Math (based on StableSwap, popularized by Curve) which allows for significantly larger trades before encountering substantial price impact, vastly increasing capital efficiency for like-kind swaps.

The Stable Math function is defined as:

$$An^n \sum x_i + D = ADn^n + \frac{D^{n+1}}{n^n \prod x_i} \tag{3.18}$$

Where:

- n is the number of tokens
- x_i is is balance of token i
- A is the amplification parameter.

When a portfolio of coins xi is loaded up, we need to calculate D, and we need to hold this equation true when we perform trades (e.g. swap $P12$ into *GameCoin*). That is done by finding an iterative, converging solution either for D, or for *GameCoin* when all other variables are known.

3.2.3 Weighted Pools

Weighted Pools enable developers to build pools with different token counts and weightings.

Weighted Pools use Weighted Math (proposed by Balancer) which designed to allow for swaps between any assets whether or not they have any price correlation. Prices are determined by the pool balances, pool weights, and amounts of the tokens that are being swapped.

The value function V is defined as:

$$V = \prod_t B_t^{W_t} \tag{3.19}$$

Where:

- t ranges over the tokens in the pool
- B_t is the balance of the token in the pool
- W_t is the normalized weight of the tokens, such that the sum of all normalized weights is 1.

By making V constant we can define an invariant-value surface.

The spot price between any $P12$ and *GameCoin* is the the ratio of the token balances normalized by their weights:

$$SP_{P12}^{GC} = \frac{\frac{B_{P12}}{W_{P12}}}{\frac{B_{GC}}{W_{GC}}} \tag{3.20}$$

Where:

- B_{P12} is the balance of $P12$, the token being sold that is going into the pool.
- B_{GC} is the balance of *GameCoin*, the token being bought that is going out of the pool.
- W_{P12} is the weight of $P12$
- W_{GC} is the weight of *GameCoin*

From this definition it is easy to see that if weights are held constant, the spot prices offered by Weighted Pools only change with changing token balances. If the pool owner (developer) does not add or remove tokens to/from the pool, token balances can only change through trades. The constant surface causes the price of tokens being bought by the trader (*GameCoin*) to increase and price of tokens being sold by the trader ($P12$) to decrease.

Knowing the value function after the trade should be the same as before the trade, we can calculate the amount of *GameCoin* a player gets when sending $P12$ to the pool.

$$A_{GC} = B_{GC}(1 - (\frac{B_{P12}}{B_{P12} + A_{P12}})^{\frac{W_{P12}}{W_{GC}}}) \tag{3.21}$$

where:

- A_{GC} is the amount of *GameCoin* received
- A_{P12} is the amount of $P12$ sent.

In reality, V will increase as a result of trading fees applied after a trade state transition.

3.3 GameCoin Issuance Method

3.3.1 CPMM Offering

If a game developer uses the CPMM model to issue *GameCoin*, there will be 50% $P12$ and 50% *GameCoin* in the pool prepared by the developer. As players continue to use $P12$ to buy *GameCoin*, the amount of $P12$ in the pool will increase and the amount of *GameCoin* will decrease, but the ratio of $P12$ and *GameCoin* value remains 1:1.

The CPMM method of issuing coins is widely used. When a token is sold, the liquidity pool has been established at the same time and can be used for trading all the time. Using the CPMM model to sell *GameCoin* is the most concise, but the disadvantage of this method is that developers need to prepare more $P12$ for initial liquidity.

3.3.2 Bonding Curve Offering

Bonding Curve Offering (BCO) use a bonding curve for *GameCoin* distribution.

With a bonding curve, new *GameCoin* are minted when purchased by players and burned when sold to the swap. This creates an autonomously fluctuating swap where the price is actively adjusting. As players buy *GameCoin*, the price of the next *GameCoin* increases, and only decreases when users sell *GameCoin* back to the bonding curve. Since the bonding curve equation is known, *GameCoin* prices are predictable and are dependent on the market supply at any given moment.

Besides the convenience at which purchases and sales take place, a bonding curve has a few other benefits, such as customizability, resilience to manipulation and fair distribution.

Now that we have discussed what a bonding curve is, let us use a example to illustrate what a BCO is.

For example, our function (not the actual price function of *GameCoin* LBP) takes the form of:

$$y = x \tag{3.22}$$

A user wants to buy b amount of *GameCoin* when the current token supply is at a. To calculate the value of $P12$ need to be added into the pool, we need to taking the integral of the function.

