



Unpacking the Potential of Crypto Interest Rate Market with LSD Market Service Provider: Pendle

Colin Li

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You should conduct your own research and consult independent counsel on the matters discussed within this report.

The past performance of any asset is not indicative of future results.

About the Author

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Researcher at Mint Ventures, specializing in tokenomics, algo stablecoins, central bank, derivatives, uncollateralized lending and X2E projects. Before entering crypto world, he has 4 years experience in traditional financial institutions. Colin has Master of Finance from Peking University.



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1. Key Insights

1.1 Core Investment Logic

As the LSD narrative grows, an increasing number of market participants are calling for the development of advanced tools built on Decentralized Finance. Greater emphasis is being placed on bond market analysis and extrapolation, with Pendle emerging as a valuable player tapping into innovative trading strategies.

- Pendle's V2 version boasts a restructured Automated Market Maker (AMM) model, which draws inspiration from Notional Finance's proposal and has led to a marked improvement in trading efficiency.
- In the realm of underlying assets, Pendle has steadily established four layers of fixed-rate markets, each catering to different risk levels, effectively addressing the requirements of a diverse user base, including conservative investors, arbitrageurs, liquidity providers, and yield speculators.

The introduction of the Ve-model has enabled the PENDLE token to gradually develop a more resilient value capture mechanism. As key business metrics, such as Total Value Locked (TVL), show consistent growth, PENDLE is increasingly attracting the attention of moderate investors.

1.2 Main Risks

- **Smart Contract Risk:** In the event of a significant disruption, both the project's regular operations and the token's value capture could be adversely affected. This risk extends beyond Pendle itself, as its underlying assets originate from other DeFi projects. Consequently, any contract risk stemming from these projects could potentially impact Pendle as well.
- **Strategy Risks:** If the project fails to select the appropriate assets or public chains bearing the assets, it may fall behind competitors in the next stage of competition. Pendle teams must identify the optimal underlying assets and possess a clear understanding of the fierce nature of public chain competition.

- **Market Risks:** A substantial market downturn during the project's operation could lead to a decrease in underlying assets, which would be unfavorable for those who regard USDT as the standard currency.

1.3 Valuation

According to the "FDV/TVL" metric, Pendle's present valuation appears to be relatively lower compared to its rivals who have previously launched tokens.

2. The Overview of Pendle

2.1 Project Scope

Pendle, a platform operating within the yield tokenization sector, effectively segregates interest-bearing assets into Principal Tokens (PT) and Yield Tokens (YT) upon locking them for a predetermined period. This innovative mechanism caters to users seeking low-risk liquidity management solutions, while simultaneously providing a versatile instrument for traders skilled at exploiting yield fluctuations to maximize yields.

In relation to the crypto interest rate market, our recent coverage includes a pair of in-depth articles that dive into the business rationale and progression of this burgeoning market. The articles, titled "[An Exploration of Risk-Free Rate in the Crypto World](#)" and "[The Outlook of the On-Chain Bond Market](#)," offer valuable insights for readers eager to deepen their understanding of these topics. We encourage our audience to explore these pieces for a comprehensive analysis.

2.2 Milestones and Roadmaps

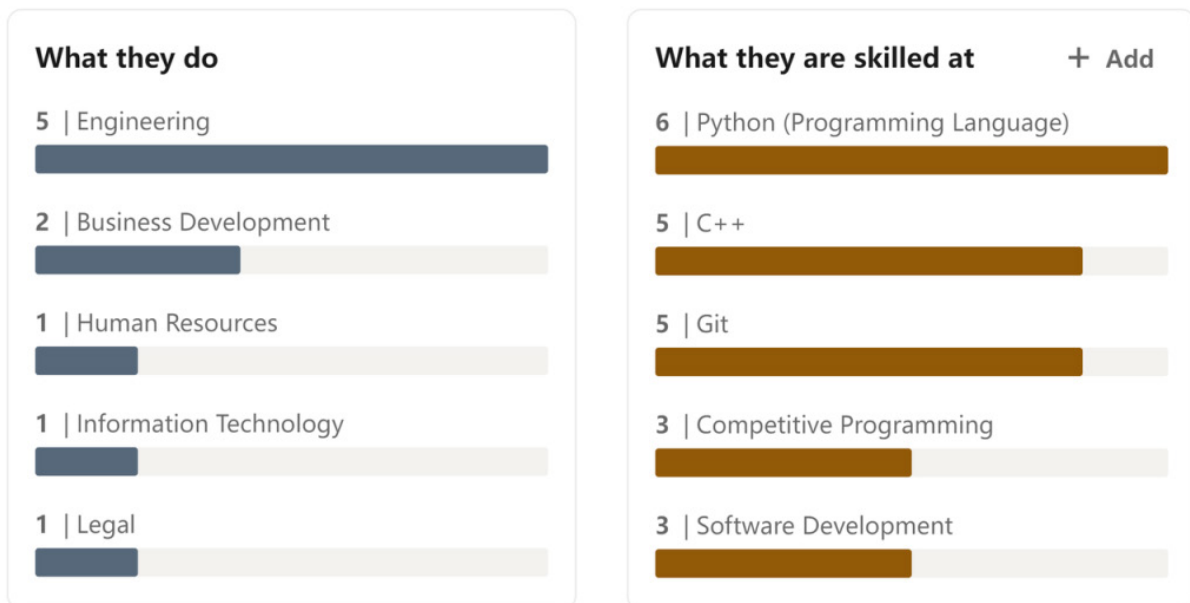
- In March 2021, rebranded from Benchmark to Pendle and launched the testnet.
- In June 2021, Pendle markets were up on Ethereum mainnet.
- In November 2021, Pendle went live on Avalanche.

- In March 2022, Pendle launched Project Permissionless, which allows anyone to use any asset to create a new pool and provide liquidity.
- In November 2022, Pendle V2 went live.
- In March 2023, Pendle went live on Arbitrum.

2.3 Team

2.3.1 Basic Info

According to LinkedIn, the Pendle team is made up of 13 members, with the majority being engineers and business development managers.



Source: <https://www.linkedin.com/company/pendlefinance/people/>

2.3.2 The Founder



TN Lee is the founder of Pendle. Prior to establishing Pendle, he founded DSR, a data analytics company. TN Lee entered the blockchain space in 2017 as a founding team member of Kyber Network, where he was responsible for marketing and business development. In 2019, he served as an advisor to RockMiner. That same year, TN Lee created both Pendle and Dana Labs, an R&D firm specializing in FPGAs.

2.3.3 Core Team Members

- Long Vuong Hoang: Head of Smart Contract Development at Pendle, graduated from the National University of Singapore. Before joining Pendle, he interned as a software development engineer at Jump Trading.
- Jeffrey Soong: Serving as the Head of Front-End Development at Pendle, Soong has previously worked as an engineer at several internet companies.

2.4 Financing



Source: <https://medium.com/pendle/pendle-raises-3-7m-to-create-the-next-layer-of-defi-yield-markets-3b059bfbaa1>

- In April 2021, Pendle announced a \$3.7 million funding round led by Mechanism Capital with other notable institutions, including Hashkey Capital, Spartan Group and others.
- In April 2023, Bixin Ventures announced an investment in Pendle via OTC trade for an undisclosed price and amount.

3. Business Analysis

3.1 User Base

Pendle offers suitable products catering to four different user bases: conservative investors, interest rate traders, liquidity providers, and arbitrageurs.

- **Conservative Investors:** They can buy PTs (principal tokens) to earn a fixed yield. PT is the equivalent of zero-coupon bonds, which are sold at a discount

and accrue interest during the holding period. As the maturity date approaches, the price increases, and the PT is paid at par upon maturity.

- **Interest Rate Traders:** They can buy YTs (yield tokens) and earn high yields when the yield rises as expected;
- **Liquidity Providers:** They can opt to supply liquidity and earn swap fees, underlying asset yields, and incentives if the estimated APY remains relatively stable.
- **Arbitrageurs:** In cases where yields are misaligned or when underlying asset changes have yet to impact Pendle, these investors can exploit arbitrage opportunities by buying various assets.

3.2 Business Classification

Pendle has been concentrating on yield tokenization, launching two versions to date, V1 and V2. The adjustments in the underlying assets of these versions reflect Pendle's evolving business strategy.

In the early V1 version, Pendle focused on deposit vouchers from lending DeFi protocols as the core underlying assets, which consisted of "stablecoins + public chain tokens." For example, on Ethereum, Pendle's underlying assets were interest-bearing assets from Aave and Compound, such as aUSDC and cDAI; on Avalanche, they are xJOE from Trader Joe, qiUSDC and qiAVAX from BenQi, etc. This choice of underlying assets was in line with the narrative of "institutional investors flocking in the market" and "treasury management" at the time when the bull market that started in 2020 has made many traditional VCs interested in the crypto market. Along with the expansion of the market volume, the DAO treasury of some projects also filled with a large number of funds. Being able to take into account the categories familiar to traditional investors and how to make the DAO treasury get more revenue has become the focus of some investors and startup teams. For example, in October 2021, Multicoïn Capital started discussions on interest rate management tools. At the same time, it collaborated with Rari Capital and Olympus to expand the application scenarios of some tokens.

Transitioning from late V1 to V2, Pendle implemented several adjustments, ceasing operations on Avalanche and going live on Arbitrum. Furthermore, its underlying assets expanded beyond public chain tokens and stablecoins, evolving in four directions, three of which are deployed on Ethereum:

- On Ethereum, underlying assets now include liquid staking derivatives (LSD) such as stETH and ankrETH.
- Expansion of popular, high-yield staked tokens like APE and LOOKS.
- Providing peripheral services for relatively popular tokens, exemplified by the APE Compounder, which offers reinvestment services for token holders and introduces a corresponding yield token pool.

