Klein Finance

Provide an effective mechanism for the liquidity of the long-tail market and stablecoins

1. Introduction

Automated market maker (AMM) is a part of the decentralized finance (DeFi) ecosystem. They allow digital assets to be traded in a permissionless and automatic way by using liquidity pools rather than a traditional market of buyers and sellers. AMM uses crypto tokens to provide liquidity pools, and prices are determined by a constant mathematical formula. Liquidity pools can be optimized for different purposes, and these are proving to be an important instrument in the DeFi ecosystem.

First, Uniswap brought markets created by $m \cdot n = \lambda$ invariant which doesn't make any assumption about pricing of underlying assets and spreads liquidity evenly across all prices. At the same time, Klein Finance and automated market-making with dynamic peg provide excellent solutions to a series of problems such as impermanent losses, centralized liquidity, improved capital efficiency, low slippage, and dynamic fees on general exchange channels.

In this project, the Klein Finance model can be applicable to the trading field of stable assets, while the AMM with dynamic peg model is applicable to the trading of unstable assets, such as USDT, WBTC and ETH.

2. About Klein Finance

Klein Finance is used to provide liquidity and trade KCC20 tokens on the KCC chain. Klein Finance is a safe and efficient decentralized trading platform for digital assets. It aims to make digital assets safe and stable with low slippage, good depth, low transactions fee on-chain environment and stake for rewards. The trading model is a mixed liquidity pool, which provides a cross-market mechanism for creating stablecoins, which can meet the requirements of multiple stablecoins vs. non-stablecoins and multiple non-stablecoins vs. multiple non-stable tokens.

Klein Finance provides liquidity pools to the market and rewards users who provide liquidity (also known as liquidity providers). Klein Finance charges a small fee for each transaction, and a part of the collected fee is shared equally by all liquidity providers.

3. Why choose Klein Finance AMM with dynamic peg?

Klein Finance provides a mechanism to create cross-markets for stablecoins in what could be called "Uniswap with Leverage". Its immutability allows most of the liquidity to be concentrated around the price of 1.0 (or any real price), and this is a very useful feature for creating liquidity between stablecoins.

The AMM with dynamic peg method creates liquidity for assets which aren't necessarily pegged to each other in a way more efficient than $m \cdot n = \lambda$ invariant. This creates more than 5 - 10 times more liquidity than Uniswap and provides higher profits for liquidity providers.

So, what problems Klein Finance solve:
(a) It inherits the advantages of StableSwap's ultra-low slip point and aggregation liquidity near the "equilibrium point".

(b) By fitting between the constant product curve and the StableSwap curve and to the constant product curve in the middle and tail area of the curve, the advantage of the constant product curve in rapid response to liquidity changes is obtained, to avoid the depletion of pool liquidity and respond flexibly to rapid market changes.

3.1 Mathematical principles of Klein Finance

Klein Finance is based on two basic AMM methods: constant sum equation and constant product equation. The constant C has a meaning of the total amount of tokens when they have an equal price. (mi is the amount of each asset in the capital pool)

When using the constant sum equation, the price will not change with the transaction and will remain stable, but once the price deviates too much, the liquidity of the capital pool will be evacuated. Therefore, the constant sum formula is only suitable for asset groups with constant expected prices, and the market making strategy is to provide liquidity for all funds at a fixed price

$$\sum \mathrm{m_i} = C$$

The constant product equation is an AMM model like UniswapV2, which just pushes the two-dimensional equation to multiple dimensions. The market making strategy of the model is to diversify the liquidity on all prices.

$$\prod \mathrm{m}_i = \left(\frac{C}{n}\right)^n$$

4. Why do Klein Finance and AMM use dynamic peg?

Stablecoins have become very popular recently: custodial USDC, USDT, BUSD, PAX, TrueUSD, and decentralized DAI. However, they (especially decentralize) have a problem of price stability and liquidity. This is especially painful for DeFi arbitrage. For example, when MakerDAO decreased its stability fee to 5.5%, many users of Compound (the interest rate was 11% at the time) preferred to stay there because they've taken the loan in DAI and converting between DAI and USDC is an expensive task.