The integral of the function will then be:

$$Y = \int_{a}^{a+b} ydx = \int_{a}^{a+b} xdx = \frac{1}{2}x^2\Big|_{a}^{a+b} = \frac{1}{2}(a+b)^2 - \frac{1}{2}a^2 \tag{3.23}$$

Where Y is the total cost of $P12$ purchasing b amount of *GameCoin*.

The same technique can be used to help players calculate how much they would receive when selling b amount of *GameCoin* back to the bonding curve:

$$Y = \int_{a-b}^{a} ydx = \int_{a-b}^{a} xdx = \frac{1}{2}x^2\Big|_{a-b}^{a} = \frac{1}{2}a^2 - \frac{1}{2}(a-b)^2 \tag{3.24}$$

3.3.3 LBP Offering

Liquidity Bootstrapping Pools (LBPs) are pools that can dynamically change token weighting (e.g 1/99 to 99/1 for $P12$/*GameCoin*). LBPs use Weighted Math with time-dependent weights. The starting and end weights and times are selected by the developer, who also has the power to pause swaps.

LBPs often start with intentionally high prices. This strongly disincentivizes whales and bots from snatching up much of the pool liquidity at the get-go. When LBPs are used for *GameCoin*, this can help increase how widespread the token distribution is.

Developers who use LBPs to kickstart the liquidity of a *GameCoin* that has not been well distributed yet can do so with minimal starting capital. For a developer running an LBP with their *GameCoin* and $P12$, starting with 10% or 20% $P12$, as opposed to 50% $P12$ like they might need on another token issuance method, significantly reduces their starting capital requirements. Shifting from 80/20 *GameCoin*/$P12$ to 20/80 would look like this:

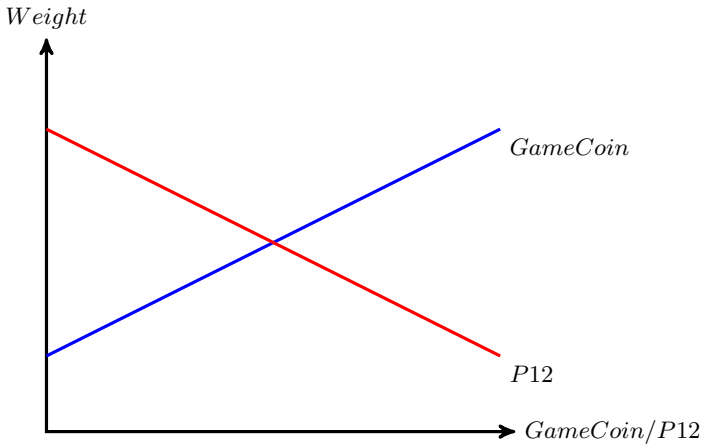

Figure 5. $GameCoin/P12$ Weight Change in a LBP

and would ultimately result in the developer holding far more $P12$ at the end of the LBP while reducing the price volatility that $GameCoin$ would experience when launching a CPMM 50/50 pool.

3.4 Genesis Liquidity Providing

One of the advantages of using P12 Swap to acquire $GameCoin$ over using other swaps is that P12 Swap is higher liquidity, which means lower slippage and adequate token supply.

In P12 Swap, the developers of the game provide the initial liquidity of $GameCoin$ when they issue the tokens.

Here is how it works. This mechanism is called Genesis Liquidity Providing (GLP), which is designed to issue each $GameCoin$ and add liquidity to our swap. The explanation here is based on CPMM but can be applied to other models.

If a game developer wants to design a game and issue a specific $GameCoin$ for it, $P12$ is needed when the tokens are issued and to establish the liquidity pool between $P12$ and $GameCoin$.

Suppose that the quantity of $P12$ and $GameCoin$ is x and y, and the liquidity of the pool could be defined as:

$$L = \sqrt{xy} \tag{3.25}$$

The value of liquidity of pool is:

$$V_L = px + p_{GC}y \tag{3.26}$$

where p stands for dollar value of $P12$ and p_{GC} is dollar value of $GameCoin$.

Here clarifies the detail of how developers mint $GameCoin$ and add initial liquidity.