Markets

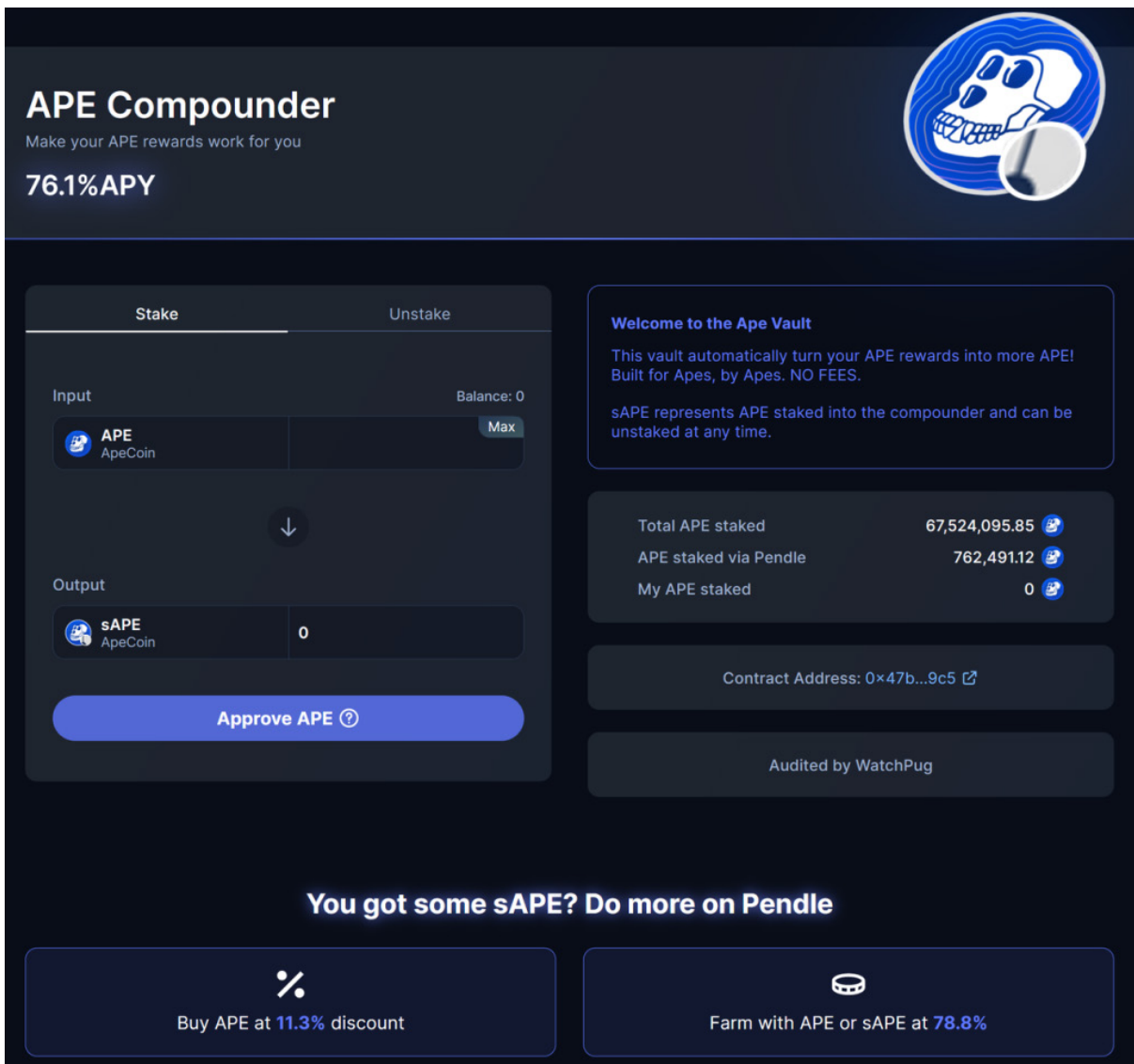
All yield is streamed to YT until maturity.
PT can be redeemed for the underlying asset after maturity.

Search name or paste address

Active Matured

Name	Maturity	Underlying APY	Implied APY	Long Yield APY	Fixed APY
		Price		YT Price	PT Price
USDT Stargate	27 Jun 2024 442 days	4.91% \$1.00	4.24%	YT 14.7% \$0.04916	PT 4.24% \$0.9513
stETH Lido	29 Jun 2023 78 days	4.94% \$1,910.97	4.69%	YT 14.7% \$18.76	PT 4.69% \$1,892.41
stETH Lido	26 Dec 2024 624 days	4.94% \$1,910.97	3.64%	YT 22.1% \$113.30	PT 3.64% \$1,797.86
stETH Lido	25 Dec 2025 988 days	4.94% \$1,910.97	3.77%	YT 13.7% \$162.44	PT 3.77% \$1,728.72
sfrxETH Frax	26 Dec 2024 624 days	5.79% \$1,902.02	3.61%	YT 34.8% \$111.96	PT 3.61% \$1,790.05
rETH-WETH Aura	28 Dec 2023 260 days	6.35% \$1,959.36	7.9%	YT -21% \$101.40	PT 7.9% \$1,817.40
wstETH-WETH Aura	27 Jun 2024 442 days	4.92% \$1,977.47	6.56%	YT -16% \$141.89	PT 6.56% \$1,772.60
ankrETH-WETH Aura	28 Mar 2024 351 days	7.2% \$1,909.70	8.18%	YT -7.7% \$138.49	PT 8.18% \$1,761.37
sAPE ApeCoin	29 Jun 2023 78 days	74.9% \$4.34	75%	YT 50.9% \$0.4919	PT 75% \$3.84

Source: https://app.pendle.finance/pro/markets?utm_source=landing&utm_medium=landing



APE Compounder
Make your APE rewards work for you
76.1%APY

Stake | Unstake

Input: APE ApeCoin (Balance: 0, Max)

Output: sAPE ApeCoin (0)

Approve APE

Welcome to the Ape Vault
This vault automatically turn your APE rewards into more APE!
Built for Apes, by Apes. NO FEES.
sAPE represents APE staked into the compounder and can be unstaked at any time.

Total APE staked	67,524,095.85
APE staked via Pendle	762,491.12
My APE staked	0

Contract Address: 0x47b...9c5

Audited by WatchPug

You got some sAPE? Do more on Pendle

- Buy APE at **11.3%** discount
- Farm with APE or sAPE at **78.8%**

Source: <https://app.pendle.finance/utilities/ape>

Pendle's operations on Arbitrum encompass the fourth strategic direction: integrating higher-yield and lower-risk underlying assets such as GLP and gDAI. GLP and gDAI are LP tokens for derivative protocols GMX and Gains Network. GLP is composed of stablecoins, ETH, WBTC, and other mainstream assets, with respective weightings of approximately 50%, 28%, 20% and 2%. Liquidity providers enter or exit the market by minting or redeeming GLP, while gDAI is primarily made up of DAI. Both GLP and gDAI generate revenue via transactions and liquidations.



Source: <https://app.pendle.finance/pro/markets>

Pendle has not expanded its token application scenarios so far, such as partnering with other DAOs for treasury fund management, possibly because Pendle aims to have users directly utilize its services.

The anticipated Project Permissionless (PP) program, though impacted by the shutdown of partner Rari Capital and strategic realignment, continued to progress. It introduced a new token standard, ERC-5115, capable of wrapping a majority of interest-bearing assets, addressing the issue of LP tokens that were previously challenging to be wrapped and tokenized for yields.

Furthermore, the projects integrated LayerZero, a cross-chain solution, and Kyber Network, a decentralized exchange, to support higher-yielding products that may be available on other chains.

3.3 Business Details

Pendle's yield tokenization is the splitting of yield-bearing tokens into two parts: Principal Tokens (PT) and Yield Tokens (YT).

Take DAI as an example, when a user deposits 100 DAIs into Pendle, the platform first stakes the DAIs in Compound, yielding 100 cDAIs. Pendle then wraps the 100 cDAIs into sy-cDAI (standardized yield token, SY), which is subsequently split into 100 PT-cDAIs (principal tokens, PT) and 100 YT-cDAIs (yield tokens, YT). Each PT-cDAI(PT) is redeemable for one DAI at maturity, while YT-cDAI(YT) holders can receive the yield of cDAI yield during the entire duration.



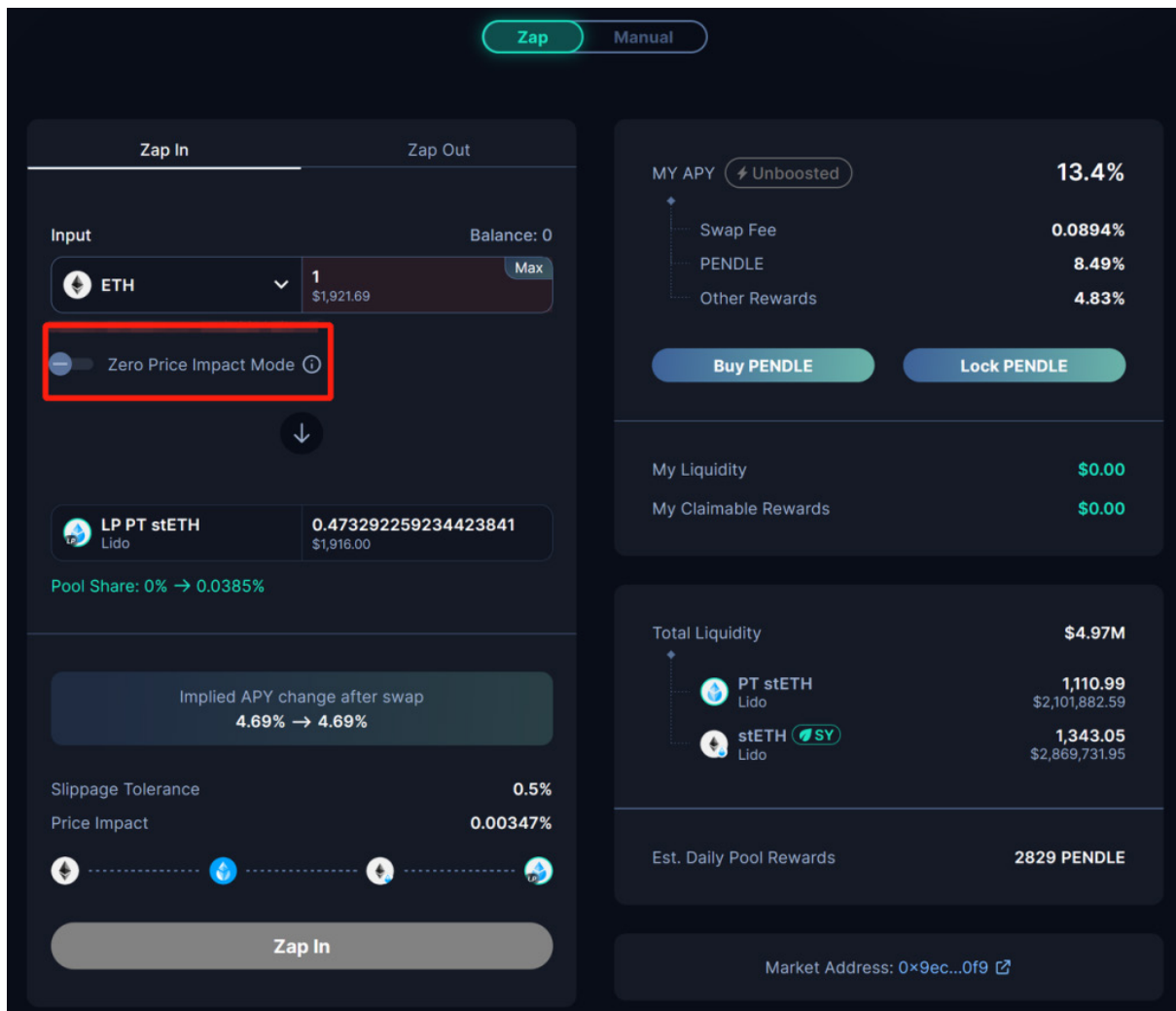
Source: <https://app.pendle.finance/pro/learn?level=1>