At the same time, many DeFi users are willing to deposit their stablecoins for lending to earn 5% APR since the interest rate is much higher than what traditional banking offers. However, they would be uncomfortable providing the same money to trading firms which also "promise profits".

The Klein Finance model is used for stable assets and unstable assets trading, the AMM with dynamic peg improves the Klein Finance model so that it can adapt to the trading of non-stable assets. The AMM with dynamic peg method gathers liquidity around the "equilibrium point". It does not rely on external oracles to achieve the "equilibrium point" but relies on the trading game within the traditional AMM system until the system is balanced. In this method, the Named "internal oracle". Klein Finance generates more than five times more liquidity than Uniswap invariants, and liquidity providers are more profitable.

4.1 What are Klein Finance and AMM with dynamic peg

Klein Finance is an automated liquidity provider for stablecoins. At the same time, on the demand side, Klein Finance offers an exchange function with very low-price slippage (typically 100 times smaller) like Uniswap. On the supply side, it offers a multi- stablecoins like “savings account”. According to the simulation, it is assumed that traders will arbitrage between smart contracts and existing exchanges, which can bring 300% APR considering their stablecoin trading volume and price over the past six months. This happens with no middleman being responsible for the trading, e.g., no exchange owners, no order books, no human market makers.
The AMM with dynamic peg is completely different from UniswapV3. UniswapV3 offers liquidity providers the greatest flexibility. Liquidity providers can provide liquidity by choosing the price range. The difference between Klein Finance and uniswap V3 is that the AMM method of dynamic peg can automatically adjust the liquidity aggregation range according to the built-in Oracle purchase price, without the need for liquidity providers to redeploy the liquidity range themselves. This design is more friendly to individual investors and does not require liquidity providers to formulate complex market-making strategies.

4.2 Project Highlights

Klein Finance has the advantages of ultra-low slippage and aggregated liquidity close to the "price equilibrium point".

The Klein Finance model is applied to stable asset transactions. Because the number of each asset is equal, it is C / n, so the constant product is the power of C / n. When coefficientΨ approaching positive infinity, Klein Finance invariant function approaches the sum constant formula; When coefficientΨapproaches 0, the Klein Finance invariant function approaches the product constant formula.

$$\Psi C^{n-1} \sum m_i + \prod m_i = \Psi C^n + \left(\frac{C}{n}\right)^n$$

If equation (1) is always valid, we will trade with a leverage Ψ. However, it wouldn’t support prices way below the ideal price 1.0. The invariant should support any price (so we always have some liquidity). To doing this, we make Ψ Become dynamic. When the price is away from the price equilibrium point (the expected price), when Ψ tends to 0, the Klein Finance invariant function is similar to the constant product equation; When the price is close to the price equilibrium point, Ψ tending to the coefficient K, the Klein Finance invariant function is similar to the constant sum equation.

$$\Psi = \frac{K \prod m_i}{(C/n)^n}$$

Therefore, compared with the ordinary constant product formula, the curve's stable swap model has the advantages of ultra-low sliding point and aggregated liquidity near the "price equilibrium point" (as shown in the figure below). It is worth noting that the model has an important assumption: the price of each asset should be stable at the same level.

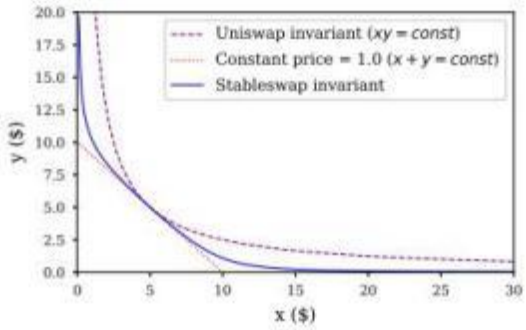


Figure 1: Comparison of StableSwap invariant with Uniswap (constant-product) and constant price invariants. The portfolio consists of coins X and Y which have the "ideal" price of 1.0. There are $x = 5$ and $y = 5$ coins loaded up initially. As x decreases, y increases, and the price is the derivative dy/dx.