Suppose that y_0 of tokens $GameCoin$ is issued, and x amount of $P12$ is provided as initial liquidity. When developers decide to issue $GameCoin$ through Factory Contract, u percentage of $GameCoin$ and x tokens of $P12$ will establish a liquidity pool, and the $1-u$ percentage of tokens of $GameCoin$ will be invoked freely by developers (The developer can use these available $GameCoin$ for the economic construction and mechanism design of the Game World of the game he develops). At the first stage, $u = 50\%$, which might be changed or increased different options based on the vote of resolution.

Let $y = uy_0$, then the quantity of $P12$ and $GameCoin$ are x, y. Suppose the price of $P12$ is p, and the initial price of $GameCoin$ could be settled as:

$$p_{GC} = \frac{px}{y} = \frac{px}{uy_0} \tag{3.27}$$

When the liquidity pool is established, the value of the liquidity of the pool would be:

$$V_L = px + p_{GC}y = 2px \tag{3.28}$$

The value of developers' assets can be calculated as the sum of the value of pool liquidity and the value of the remaining $GameCoin$ in the P12 Factory Contract:

$$V = V_L + p_{GC}(1-u)y_0 = px(1+\frac{1}{u}) > px \tag{3.29}$$

Therefore, the total value of developers' assets increases in this process, and the developers are obliged to provide initial liquidity and stake their $GameCoin - P12$ LP tokens (They can remove the liquidity, but must announce it first. See Section 4.2 Remove Liquidity).

If this game gains popularity and players come to this pool to buy more $GameCoin$, the amount of $P12$ in the pool will increase and the amount of $GameCoin$ will decrease, which means, the number of $P12$ corresponding to

each LP token will increase and the number of *GameCoin* will decrease. When developers act as initial liquidity providers, the value of $P12$ they own increases, and they can sell a portion of $P12$ for profit in return for developing valuable games. As the number of *GameCoin* in the pool decreases, the price of that *GameCoin* increases (due to AMM's algorithm).

After developers mint *GameCoin* and the liquidity pool is established, anyone can exchange between $P12$ and *GameCoin* in the corresponding pool. It should be noted that although the initial liquidity is provided by developers, anyone can provide liquidity to the pool and earn transaction fees once the pool is established. At the same time, liquidity providers can also choose to stake their LP tokens to earn $P12$ stake rewards.

4 CastDelay

In a Game World, the central bank is the developer, and $P12$ is a precious metal reserve in the ecosystem with *GameCoin* as another currency. The central bank has the right to formulate national policies to guarantee the game's economic stability and sustainability. To ensure stable operation of the game, the country's monetary policy must be circulated and paid attention to in advance: especially when it involves currency issuance (when related to expected inflation rate) and currency supply (liquidity of the pool).

Staking or unstaking a large proportion of tokens could be a controversial action because of its oversized influence over GameCoin's price. Timelock[1] [2], is a lock controlled by clockwork to prevent it from being opened before a set time, which is established as CastDelay in P12 ecosystem. CastDelay delays a transaction by a period that is proportional to the size of the transaction.

Suppose that S_T is the total amount of LP tokens staked, and T can be representative of both *GameCoin* and $P12$. ΔS_x is the change in stake caused by x users. The change of time delays ΔD is proportional to $\frac{\Delta S_x}{S_T}$, which is:

$$\Delta D \propto \frac{\Delta S_x}{S_T} \tag{4.1}$$

The delay is to first inform players (citizens in the Game World) of the expected monetary policy, which will be implemented after some time. The benefits of Blockchain Technology brought by "Central bank communication" might be that its expectation will be realized 100%. The operations of Delay include but are not limited to:

1. Increase the amount of currency issuance in circulation;
2. Liquidity removal.

Just as in the real world, the game's economy is also constrained by the Mundell-Fleming trilemma where it is impossible to have all three of the following at the same time:

- Free Capital Movement;
- Fixed Exchange Rate System;
- Independent Monetary Policy.

The economic system of Game World prioritizes free capital movement and independent monetary policy while leaving the exchange rate between $P12$ and *GameCoin* to the market via a floating rate. Developers could decide the amount of currency in circulation and the liquidity of markets. Therefore, permissionless swap and liquidity are provided in the ecosystem.

4.1 Mint Additional GameCoin

The more *GameCoin* the game developers issue, the longer it takes for a Delay. It stacks linearly so there is no incentive to break down one mint into multiple minting actions. During the Delay, game players will know in advance the additional supply of *GameCoin* that will increase and can prepare for the increment.