We can take the principal token (PT) as the equivalent of a zero-coupon bond, where the price approaches par value as the maturity date gets close. The yield token (YT) holders receive all rewards during the holding period, such as interests and COMP incentives provided by Compound.

It is important to note that in this process, $YT+PT=SY$.

Several steps take place in total after a user deposits an asset, such as ETH, into Pendle. The process is as follows:

- In "Zap" mode, upon depositing ETH, Pendle automatically swaps ETH for stETH via Kyberswap.
- Pendle wraps stETH into sy-stTH, a Standardized Yield token (SY), which is an ERC-5115 token capable of wrapping most yield-bearing assets. The Pendle team designed this token standard.
- If the user chooses "zero price impact mode", Pendle splits half of the sy-stETH into YT-stETH and PT-stETH and deposits the PT-stETH, along with the remaining sy-stETH, into liquidity pools as an LP. If not, Pendle automatically sells YT-stETH while deposits PT-stETH and the other half of sy-stETH as an LP. Users can also select a "manual" model to manually perform these steps.



Source: <https://app.pendle.finance/pro/pools/0x54e28e62ea9e8d755dc6e74674eabe2abfdb004e/zap/in>

In addition to becoming LPs by directly depositing assets, users can buy PT or YT on Pendle.

PT and YT are traded on Pendle AMM, which considers PT and SY prices over time and interest rate levels, differing from the traditional Uniswap AMM mechanism.

In version V2, Pendle has improved its AMM mechanism by learning from the AMM model of Notional Finance, another fixed-rate protocol. This improvement provides users with higher efficiency and less impermanent loss under the condition of the same liquidity level.

In Figure 1:

- Red represents Notional Finance's model
- Black indicates Pendle V1 AMM model
- Blue signifies AMM models of other fixed-rate protocols, such as Element Finance and Sense Finance

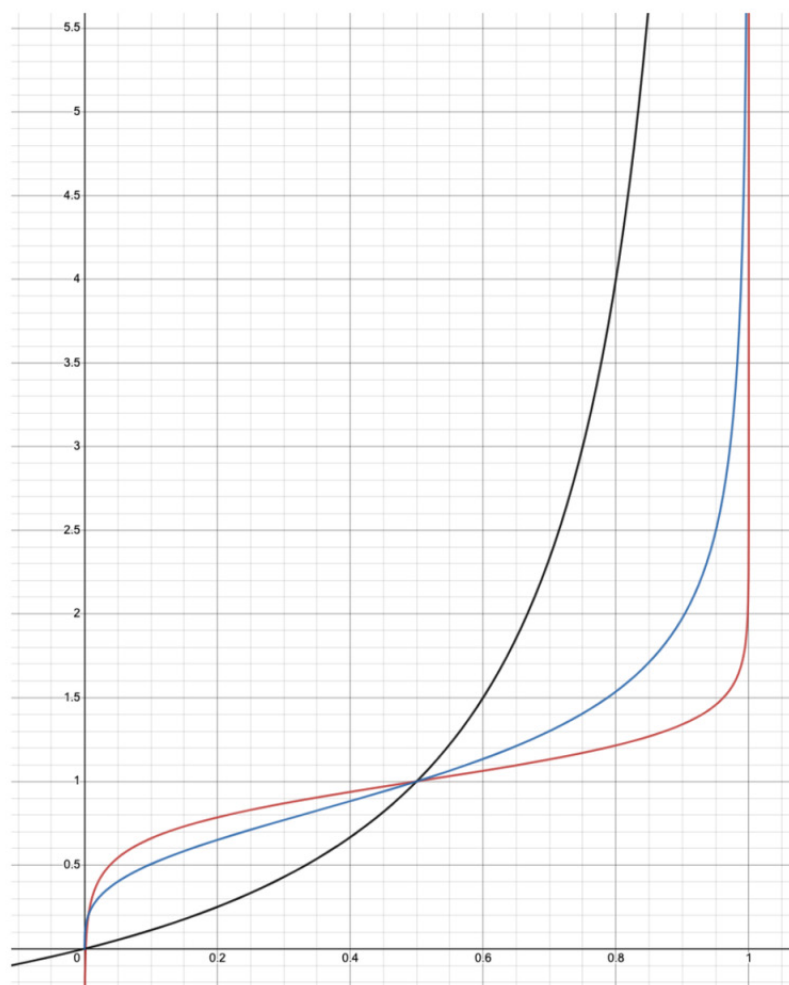


Figure 1: Price over proportion

Source: https://raw.githubusercontent.com/pendle-finance/pendle-v2-resources/main/whitepapers/V2_AMM.pdf

Notional Finance's model allows for parameter adjustments according to the interest rate range of various yield-bearing assets, developing a customized AMM model better suited for different assets.

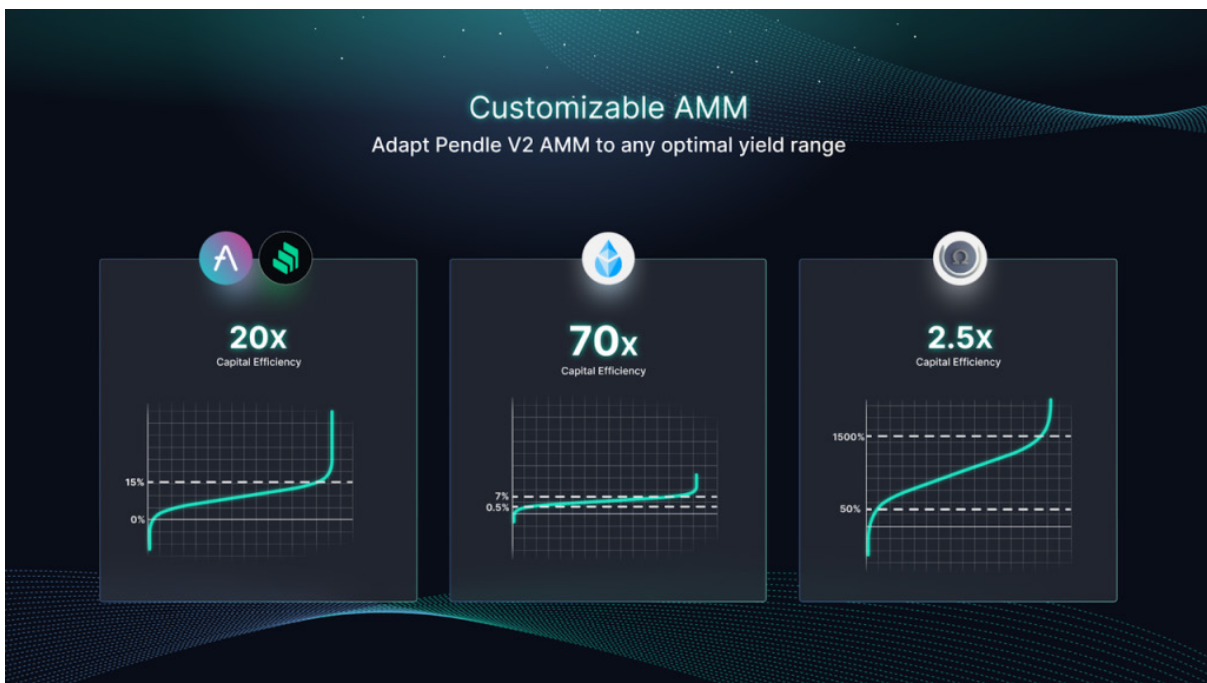
$$exchangeRate_{tradeNoFee} = \frac{\ln\left(\frac{p_{trade}(t)}{1-p_{trade}(t)}\right)}{rateScalar(t)} + rateAnchor(t)$$

$$exchangeRate_{trade}^{\frac{1}{yearsToExpiry(t)}} = exchangeRate_{tradeNoFee}^{\frac{1}{yearsToExpiry(t)}} (\times \text{or } \div) feeRateRoot$$

Source: https://raw.githubusercontent.com/pendle-finance/pendle-v2-resources/main/whitepapers/V2_AMM.pdf

Adjusting the "rate scalar" sets the maturity time, improving capital utilization efficiency. Shorter maturity results in more concentrated liquidity and more efficient fund utilization. Modifying the "rate anchor" to set the interest rate range also enhances capital utilization.

Backtesting reveals that different underlying assets can achieve significantly higher capital efficiency than the V1 AMM model by using the new model.