Comparison of StableSwap invariants to Uniswap (constant product) and constant price invariants. This portfolio consists of coins X and Y with an "ideal" price of 1.0. Tokens with r = 5 and y = 5 are loaded initially. a decreases, y increases, and the price is the derivative of dy/dr.

5. How does the model work?

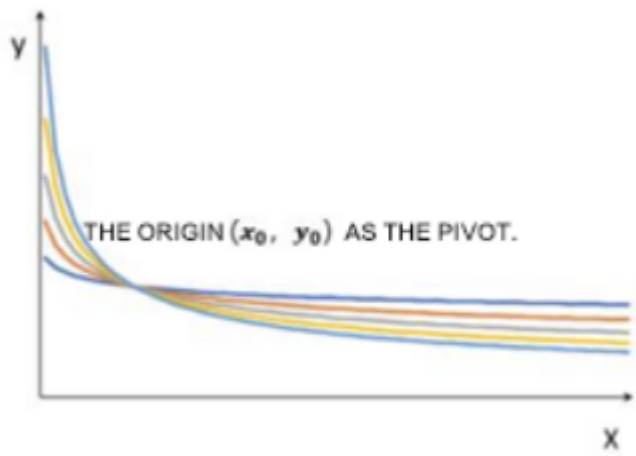
First of all, we need to introduce an oracle for AMM to provide quotations to make up for the missing price function of traditional AMM to a certain extent. The quotation provided by the oracle at time t is recorded as **P*t***. Then, we modify the classical constant product function to transform into the following form

$$x^{\alpha_t} * y = k_t \qquad (1)$$

x represents the number of basic tokens (such as ETH), y represents the number of ERC20 tokens, and the parameters **a*t*** and **k*t*** are calculated by the following formulas:
Since AMM will receive a quotation **P*t*** from an oracle machine at a fixed point in time, the alpha index a of x will also change accordingly. At this point, the slope of the tangent at ($x0$, **y**0) is:

$$P = -\frac{\Delta y}{\Delta x} = -y' = \frac{\alpha_t y}{x} = \frac{P_t}{P_0} * P_0 = P_t$$

From the above, we can see that the price represented at the origin (x**0**, **y0**) is the market price provided by the oracle at time t. Therefore, no matter how the external price changes, after the oracle machine provides the quotation, the second type of arbitrage transaction will not occur, and no matter where the asset pool (**x** , **y**) is at this time, with the first type of arbitrage and normal transactions As the activity progresses, (**x** , **y**) will return to the origin (**x**0 , **y**0). From the figure, it looks like many curves meet at the same point (the origin), so the model is called the Pivot model.



In the time interval of the oracle machine quotation, the constant product function of the Pivot model can be regarded as a special Uniswap original function. For example, in the time period 1 to 2, the oracle machine provides the quotation at time 1, and the constant product function at this time is:

$$\boldsymbol{x}^{\alpha_{t_1}} * \boldsymbol{y} = \boldsymbol{k}_{t_1}$$

If users want to buy y on the platform by deposit in a certain amount of Δ x, the Δ y that can be obtained taking into account the fee ρ can be calculated according to the following formula:

$$[x + \Delta x \quad (1-\rho)]^{\alpha_{t_1}} * (y - \Delta y) = k_{t_1}$$

$$\Delta y = [1 - \frac{1}{(1+mr)^{\alpha_{t_1}}}] * y$$

$$m = \Delta x / x, \quad r = 1 - \rho$$

Similarly, if users want to buy x on the platform, and deposit a certain amount of Δy, considering the fee ρ, the Δx that can be obtained is:

$$\Delta x = \left[\frac{1}{(1-n)^{\frac{1}{\alpha_{t_1}}}} - 1\right] * x * \frac{1}{r}$$

This moment:

$$y' = \frac{1}{(1+mr)^{\alpha_{t_1}}} * y = (1-n) * y$$

$$x' = (1+m) * x = \frac{1 + (1-n)^{\frac{1}{\alpha_{t_1}}}(r-1)}{(1-n)^{\frac{1}{\alpha_{t_1}}}} * x * \frac{1}{r}$$

It can be seen from the above that when ρ > 0, $\boldsymbol{x}^{\alpha_t} * \boldsymbol{y} > \boldsymbol{k}_t$, the extra part is the income of the liquidity provider.