For game players, minting additional *GameCoin* is not necessarily bad, which may represent an increase in the output of this Game World, the need to avoid deflation, or an easy monetary policy.

Assume that the current total supply of *GameCoin* in circulation is S_G, and the amount of additional *GameCoin* issued is ΔS_G. Then the proportion of additional *GameCoin* is

$$A_1 = \frac{\Delta S_G}{S_G} \tag{4.2}$$

The engineering implementation of CastDelay mechanism is in the number of blocks. Conceptually, the change of delay can be viewed at any time D. $D_0$is the minimum number of delayed days, and D is calculated and timed from the last time the Mint was completed. with some constant K_{mint}, it holds that

$$\begin{aligned} D &= D_0 + K_{mint} A_1 \\ &= D_0 + K_{mint} \frac{\Delta S_G}{S_G} \end{aligned} \tag{4.3}$$

[1] https://github.com/OpenZeppelin/openzeppelin-contracts/blob/master/contracts/governance/TimelockController.sol
[2] https://github.com/compound-finance/compound-protocol/blob/master/contracts/Timelock.sol

4.2 Unstake the Liquidity

4.2.1 When Does CastDelay Work

Under the Genesis Liquidity Providing mechanism, developers provide the initial liquidity of the $P12-GameCoin$ pool and their LP tokens will be staked automatically.

When developers want to remove liquidity, they have to unstake their LP tokens and remove liquidity. CastDelay will be applied to the process of unstaking as a form of timelock mechanism.

Our goal is to prevent developers from suddenly withdrawing liquidity. Because the developer's LP token is automatically staked (at the time of initial liquidity creation), we delay the step of unstaking, in order to achieve the purpose of letting everyone know before the developer removes the liquidity. It should be noted that the CastDelay mechanism only takes effect on the operation of unstaking LP tokens. If someone acts as the liquidity provider of the pool, they can freely enter and leave the pool (add or remove liquidity), but if they use their LP tokens for yield farming, which is staking their LP tokens, the steps of unstaking will also be affected by CastDelay.

4.2.2 How to Calculate Delay Time

The duration of the delay is related to the amount of unstaking. The larger the proportion of unstaking amount to the total amount of LP tokens in the pool, the longer the delay time. We assume that unstaking amount is ΔL, and total amount of LP tokens is L. Then

$$A_2 = \frac{\Delta L}{L} \tag{4.4}$$

where A_2 is the proportion of unstaking amount to the total amount of LP tokens.

The number of days for Delay is D, D_0 is the minimum number of Delay days. With some constant $K_{unstake}$, it holds that

$$\begin{aligned} D &= D_0 + K_{unstake} A_2 \\ &= D_0 + K_{unstake} \frac{\Delta L}{L} \end{aligned} \tag{4.5}$$

D is also calculated and timed from the last delay period was completed.

5 Meritocracy

Meritocracy is a unique governing system in the $P12$ Game World. Among all $P12$ tokens, 60% will be distributed to games to reward quality content and booming economic activities. The reward for the content of good quality will boost overall performance on the platform. Otherwise, according to Gresham's Law, bad money would drive out good, which is shown in traditional gaming ecosystems. The reward can be distributed based on three categories: Usage Statistics, Economic Activities, and Keynesian Policies.

$$Meritocracy = m_0 + m_1 U(D_i) + m_2 E(D_i) + m_3 K(D_i) \tag{5.1}$$

- Usage Stats: The reward is distributed based on population policy and proof of play.
- Economic Activities: The reward is distributed based on Swap and NFT marketplace (the SecretShop) trading volumes.