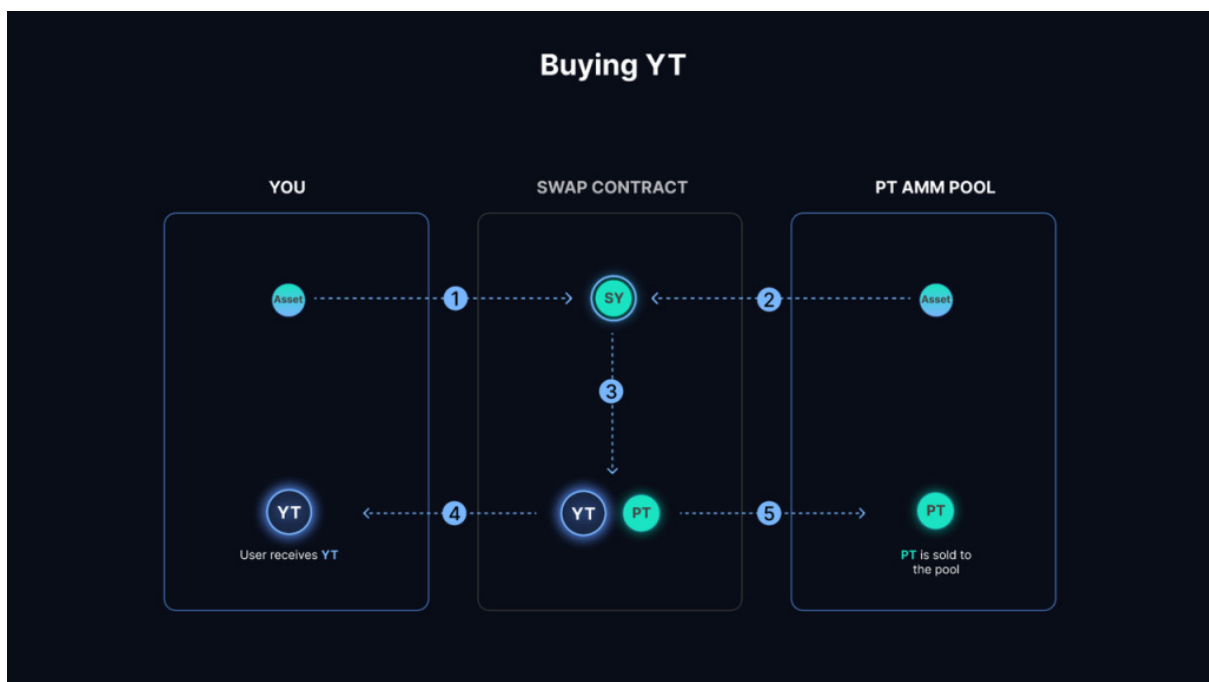


Source: <https://docs.pendle.finance/PendlePro/HowItWorks/AMM>

This AMM model was initially designed to facilitate PT and YT swaps. However, given that $YT+PT=SY$ and $YT=SY-PT$, this AMM model also supports trading of the revenue token, YT.

The process of buying YT:

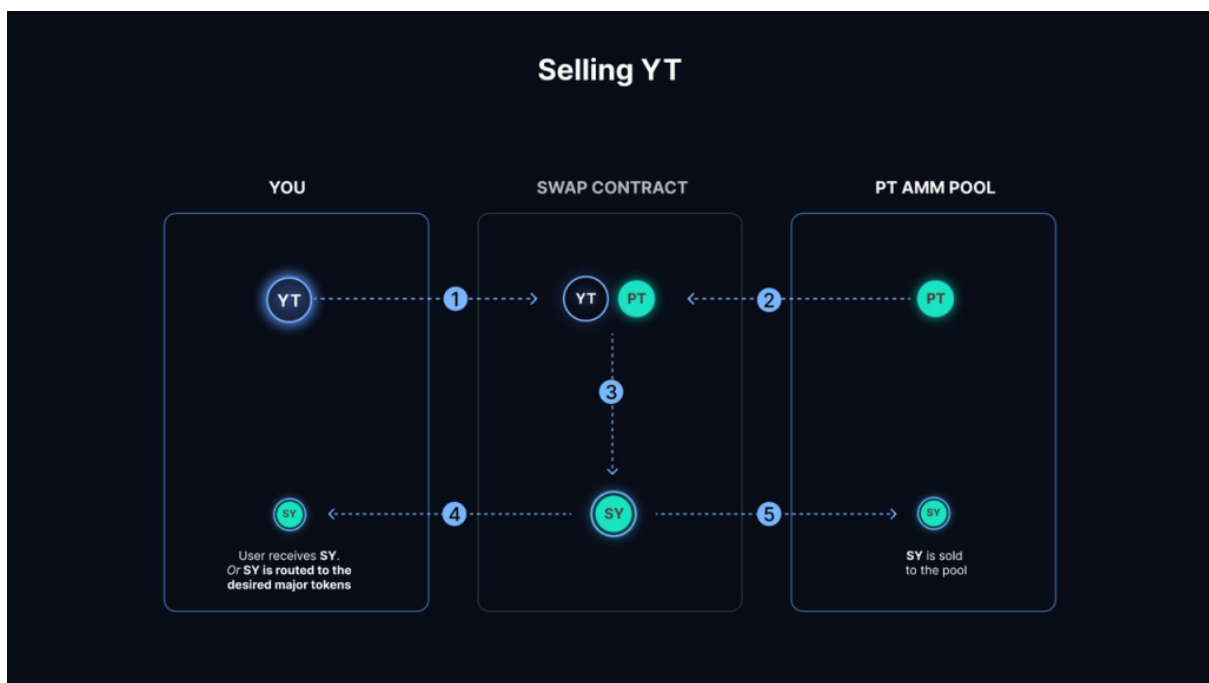
1. Buyer sends SY into the swap contract
2. Contract withdraws SYs from the pool
3. Split SYs into PTs and YTs
4. Send the YTs to the buyer
5. The PTs are sold to the pool



Source: <https://docs.pendle.finance/PendlePro/HowItWorks/AMM>

The process of selling YT:

1. Seller sends YT into the swap contract
2. Contract borrows an equivalent amount of PT from the pool
3. The YTs and PTs are used to redeem SY
4. A portion of the SY is swapped to PT to return the amount from step 2
5. SY is sent to the seller



Source: <https://docs.pendle.finance/PendlePro/HowItWorks/AMM>

As a result, Pendle's AMM model supports transactions in YT, PT, and SY tokens, but only the two assets, SY and PT, are available in the pool when no YT transactions occur.

This AMM mechanism allows for the development of various investment strategies.



Source: <https://app.pendle.finance/pro/learn?level=1>

As a first strategy, users can add liquidity to become LPs, earning fees and token incentives.

With only two assets in the pool, PT and SY, and considering the price of 1 PT is less than 1 SY until maturity, the relationship between PT and SY is interest rate-based. Thus, liquidity providers on Pendle can view their participation as providing a single asset: SY, with $LP = PT + ST = SYf(r) + SY = SY(1 + f(r))$, where $1 + f(r) < 2$. The function $f(r)$ is inversely correlated with the interest rate, as higher interest rates result in lower PT prices and lower interest rates lead to higher PT prices. As an LP in Pendle, it can be viewed as providing only SY, anticipating lower interest rates in the future and effectively shorting interest rates.

Upon maturity, $LP = PT + SY = 2SY - YT$.

Consequently, pre-maturity earnings from being an LP comprise four components:

- PT Appreciation
- Partial swap fees

- Token incentives
- Yields from SY's underlying yield-bearing assets

If LP holds tokens until maturity, there will be no impermanent loss. Other strategies include depositing interest-bearing assets and selling YT after splitting into PT and YT to lock in the yield; buying PT directly, which is equivalent to purchasing zero-coupon bonds for a conservative investment; or buying YT directly to capitalize on expected yield changes for more returns.:

To better guide users in their transactions, Pendle gives two different definitions of APY:

- Underlying APY represents the realized yield rate of the underlying asset.
- Implied APY is the market consensus of the future APY of an asset.

The formula of implied APY is shown below:

$$\text{Implied APY} = \left[\left(1 + \frac{\text{YT Price}}{\text{PT Price}} \right)^{\frac{365}{\text{Days to expiry}}} \right] - 1$$

Source: <https://docs.pendle.finance/FAQ/General#glossary>

- When underlying APY > implied APY, it may be a good opportunity to buy YT, sell PT, or provide liquidity. However, the convergence of underlying APY to implied APY might be achieved by a decrease in underlying APY instead of an increase in implied APY.

- On the other hand, when underlying APY < implied APY, consider buying PT, providing liquidity or selling YT. In this case, the convergence of underlying APY to implied APY may be realized through a decline in implied APY rather than an increase in underlying APY.



Source: <https://app.pendle.finance/pro/markets/0xfcbae4635ca89866f83add208ecceec742678746/swap?view=yt>



Source: <https://app.pendle.finance/pro/markets/0x5546d0f27bed4075ea03a22c58f7016e24c94ea7/swap?view=yt>



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Source: <https://app.pendle.finance/pro/markets/0x9a76925dd91a7561b58d8353f0bce4df1e517abb/swap?view=yt>

The crux of the relationship between implied APY and underlying APY lies in understanding the actual market conditions. The forecast for APY direction is assessed in the context of factors influencing the yield of underlying assets.

Focusing on yield-bearing assets on Ethereum, there are currently three types of LP tokens, including wstETH-WETH, rETH-WETH, and ankrETH-WETH in Aura Finance. For these assets, besides token incentives from protocols, the factor that most significantly impacts short-term yield is the LP fee.

Markets

All yield is streamed to YT until maturity.
PT can be redeemed for the underlying asset after maturity.