For example, purchasing LINK with ETH, the fee rate according to the market standard is 0.3%.

At the initial moment, assuming that the exchange rate is 1 ETH = 50 LINK, the liquidity provider will deposit 500 LINK and 10 ETH into the smart contract. At this time, P_t is equal to P_0 and α_t is 1, so the function of the Pivot model is the standard Uniswap constant product function:

It can be seen from the above that when ρ > 0, $x^{\alpha_t} * y > k_t$, the extra part is the income of the liquidity provider.

$$x * y = 10 * 500 = 5000$$

Assuming that there is no new liquidity is added before time t_1, and the oracle quotes 1 ETH = 100 LINK at time t_1, the functional form of the model will become:

$$x^2 * y = 10^2 * 500 = 50000$$

At this moment, the slope of the tangent at the model origin is P = 2 * 500 / 10 = 100, which is the same as the market price, so it does not appear the second arbitrage, impermanent losses will not occur.

During this time interval, LINK buyers send 1 ETH to the contract, pay a 0.3% fee to the liquidity provider, and the remaining 0.997 ETH that is added to the asset pool. the parameter ***kt*1** (50000) divided by the existing ETH amount in the asset pool, and the extra LINK can be sent to the buyer:

Buyer sends : 1 ETH
Fee = 1 ETH * 0.003 = 0.003 ETH
ETH_Pool = 10 + 1 – 0.003 = 10.997
LINK_Pool = 50000 / 10.997^2 = 413.45
Buyer receives: 500 - 413.45 = 86.55 LINK

At this time, arbitrageurs in the market found that the current trading price is 1 ETH = 86.55 LINK, and the price of ETH on the platform is more expensive than the market price (100 LINK). Therefore, the first arbitrage opportunity in 2.1 will appear. The arbitrageur will enter LINK on the platform to buy ETH, and pull the asset pool (x, y) back to the origin (10 ETH, 500 LINK).

For Uniswap, assuming that the origin is (10 ETH, 500 LINK), the price is 1 ETH = 50 LINK currently.
When the price becomes 1 ETH = 100 LINK, under the continuous action of the arbitrage mechanism, the final asset pool will approach (7.07 ETH, 707.11 LINK) position. The impermanent loss currently is:

10 * 100+500-7.70*100-707.11 = 22.89 LINK.

6. Klein Finance Product Description

1. Create a transaction pool without permission.

2. Allow users to freely create trading pairs, not only limited to stablecoins trading pairs, and users can create trading pairs of any tokens: trading pairs of any tokens and meta pool with shared depth.

3. Allow users to freely create trading pairs and support long-tailed tokens, and use the meta pool to create them, which can be done one by one to complete the swap of main stablecoins.

4. Transaction Routing: this allows users to create liquidity, transactions require users to use transaction routing to select the exchange pool with the smallest slippage for users at the front end.

5. Transaction mining: According to the different transaction pools, the user's transactions are counted, calculated according to the token distribution speed and the different reward pools. Different xTokens are obtained according to the user's transaction volume within a period of time.

6.1 Transactions

The bottom layer of Klein Finance uses a permissionless transaction module, which can satisfy stablecoin-to- stablecoin transactions and stablecoin-to-non- stablecoin transactions. On the one hand, it can expand xUSD's transaction requirements for main tokens. On the other hand, it can also meet xUSD's transaction requirements for stablecoins, and use stablecoin assets as transaction LPs to improve its utilization rate.
AMMs are one of the major innovations brought about by decentralized finance. First, Uniswap brings a market created by the x y = k invariant, which makes no assumptions about the pricing of the underlying asset and distributes liquidity evenly across all prices. Next, we introduce the stableswap invariant, which allows the concentration of most liquidity around price 1.0 (or any real price), a very useful function for creating stablecoin-to- stablecoin liquidity.