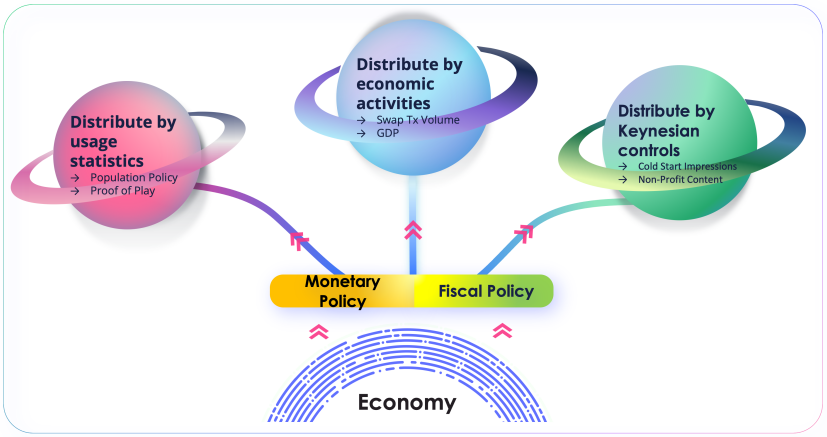

Figure 6. P12 Economic Activities

Suppose T_0 amount of tokens of $P12$ is awarded, and the transaction rate is f_0. Total transaction fees might be

$$T_f = T_0 f_0 \tag{5.2}$$

To prevent faked orders, we also set up the gas fees as g. Suppose that the gas price was y_0, then the total gas fee would be

$$g_0 = T_0 y_0 \tag{5.3}$$

Therefore, the total cost is made up of transaction fees and gas fees, which equal to

$$(X_0 + Y_0)T_0 \tag{5.4}$$

If the value of awarded $P12$ is less than the total cost, the meritocracy function is represented as:

$$PT_0 < (X_0 + Y_0)T_0 \tag{5.5}$$

The key is to make

$$X_0 + Y_0 < P. \tag{5.6}$$

• Keynesian controls: Keynes advocated for increased government expenditures and lower taxes to stimulate demand and pull the global economy out of the depression.[8] Similarly, in the P12 ecosystem, Keynesian controls are used to refer to the concept that optimal economic performance can be achieved—and economic slumps prevented—by influencing aggregate demand through active stabilization and economic intervention policies by the government.

The multiplier effect is one of the chief components of Keynesian counter-cyclical fiscal policy.[9] According to Keynes's theory of fiscal stimulus, an injection of government spending eventually leads to added business activity and even more spending. This theory proposes that spending boosts aggregate output and generates more income. If workers are willing to spend their extra income, the resulting growth in the gross domestic product could be even greater than the initial stimulus amount.

Suppose T_1 amount of tokens of $P12$ is awarded, the multiplier brought by the stimulus is g_1, then the growth of the whole $P12$ pool will be larger than T_1.

$$T_g = T_1(1 + g_1) \tag{5.7}$$

Additionally, in the Game World, the reward is distributed based on two mechanisms: Cold Start Impressions and Non-profit Content. Cold Start Impressions is the TMC support given by the game's initial launch. For newly released games and individual independent developers, we will give various kinds of support and help, including TMC and promotion. In addition, we will support non-profit games which do not make money but have public welfare value. For example, many independent games are about art, war, and culture, or about the history of the Internet and video games. Certain incentives will be given to prevent economic recessions.

6 GameMaster

6.1 P12 Governance

GameMaster means that the gamer is the master of the game. In traditional centralized games, gamers have no real governance rights. Decentralized Autonomous Organization (DAO) is a new organizational structure in Web3.0 that enables gamers in the P12 ecosystem to have real governance rights.

P12 DAO consists of multiple smart contracts connected by Aragon. As for vote weight, standard Aragon's 1 token = 1 vote method is replaced with the voting weight proportional to locktime similar to Curve Finance[7] .

Instead of voting with amounts of tokens, $P12$ tokens are lockable in a $VotingEscrow$ for a selectable lock time t_l, where $t_l < t_{max}$, and t_{max} is the maximum length of time to stake. After staking, the time left to unlock is $t \leq t_l$. The voting weight is equal to:

$$w = a\frac{t}{t_{max}} \tag{6.1}$$

where a stands for the amount of $P12$ staked.

The vote is both amounts- and time-weighted, where the time is counted by how long the tokens cannot be moved in the future. The voting weight decreases linearly over time. To get more $veP12$, there are only two ways:

- Increase the amount of $P12$ staked;

- Extend the lock-up time of $P12$. If the same amount of P12 is staked, the longer the lock-up time, the greater the amount of $veP12$ obtained by staking.