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Active Matured

Name	Maturity	Underlying APY	Implied APY	Long Yield APY	Fixed APY
USDT Stargate	27 Jun 2024 442 days	4.91% \$1.00	4.24%	YT 14.7% \$0.04916	PT 4.24% \$0.9513
wETH Lido	29 Jun 2023 78 days	4.94% \$1,910.60	4.69%	YT 14.7% \$18.75	PT 4.69% \$1,891.85
wETH Lido	20 Dec 2024 624 days	4.94% \$1,910.60	3.64%	YT 22.1% \$113.26	PT 3.64% \$1,797.34
wETH Lido	25 Dec 2025 988 days	4.94% \$1,910.60	3.77%	YT 13.7% \$182.39	PT 3.77% \$1,728.21
sfrxETH Frax	20 Dec 2024 624 days	5.79% \$1,002.02	3.61%	YT 34.8% \$111.96	PT 3.61% \$1,790.05
rETH-WETH Aura	28 Dec 2023 260 days	6.35% \$1,958.76	7.9%	YT -21% \$101.37	PT 7.9% \$1,816.85
wstETH-WETH Aura	27 Jun 2024 442 days	4.92% \$1,977.47	6.56%	YT -16% \$141.89	PT 6.56% \$1,772.60
ankrETH-WETH Aura	28 Mar 2024 351 days	7.2% \$1,909.16	8.18%	YT -7.6% \$138.45	PT 8.18% \$1,760.88
sAPE ApeCoin	29 Jun 2023 78 days	74.9% \$4.33	75%	YT 50.9% \$0.4917	PT 75% \$3.84

Source: <https://app.pendle.finance/pro/markets>

Analyzing the volume of these three LP pairs can help guide our judgment on yield direction.

As illustrated by the four figures below, trading volume spikes in May, June, and November 2022, as well as January and March, during which swap fees increase.

Stable Pool

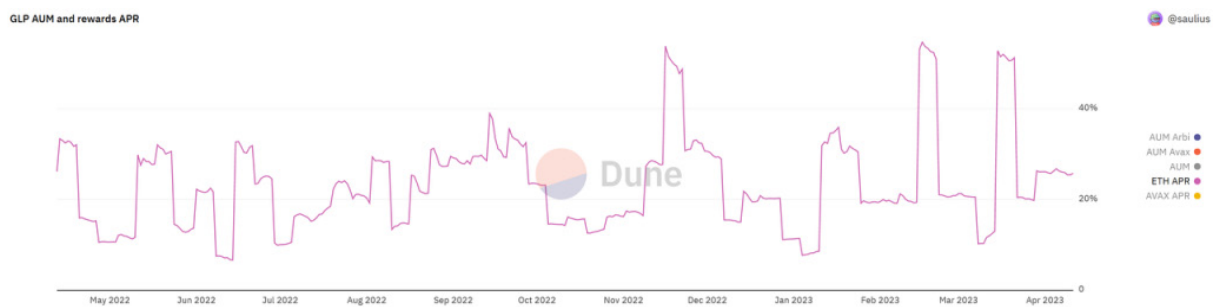
WETH aETHc

Fixed swap fees: 0.04%

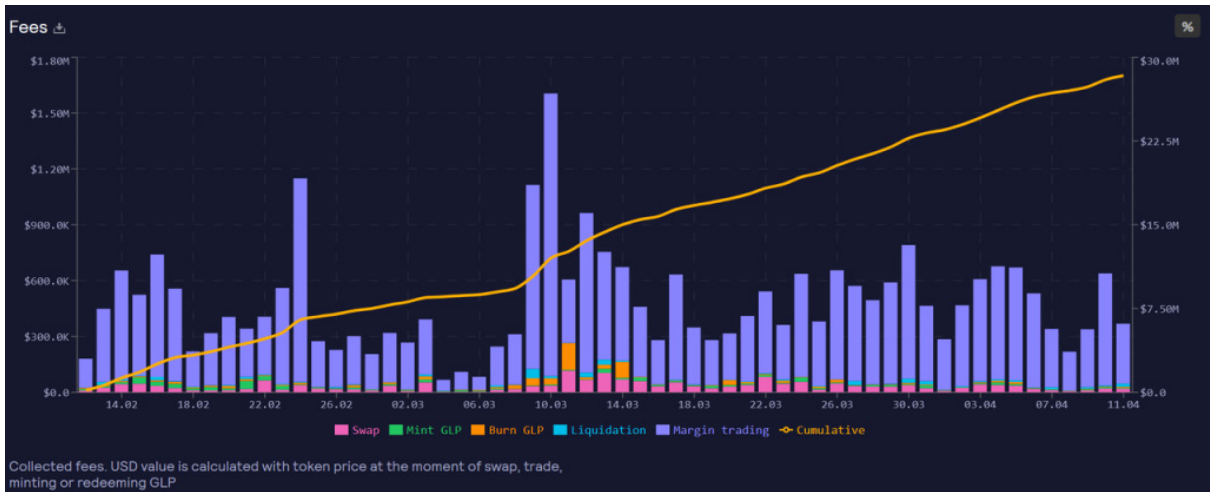


Source: <https://app.balancer.fi/#/ethereum/pool/0x8a34b5ad76f528bfec06c80d85ef3b53da7fc30000020000000000000000000043e>

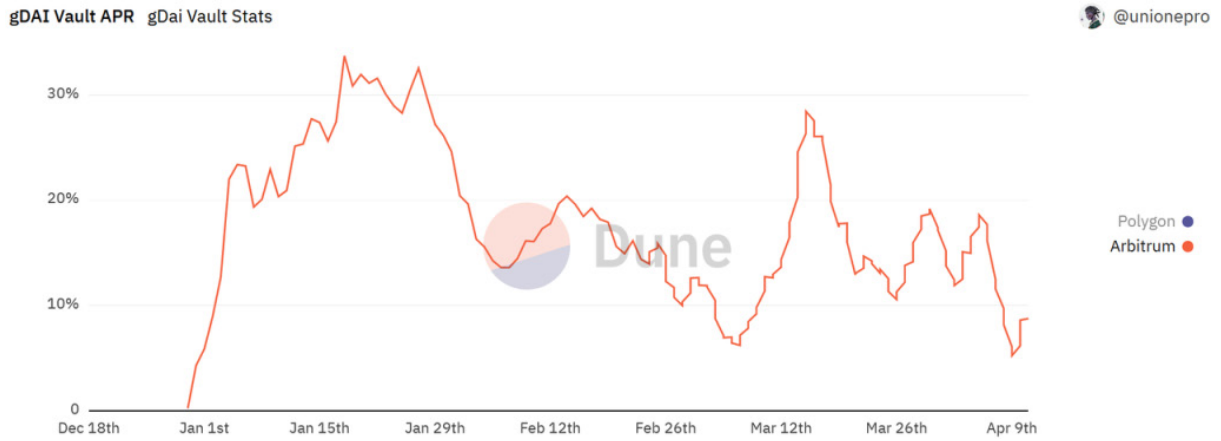
By anticipating core market factors and making timely decisions on yield fluctuations, investors may effectively navigate PT, LP, and YT trading strategies on Pendle.



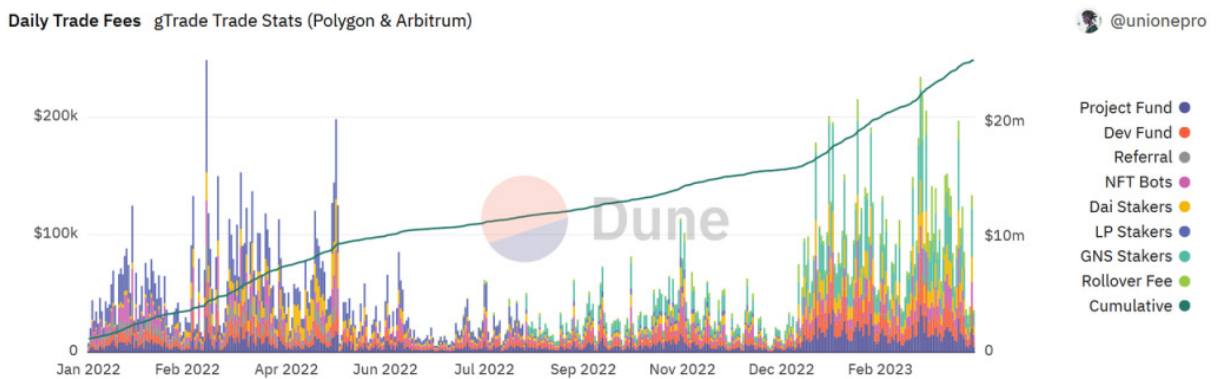
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Source: <https://stats.gmx.io/>



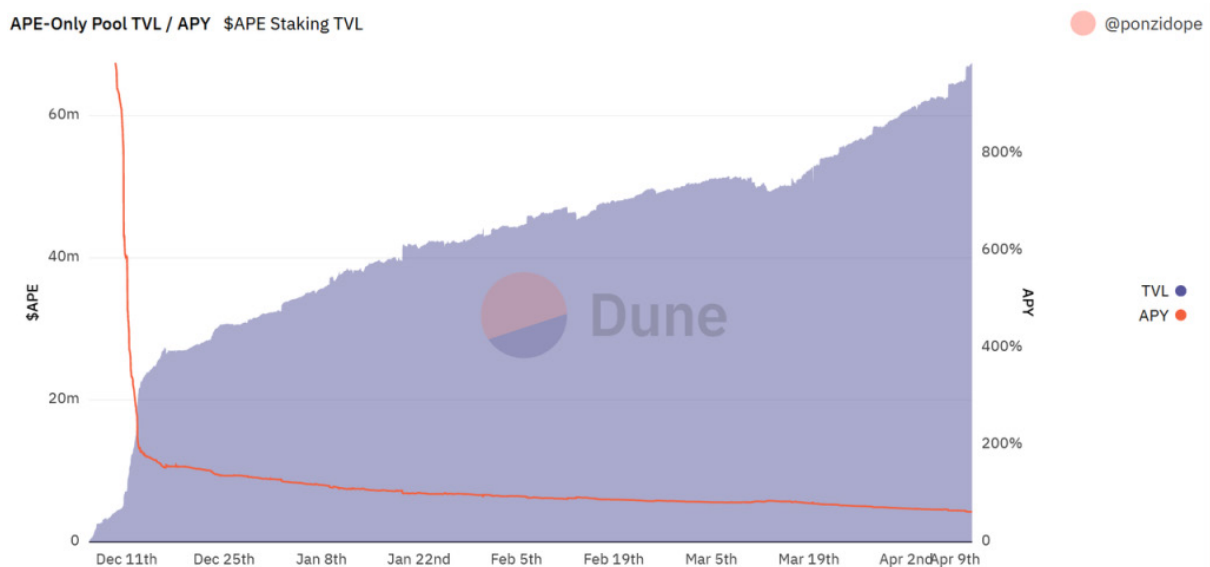
Source: <https://dune.com/unioneopro/Everything-Gains-Network>



Source: <https://dune.com/unioneopro/Everything-Gains-Network>

The same principle applies to trading GLP and gDAI, with the distinction that the net return of GLP and gDAI considers trader profitability in addition to swap fee yields from volume. Overall, if traders' short-term profitability is higher, the net return of GLP may be lower or even negative.