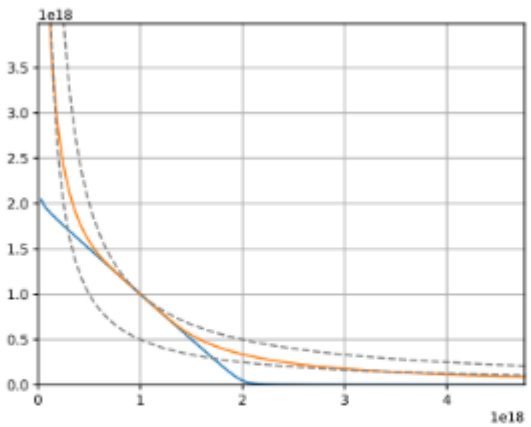


Figure 1: Comparison of AMM invariants: constant-product (dashed line), stableswap (blue) and from this work (orange)

The core part of this mathematical model is that it creates a new form of curve. From the visual point of view in the above figure, the two dotted lines are constant product curves, the blue line is the stableswap currency exchange curve, and the yellow curve constructed by AMM using the dynamic peg swap rate method has two basic characteristics:
(a) between a constant product curve and a stable exchange curve;
(b) The curve tail features have obvious equal-area curve fitting.

6.2 Transaction Mining

According to certain reward rules, Klein Finance will reward traders, liquidity providers, and partners in the expectation of working together to achieve the enhanced protocol goals. Klein Finance has built a robust ecosystem around governance, rewards, and staking. All designed to drive future growth and decentralization of Klein Finance and resulting in a better experience for users.

KEN = individual transaction volume / total transaction volume * KEN output (total transaction volume is the total transaction volume that has not been rewarded)

The number of xTokens rewarded by the transaction will change with the total transaction volume. When the total transaction volume increases, the number of xTokens that an individual can receive decreases; when other people receive KEN rewards, their transaction volume will be reduced from the total transaction volume. At this time, the number of xtokens that individuals can receive increases.

Transaction mining reward calculation

$$w = f^{\alpha} \times d^{1-\alpha}$$

$$r = R \times \frac{w}{\sum_n w_n} \quad , n = 1, 2 ... k$$

r: The number of tokens obtained through transaction mining.
R: The total reward that will be distributed among all traders in the pool for the period
f: Total transaction fees paid by traders during the period
w: Individual Trader Score
$\sum_n w_n$: Sum of all traders' scores
d: Trader's average holding volume across all markets during the period (measured hourly)
k: Total number of traders in the period
α: A constant that determines the range of fees and open contract weights. The initial value is α=0.7.

6.3 Staking Mining

By depositing funds into the on-chain liquidity pool, liquidity providers can obtain transaction benefits, which support additional benefits for liquidity providers while improving the utilization of funds.
Users stake LP to obtain mining rewards. The contract will be rewarded according to different LPs and the number of staking. The basic reward is set to 1 time, and veToken can be used to accelerate the reward up to the maximum of 3.3 times.

6.4 Three types of transaction pools

Klein Finance supports integration with other DeFi protocols, and Klein's liquidity pools are divided into three types:

1.**Meta pools**: a liquidity pool composed of a stablecoin and a Base Pool. The purpose of this liquidity pool is to reuse the stablecoins with higher capital utilization and better pool depth in the Base Pool.

2.**Stablecoin pools**: It supports 2 to 4 stablecoin trading liquidity pools. Adding liquidity to spot trading AMM helps reduce slippage. It is very common to swap one type of stablecoin for another. It is important to reduce slippage on these types of trades.

3. **Plain pools:** support 1 stablecoin and 1 non-stablecoin trading liquidity pool.