If $P12$ is staked as $veP12$, the staker loses liquidity, because $veP12$ is not tradable, and the staker cannot unstake in advance. Therefore, as a trade-off, $veP12$ holders receive the following incentives:

- P12 DAO governance. In addition to voting on proposals for the healthy and sustainable development of the P12 ecosystem, P12 also introduced a confiscation mechanism. When game developers act maliciously against players, players have the tools to protect their interests. Players can initiate slashing penalties for game developers through standard confiscation proposals, and the assets from the penalty will be confiscated into the P12 Treasury.
- Receive revenue sharing rewards from the P12 ecosystem, including part of the Swap transaction fees and SecretShop transaction fees.
- More incentives: We will design incentives for all developers and gamers in the P12 ecosystem to make veP12 work. We believe that P12 is a sustainable and prosperous gaming ecosystem, and will give benefits to everyone who stakes in P12.

6.2 Example Scenarios of GameMaster Governance

On one hand, we reward good content based on Usage Statistics, Economic Activities, and Keynesian Policies under Meritocracy. For instance, in quantitative metrics of Usage Statistics, the value of a specific game can be calculated based on its number of registered players, number of token holders, monthly active users, etc. Games with a higher value will be rewarded with a higher amount of $P12$ collection. On the other hand, we regularize the behaviors of game developers by introducing a Slashing mechanism. If game players consider the developers to be evil, $veP12$ holders could initiate a proposal to confiscate the tokens of $P12 - GameCoin$ LP tokens staked by the game developers. The slashing mechanism is also realized through Aragon.

Suppose that the initiators propose to confiscate x tokens of $P12$, then

$$X < X_{max} \tag{6.2}$$

X_{max} is the number of $P12 - GameCoin$ LP tokens that are staked by the developer during the proposal and not in the withdrawal Delay of liquidity. Since the beginning of the vote, the X amount of tokens of $P12$ of developers will be locked for t days. T represents the period when the voting for the proposal is held. And we have:

$$t = T \tag{6.3}$$

The decision is made based on the number of votes cast by $P12$, and the proposal will only be approved when more than two-thirds of the votes are in favor.

Once the proposal is implemented, the LP tokens corresponding to these x tokens of $P12$ would be distributed into $P12$ and $GameCoin$, after delay days calculated by $RemoveLiquidity$. In particular, $P12$ will be returned to P12 Treasury, and $GameCoin$ would be returned to the address of game developers.

7 Economic Growth

7.1 Solow Growth Model

The objective of the P12 economic system is to achieve price stability, high player engagement (analogous to high employment in the traditional economic system), economic growth, financial market stability, interest rate stability, and foreign exchange markets stability (the stable exchange between and mainstream crypto assets).

The core economic source of the P12 ecosystem is the value created by games, which is the total output Y. Based on the Solow Growth Model [3] :

$$Y = AF(K, L) \tag{7.1}$$

where:

- A is the rate of technological progress
- K is stock of capital
- L is labor input

We aim to maximize output Y. Therefore, P12 infrastructure is used as a support for the technological progress of the GameFi ecosystem. Through monetary policy and fiscal policy, we achieve the purpose of incentivizing capital inflows and increasing the number of game players (equals to an increase in labor input).

[3] https://academic.oup.com/oep/article-abstract/54/3/369/2361839?login=false

7.2 Fiscal Policy

Fiscal policy includes fiscal revenue policy and fiscal spending policy. The majority of fiscal revenue policy is tax policy. The fiscal spending policy contains a transfer payment policy based on meritocracy and a treasury purchase policy.