For projects like APE, the staking yield can initially be very high but rapidly decrease as the volume of staking tokens grows. This differs from public chain tokens like stETH.



Source: <https://dune.com/ponzidope/apecoin-staking-apy>

Due to the negative correlation between PT and yield and the positive correlation between YT and yield, the investment strategy for these tokens involves monitoring staking token volume and yield APY. In scenarios where staking yield declines quickly, PT may experience a significant short-term increase relative to SY.

Using USDT as the standard to calculate investment yield, an ideal situation would see SY rising as the staking ratio increases and staking yield falls, making PT an attractive investment asset. Thus, different investment strategies can be tailored based on the distinct attributes of the underlying assets.

Yield Token Type	Ideal Interest Rate Fluctuation	Direction of Interest Rate Fluctuations	Investment Underlying Assets
LP Token	1) active trading, higher trading volume and increased trading fee returns; 2) increased incentives	Increase	YT
Public Chain POS Token	Rich public chain ecology and increased on-chain activity	Increase	YT
Other Staking Token	Rapid increase in staking volume	Decrease	PT

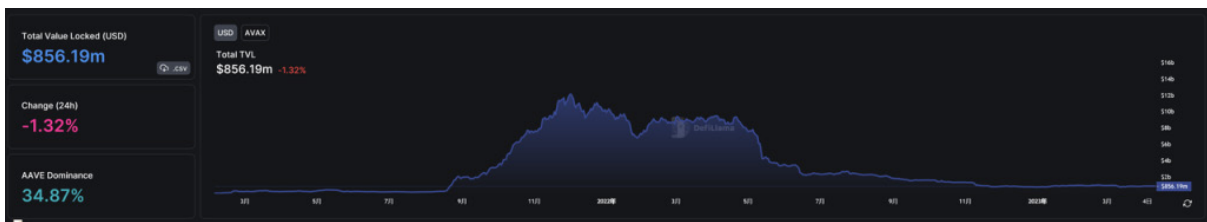
Made by Mint Ventures

3.4 Multi-Chain Deployments

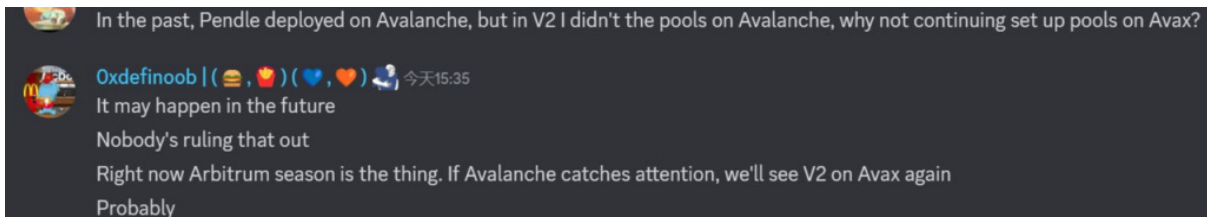
In V1, Pendle was deployed on both Ethereum and Avalanche, establishing partnerships with projects on each public chain.

For example, on Avalanche, Pendle collaborated with BENQI, integrating two pools, qiAVAX and qiUSDC. BENQI DAO allocated \$250,000 worth of its USDC and AVAX into the qiUSDC and qiAVAX pools on Pendle. A partnership with Trader Joe was also forged, launching xJOE pools and setting up the PENDLE/AVAX pool on Trader Joe.

However, in the latest V2 release, Pendle is solely deployed on Ethereum and Arbitrum. This decision might be influenced by Avalanche's current ecosystem state: Avalanche's Total Value Locked (TVL) is under \$1 billion, with its native DeFi project Benqi having the highest TVL at approximately \$240 million. This is considerably lower than Arbitrum's current \$2.3 billion TVL and its largest project, GMX, with nearly \$600 million TVL. This strategic shift towards Ethereum and Arbitrum has been positively received by the Pendle community.



Source: <https://defillama.com/chain/Avalanche>



Source: Discord

3.5 The Potential of Yield Tokenization

3.5.1 Classifications

Pendle initially positioned itself in the fixed yield market. However, based on the changes made in V2, it seems the Pendle team has segmented the "on-chain fixed yield market" into several layers:

- Low-risk fixed yield markets, represented by LSDs: This category features very low-risk underlying assets, relatively stable yields, and minimal cyclical impact on yields.
- Relatively-low-risk fixed yield markets, represented by LSD-LP tokens and stablecoin-LP tokens: This market category is characterized by lower-risk underlying assets with more pronounced cyclicity. Yields may be high during periods of market volatility.
- Medium-risk fixed yield markets, represented by GLP and gDAI: This category is marked by high yields and high risks. Derivatives traders on their chains heavily influence yields, causing violent fluctuations in response to market conditions.

- High-risk yield markets, represented by APE: This market category exhibits dramatic volatility following the underlying assets, with high but potentially unstable yields. Yields can drop sharply as staking frenzies occur among individual projects' users.

3.5.2 Market Cap

The LSD Market

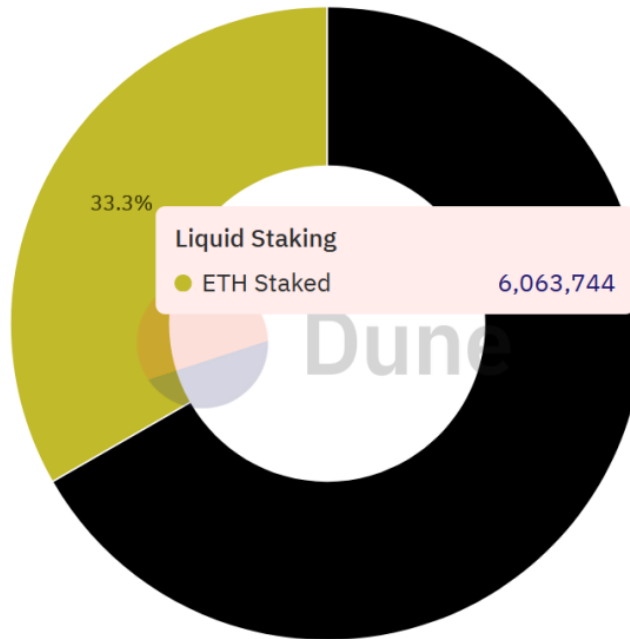
Focusing on the Top5 PoS public chains with the highest TVL, the average staking ratio currently stands at around 35%. There is still room for growth in the development of public chains, including Ethereum.

The staking market growth ratio for leading public chains is expected to be higher if it reaches the market's anticipated level of a 50% staking ratio or more. For instance, Ethereum, which currently has the highest market capitalization and the most matured ecosystem, has liquidity staking derivatives accounting for about 33%. If Ethereum's staking ratio increases to 50% within the next three years, approximately 16.5% of ETH will eventually become derivatives such as stETH. Based on Ethereum's current market valuation of around \$230 billion, the LSD market cap could reach around \$38 billion.



Public Chain	Staking Ratio	Staking APY
Ethereum	15.64%	5.07%
Tron	43.04%	3.79%
BNBChain	15.02%	2.68%
Polygon	38.58%	4.79%
Avalanche	61.27%	7.94%

Source: StakingRewards & Mint Ventures, Updated time: April 11, 2023

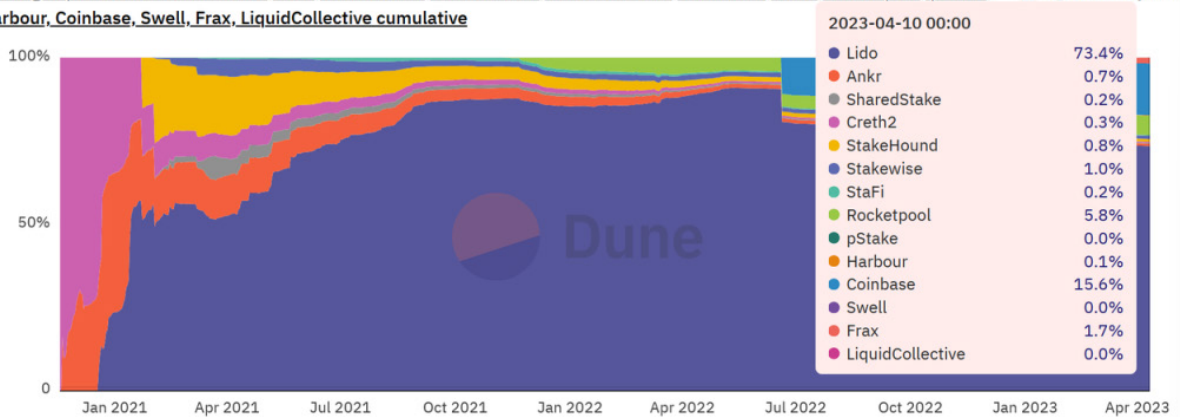


Source: <https://dune.com/impossiblefinance/liquid-staking-derivatives>

The LSD LP Market

Lido accounts for about 73.4% of Ethereum's liquidity staking market with about 14% of Lido's liquidity staking derivatives flowing into Curve.