7. DAO & veKEN mechanism

KEN is the token of Klein Finance and has three main purposes: community voting, staking to obtain community governance fee sharing, and improving the income of the liquidity pool. Users need to lock xToken and obtain veKEN to achieve above purposes and holding veKEN will provide more incentive to simultaneously provide liquidity to the protocol to gain protocol incentives.

Holding veKEN and providing liquidity to the protocol at the same time can get up to 3.3 times the veKEN liquidity incentive, so liquidity providers will be more willing to stake and lock the xToken in their hands as veToken to improve the overall income of providing liquidity. The full liquidity reward of the agreement is only available if you have both capacities.

Liquidity providers are the most important participants in Klein Finance, and it is the most beneficial behavior for the governance of Klein Finance to allow liquidity providers to obtain the most project tokens and participate in governance.
In Klein DAO, instead of voting with the number of KENs, KENs are locked in a Voting gEscrow, and the locking time can be selected

$$w = a\frac{t}{t_{\max}}.$$

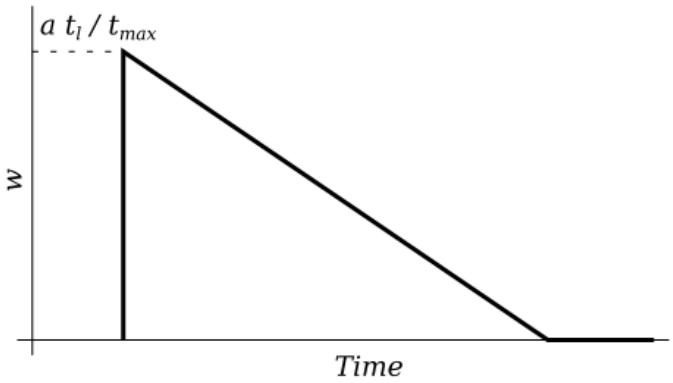
7.1 veKEN generation rules:

1. Stake KEN to obtain veKEN, the longer the lock-up time of xToken, the more veKEN it will obtain, for example: 1 KEN locked for 4 years can get 1 veKEN, and KEN locked for 1 year can only get 0.25 veKEN.

As the token approaches the lock-up expiration, the balance of veKEN will decrease linearly, which can motivate long-term staking and promote the activity of the community to obtain the highest yield.

2. When the user redeems, the amount of staked KEN will be redeemed.

3. The time function in the lock-up rules: veKEN =KEN *T/4 (T is the lock-up period), that is, the longer you stake xToken, the more veKEN you will receive. User chooses KEN to lock the position for 4 years to 1: 1 to obtain veKEN, the stake and lock-up behavior is irreversible, it cannot be unlocked or transferred during the lock-up period, and veKEN is not tradable.



7.2 Scope of using veToken

1. Boost acceleration: The acceleration mechanism of yield farming can be accelerated according to the number of users staked. The greater proportion of assets staked by users, the greater the number of veTokens that need to be staked. The liquidity provider can choose to accelerate and the larger the amount of locked veTokens, the faster acceleration ratio will be increased. The maximum acceleration can reach 3.3 times, which is a linear increase mechanism.
Boost acceleration calculation formula below:

Boost KEN Rewards:

(a).Without-Boost
earning_weight 0.4 your_liquidity
base_rate ken_emission_daily gauge_weight ken_price 365 0.4/total liquidity
e.g.xUSD gauge base_rate:
750000*0.1631*6.38*365*0.4/2298846594.78=4.95%

(b). Boost earning_weight formula:
min((DollarProvided*40/100)+(TotalLiquidity* VotingBalance/VotingTotal*(100-40)/100), DollarProvided)

2. The transaction fee of KNE xx% is charged, and the proportion of the fee charged is equally divided according to the proportion of veKEN;