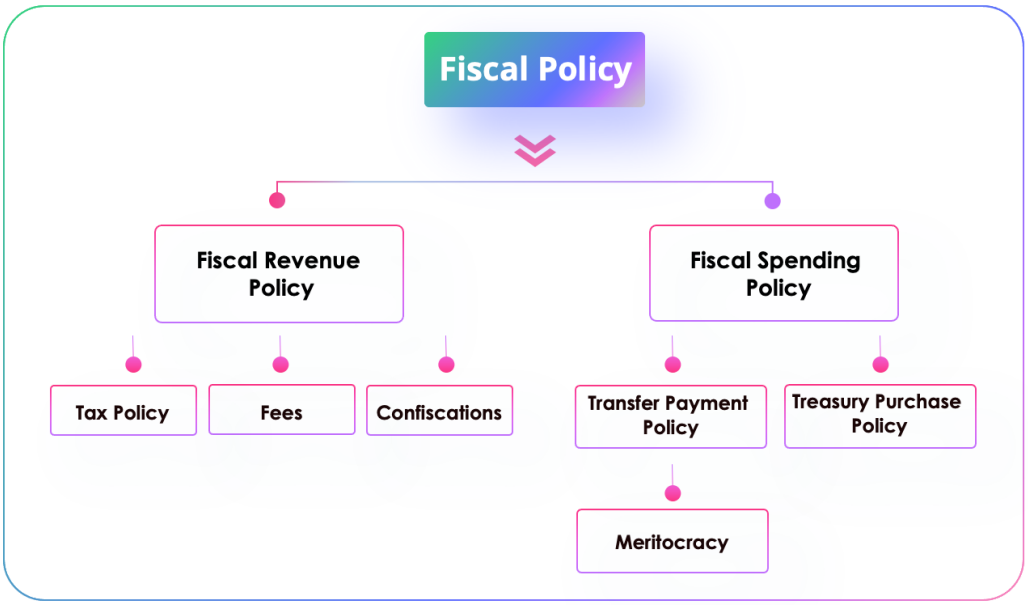

Figure 7. Fiscal Policy

7.2.1 Fiscal Revenue Policy

Fiscal Policy in the P12 ecosystem mainly consists: tax, fees, and confiscations.

- **Tax:** The experience of game players will be better when the liquidity of the pool is higher, or the quantity of tokens inside the pool is higher. To boost liquidity, Swap charges the liquidity provider (LP) a fee of f_0 per transaction.
  For instance, 83.3% f_0 is given to LP, and 16.6% of f_0 is for Protocol fee in the Uniswap.[2] Specific percentage of charge is reflected in the code through LP tokens.
- **Fees:** Certain amounts will be needed to list a game, especially when the developers hope the game to be advertised in a prominent position on the platform.
- **Confiscations:** If initiators confiscate x tokens of $P12$, then treasury will also gain C_0percentage tokens of x.

7.2.2 Fiscal Spending Policy

Fiscal spending policy mainly consists of a transfer payment policy and treasury purchase policy.

The main form of transfer payment policy is Meritocracy (See Section 5 Meritocracy). Meritocracy corresponds to the fiscal subsidies in the traditional economic system. P12 Treasury will provide financial subsidies as incentives to those who contribute to the P12 Universe, such as providing high-quality content and consuming or investing in the total output value. It is similar to the governments' financial subsidies for high-tech industries and preferential policies for enterprises investing in the traditional economic system.

In the process of P12's economic development, the P12 Treasury may purchase $P12$, $GameCoin$, or other tokens in circulation to control inflation or for investment, similar to government purchases in a traditional economic model. The purchasing decision would be made by P12 DAO.

7.3 Monetary Policy

In a traditional economic system, we commonly hear the terms "inflation" and "deflation". The government uses policy tools to adjust the supply of currency and interest rate through the central bank which affects the level of macroeconomic activities. In the P12 ecosystem, the monetary policy is implemented through code, to avoid credit problems such as the expectation management by the central bank in traditional economic systems. P12 ecosystem hopes to build up an economic system under good development by using the code to interpret monetary policy. In the ecosystem, the main concerns of monetary policy are inflation and ve economic model.

7.3.1 Inflation

$P12$ tokens will have a linear release of X years first. After X years there will be a hard-cap to reduce inflation and stabilize the token price. $P12$ tokens will not be issued after the maximum supply (the code limits the possibility of additional issuance of $P12$).

To ensure a sustainable economic growth, the distribution of $P12$ tokens will be a fair launch. A large proportion of tokens will be released into the ecosystem in the form of Meritocracy reward.

7.3.2 veP12

Through P12 GameMaster governance, $P12$ holders stake their tokens to get $veP12$, which is the vote weight in our governance system. $veP12$ is a non-standard ERC20 implementation, used within the Snapshot to determine each account's voting power. The longer you stake the more accurate amount of $P12$ will be generated.

$veP12$ cannot be transferred. The only way to obtain $veP12$ is by locking $P12$.

A user's $veP12$ balance decays linearly as the remaining time until the $P12$ unlock decreases. For example, a balance of 4000 $P12$ locked for one year provides the same amount of $veP12$ as 2000 $P12$ locked for two years, or 1000 $P12$ locked for four years.