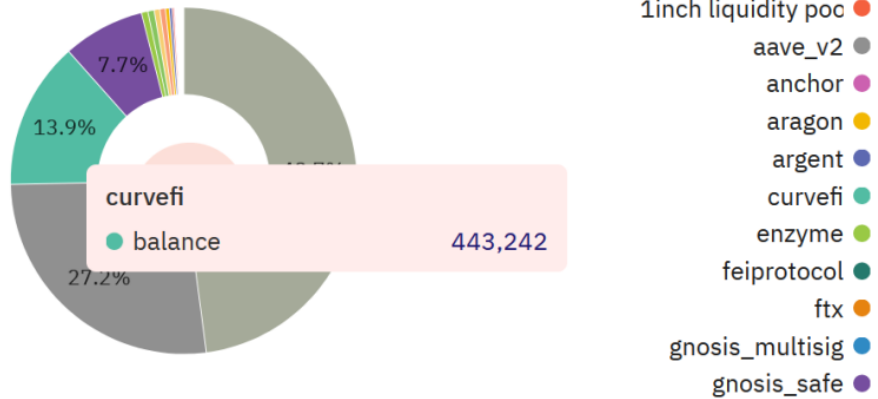
Staking deposits DoD: Lido Finance, Ankr, StakeHound, SharedStake, Cream.Finance, Stakewise, StaFi, Rocketpool, pStake, Harbour, Coinbase, Swell, Frax, LiquidCollective cumulative  @LidoAnalytical



Source: <https://dune.com/LidoAnalytical/Lido-Finance-Extended>

stETH per protocol: stETH Holders

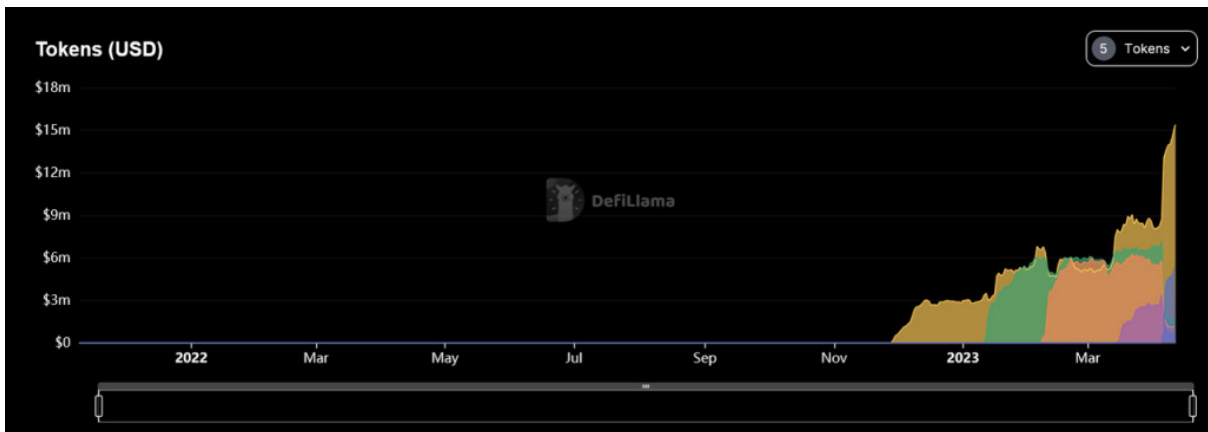
@LidoAnalytical



Source: <https://dune.com/LidoAnalytical/stETH-deposited-per-protocol>

Assuming Lido's market share remains stable and the primary destination for LSD in DEX is Curve, approximately \$3.9 billion worth of LSDs will become LPs in Curve in the future, with these LPs corresponding to a market value of about \$7.8 billion. Consequently, the total size of LSDs + LSD LPs would be close to \$46 billion. This number will likely increase further as Ethereum's market cap grows, the staking ratio rises, and more LSDs are added to DEX.

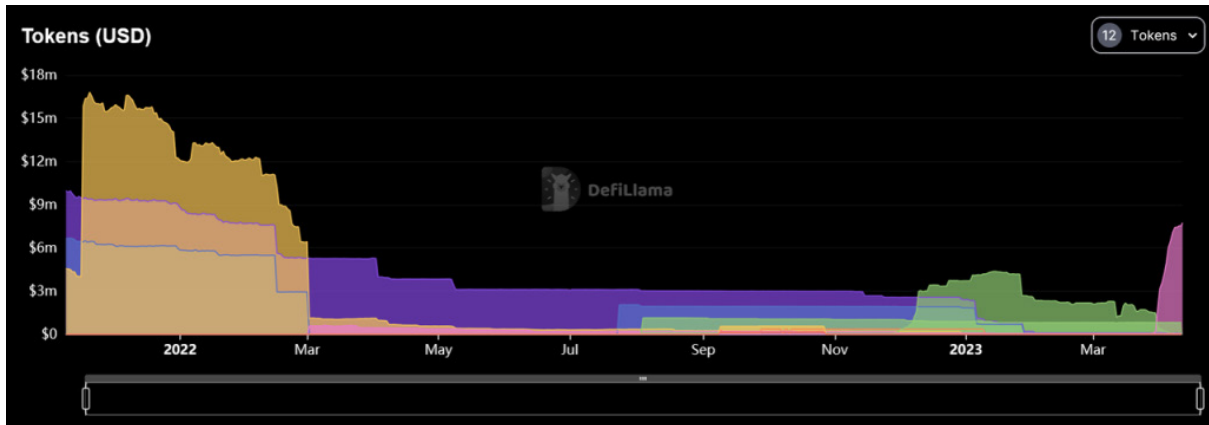
Demand for LSDs and LSD LP tokens in the fixed yield market is robust. TVL has reached a volume of \$24 million to date since the LSD LP pool launched on Pendle.



Source: <https://defillama.com/protocol/pendle>

Stablecoin LP Token Market

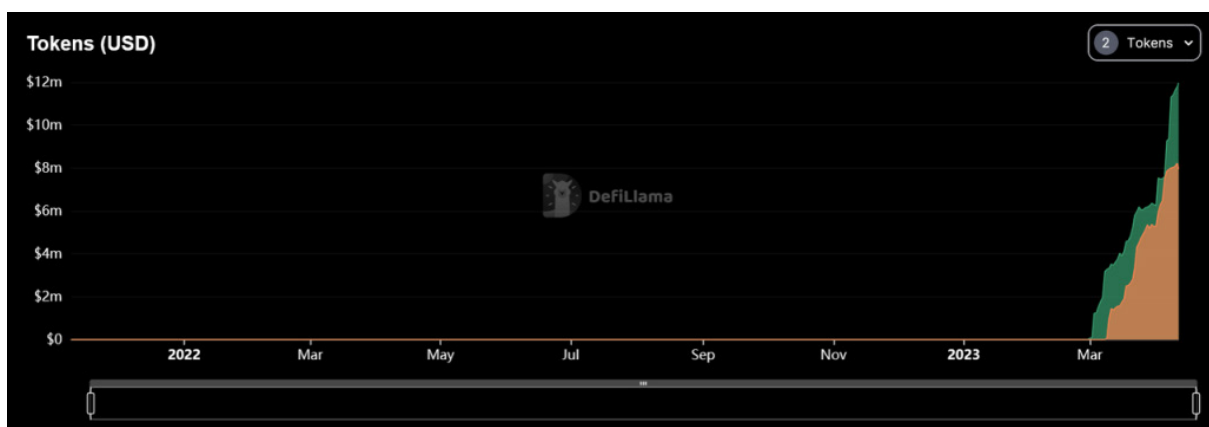
Although stablecoins are frequently swapped, the market appears to be less enthusiastic about stablecoin-based LP tokens. These pools have been online for over a year and generally exhibit declining liquidity. Moreover, Pendle's strategy for new pools suggests that stablecoin LPs may not be their primary focus in the next phase.



Source: <https://defillama.com/protocol/pendle>

Medium-risk Market Represented by GLP and gDAI

Demand in this market is relatively straightforward, with about \$20 million TVL since the pool's launch, compared to \$530 million FDV of GLP. This is partly due to token incentives offered by Pendle and partly because of the stronger speculative and risk-hedging demand in the market.



Source: <https://defillama.com/protocol/pendle>

The current PT yield of GLP and gDAI is attractive. For some conservative investors, buying and holding PTs to ensure a higher APY is appealing enough, which surpasses the long-term APY of holding GLPs. The same logic applies to gDAI.

Markets

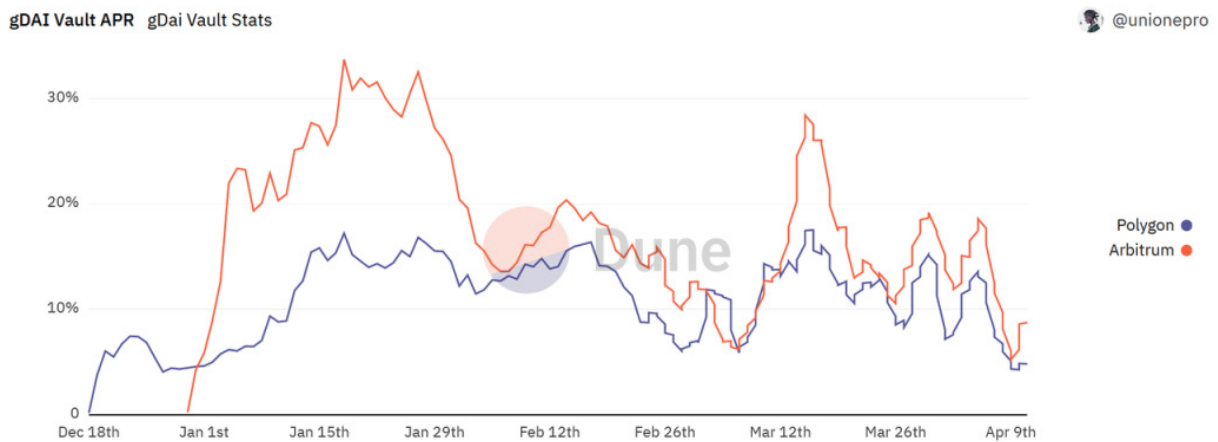
All yield is streamed to YT until maturity.
PT can be redeemed for the underlying asset after maturity.