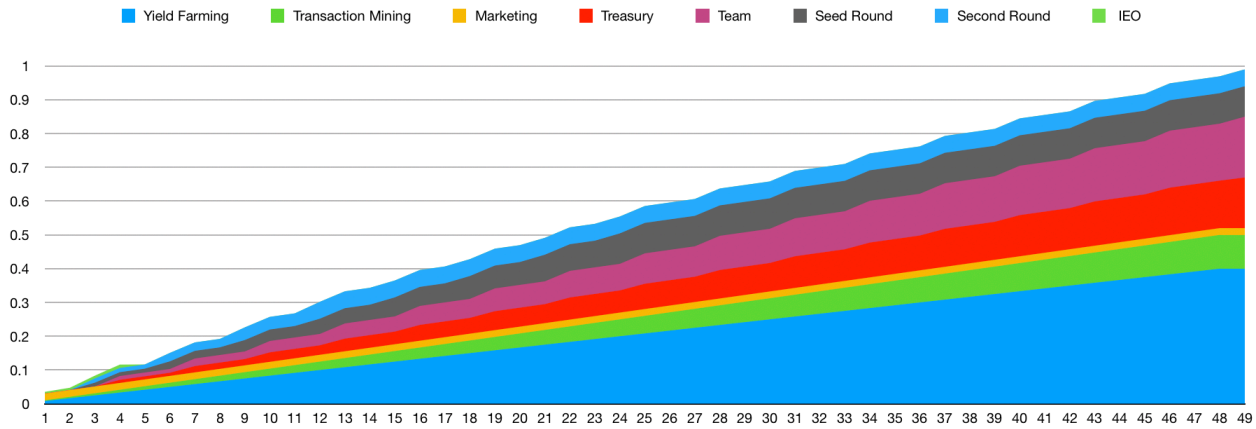
3. Voting rights mechanism: Voting rights are proportional to the lock-up time, and veKEN will decline over time, so in order to maintain sufficient voting rights, it means that the lock-up time must be refreshed all the time.
- For transaction mining listing tokens /weight adjustment: Vote to determine listing tokens and weight adjustment for transaction mining.
- For stake mining listing tokens/weight adjustment: Vote to determine listing tokens and weight adjustment for transaction mining.
- Initiate a proposal.

8. KEN Tokenomics

KEN is a non-stable equity token in the Klein Finance protocol. The supply of KEN is initially set at 100 million, which will be the entire limited supply of KEN, but deflation may occur depending on market conditions. The overarching principle of its design is to add the ability to capture value for KEN. According to the circulation of KEN in the protocol, the following design requirements need to be met:
- Realize the function of regulating and stabilizing liquidity.
- Balance the benefit of users, LPs and governors.
- As a transaction fee in each protocol.

The purpose of issuing veKEN governance tokens is to separate the governance rights and voting rights of the protocol from other rights to better meet the governance needs, and to achieve the long-term development of the protocol through a reasonable governance solution.

	Amount	Release Period	Explanations
Yield Farming	40%	About 4 to 10 years of distribution	
Transaction Mining (motivate market makers)	10%	15% about 4 to 10 years of distribution	Most of the selling pressure comes from this segment 40% of this segment requires staking veToken acceleration to get it
Marketing	2%	One-time unlock	For project market making
Treasury (Rise Reserve)	15%	do not distribute if not necessary	
Team	18%	About 2 to 4 years of distribution	Released by mining or monthly
Fundraising	15%	About 1 to 2 years of distribution	Distributed monthly or quarterly



9. Summary

The development path of Klein Finance and AMM is very different from Uniswap V3. Uniswap V3 provides liquidity providers maximum flexibility. Liquidity providers can choose a price range in which to provide liquidity. Unlike Uniswap V3, the project's AMM mode can automatically adjust the liquidity aggregation range based on the feed price of the internal Oracle, without requiring liquidity providers to redeploy the liquidity range. This design is more friendly to individual investors and does not require liquidity providers to formulate complex market-making strategies.

In general, Klein Finance still has obvious competitive advantages in the field of stable asset trading, but in the field of unstable asset trading, the AMM of the dynamic peg mode is still in the process of exploration.