The max. Lockup period is 4 years. The formula is outlined below.

$$MAXTIME = 4 * 365 * 86400 \tag{7.2}$$

$$unlock_{time} < (block_{time} + MAXTIME) \tag{7.3}$$

$$veP12_{amount} = \frac{P12_{locked_{amount}}}{MAXTIME} * (unlock_{time} - block_{time}) \tag{7.4}$$

The ve economical model proposed by Curve Finance has positive incentives for the Liquidity Providers (LP) of its projects. Liquidity Providers hold CRV, and could stake it to veCRV, which can boost liquidity providers' reward. Moreover, 50% of the transaction fee income will be distributed to the veCRV holders in the form of 3CRV.

Ve economical model similar to Curve Finance is applied by forming incentives for game developers and players in the P12 ecosystem, including boosting reward and business revenue sharing.

- Boosting reward: To encourage game players to stake their $P12$ so they can be involved in P12 governance, the P12 ecosystem will try to give some boosting rewards to gamers who staked. For example, $veP12$ holders get discounts for their traction in the P12 ecosystem, or, they have some privilege in certain aspects of the Game World.
- Revenue sharing: $veP12$ holders can also obtain a certain proportion of tax income in P12's economic system as a pledge benefit. Tax income includes transaction fees in the Swap and SecretShop (NFT Marketplace).

8 Conclusion

In conclusion, this paper defines economic and governmental rules and mechanisms for Project Twelve. It goes to show how the P12 economic mechanisms facilitate and guarantee the design goals of true ownership, transparent price discovery, guaranteed liquidity, verifiable scarcity, and lastly enforceable governance. Overall, this paper aims to lay the foundation for the P12 ecosystem and establish the sustainability and viability of P12 economy.

The paper also touches on the general topic of virtual assets and virtual world economy in general. By deduction or by evidence, it is demonstrated that virtual asset as an asset class is growing and will continue to grow. We are witnessing but the very beginning of the 1000x for virtual assets, which will one day take up 10% of the world's value and beyond. *The future doesn't belong to the fainthearted; it belongs to the brave.* A new dawn of virtual assets is on the horizon.

References

[1] Hayden Adams, Noah Zinsmeister, Moody Salem, River Keefer, and Dan Robinson. Uniswap v3 core. https://uniswap.org/whitepaper-v3.pdf, 2021.

[2] Hayden Adams, Noah Zinsmeister, Moody Salem, River Keefer, and Dan Robinson. Uniswap infrastructure and products. https://github.com/Uniswap, accessed April, 2022.

[3] Michael Egorov. Stableswap-efficient mechanism for stablecoin liquidity. *Retrieved Feb*, 24:2021, 2019.

[4] Michael Egorov. Automatic market-making with dynamic peg. Technical report, Technical report, Curve Finance, 2021.

[5] Galia Benartzi Eyal Hertzog, Guy Benartzi. Continuous liquidity and asynchronous price discovery for tokens through their smart contracts. https://cryptorating.eu/whitepapers/Bancor/bancor_protocol_whitepaper_en.pdf, 2017.

[6] Nikolai Mushegian Fernando Martinelli. A non-custodial portfolio manager, liquidity provider, and price sensor. https://balancer.fi/whitepaper.pdf, 2019.

[7] Curve Finance. Curve dao. https://curve.fi/files/CurveDAO.pdf.

[8] Robert J Gordon. What is new-keynesian economics? *Journal of economic literature*, 28(3):1115–1171, 1990.

[9] Stephen A Marglin and Peter Spiegler. Unpacking the multiplier: making sense of recent assessments of fiscal stimulus policy. *Social Research: An International Quarterly*, 80(3):819–854, 2013.

[10] Frederick Mishkin. Money, banking and financial markets. *New Horizons, Paris, France*, 2007.

[11] Vijay Mohan. Automated market makers and decentralized exchanges: a defi primer. *Financial Innovation*, 8(1):1–48, 2022.

[12] Allan Niemerg, Dan Robinson, and Lev Livnev. Yieldspace: An automated liquidity provider for fixed yield tokens. *Retrieved Feb*, 24:2021, 2020.

[13] Abraham Othman. *Automated market making: Theory and practice*. PhD thesis, Carnegie Mellon University, 2012.

[14] Philip Treleaven, Alfor Greenwood, Hirsh Pithadia, and Jiahua Xu. Web 3.0 tokenization and decentralized finance (defi). *Available at SSRN 4037471*, 2022.

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