Search name or paste address

Active Matured

Name	Maturity	Underlying APY Price	Implied APY	Long Yield APY YT Price	Fixed APY PT Price
GLP GMX	28 Mar 2024 350 days	21.6% \$0.9897	22.5%	YT 13.8% \$0.1753	PT 22.5% \$0.8144
gDAI Gains Network	28 Mar 2024 350 days	8.47% \$0.9998	10.5%	YT -15% \$0.09172	PT 10.5% \$0.908
USDT Stargate	27 Jun 2024 441 days	5.02% \$1.00	4.42%	YT 13.1% \$0.05109	PT 4.42% \$0.9496

Source: <https://app.pendle.finance/pro/markets>

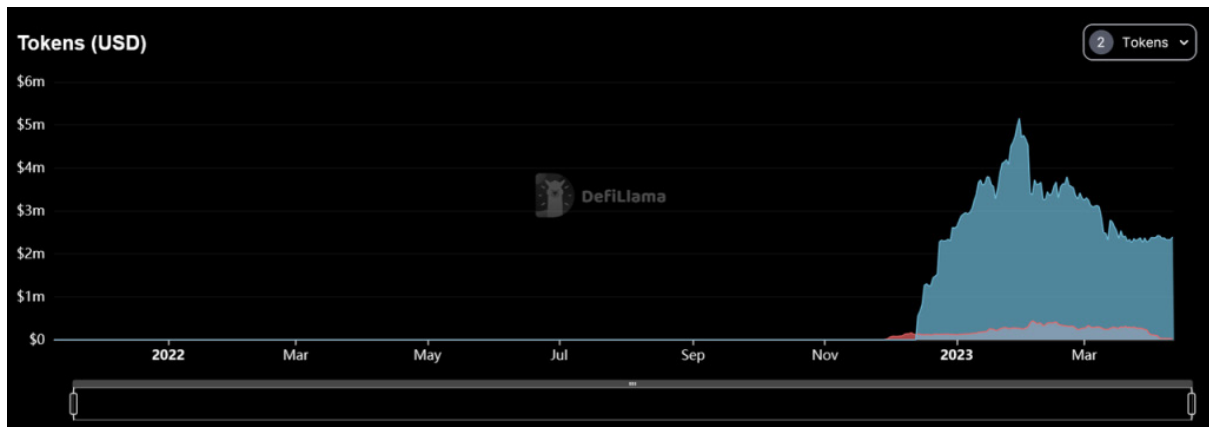


Source: <https://dune.com/unioneopro/Everything-Gains-Network>

However, only GMX and its clone projects have managed to achieve significant business scale. As a result, the growth potential of derivative assets is constrained by the development of these types of projects. In the short term, the possible market cap is estimated to be within \$1 billion.

High-risk Fixed Rate Market Represented by APE & LOOKS

The growth of the high-risk fixed rate market is related to the market cap of their native tokens and the declining speed of staking rewards. If staking rewards have a quick slump, it will be challenging to expand these pools.



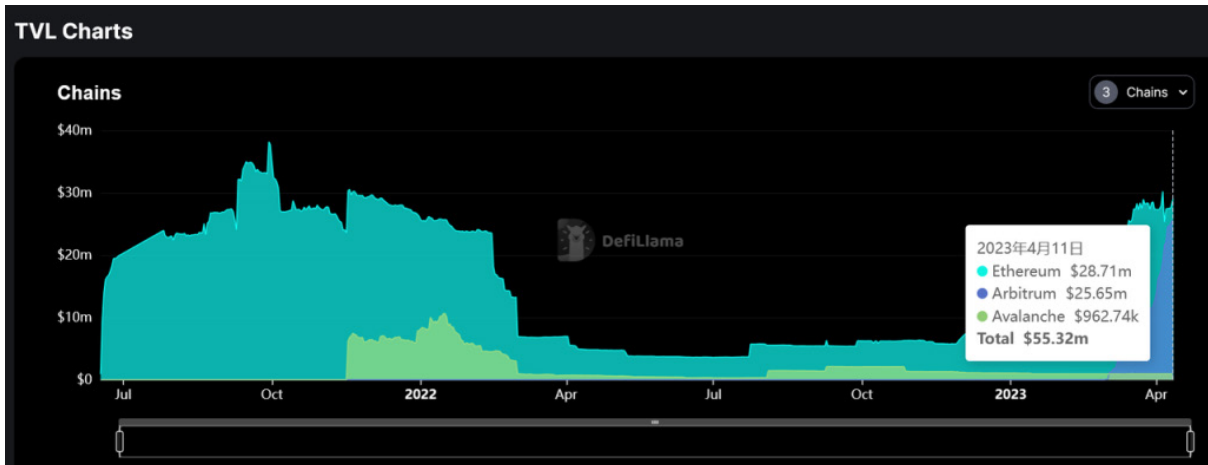
Source: <https://defillama.com/protocol/pendle>

However, the strategy for these pools may not be to hope that one single pool can achieve a large market cap, but rather to compete for growth rate: as soon as a token with a higher market cap and higher staking yield becomes available, a fixed rate pool for that token should be swiftly launched. Single pool might have a TVL of a few million to tens of millions of dollars, but the combined TVL of a series of similar pools will be higher.

Whether low or high risk, there are other strategies in the market with different risks and yields that can be included in Pendle in the future.

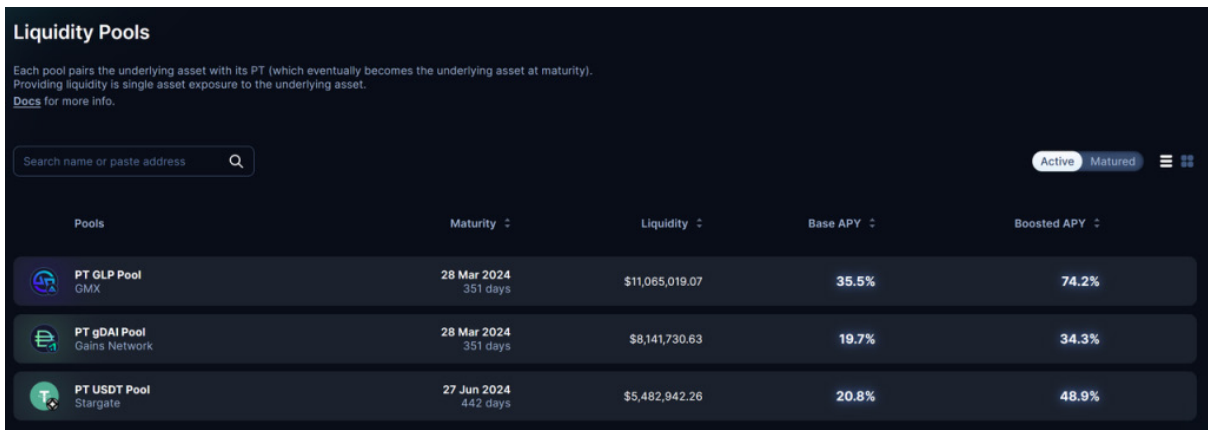
3.6 Business Metrics

Pendle has a TVL of approximately \$55.32 million up to now. With operations on Avalanche suspended, there are some unmatured assets with a TVL of \$960,000. Pendle has \$28.71 million TVL on Ethereum, while holds a TVL of about \$25.65 million on Arbitrum.



Source: <https://defillama.com/protocol/pendle>

Pendle currently supports 12 active liquidity pools, with 7 of them focused on LSD-related assets. These LSD-related pools contribute to over 50% of TVL on the protocol.



Liquidity Pools

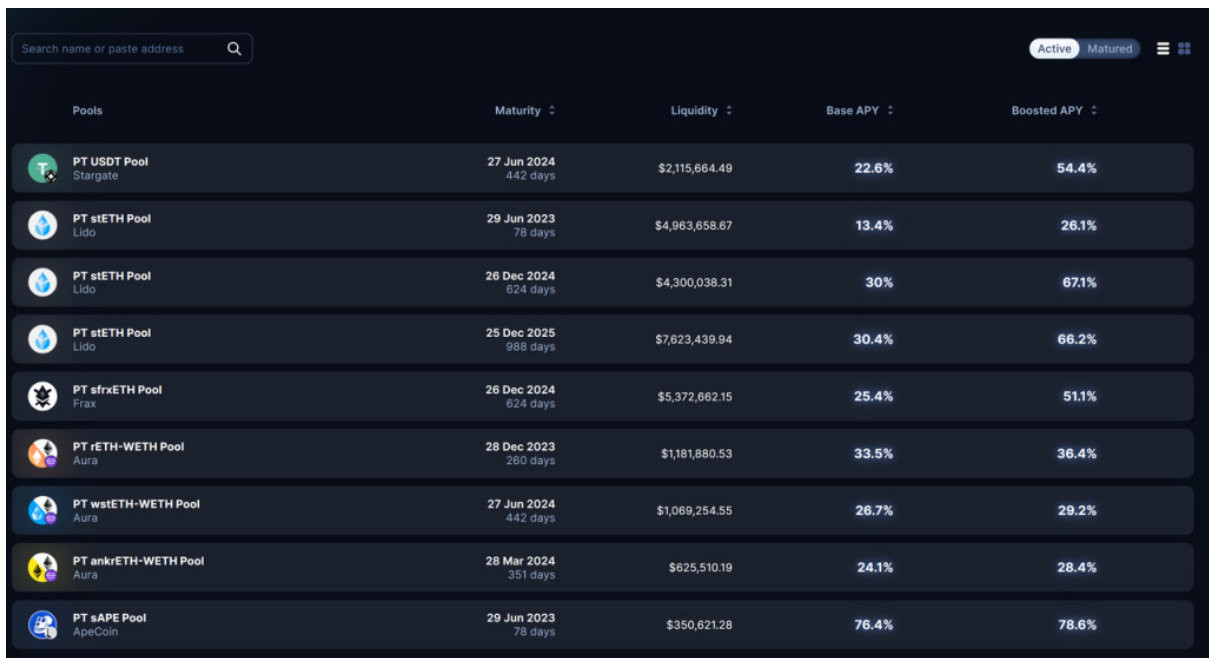
Each pool pairs the underlying asset with its PT (which eventually becomes the underlying asset at maturity). Providing liquidity is single asset exposure to the underlying asset. [Docs](#) for more info.

Search name or paste address

Active Matured

Pools	Maturity	Liquidity	Base APY	Boosted APY
PT GLP Pool GMX	28 Mar 2024 351 days	\$11,065,019.07	35.5%	74.2%
PT gDAI Pool Gains Network	28 Mar 2024 351 days	\$8,141,730.63	19.7%	34.3%
PT USDT Pool Stargate	27 Jun 2024 442 days	\$5,482,942.26	20.8%	48.9%

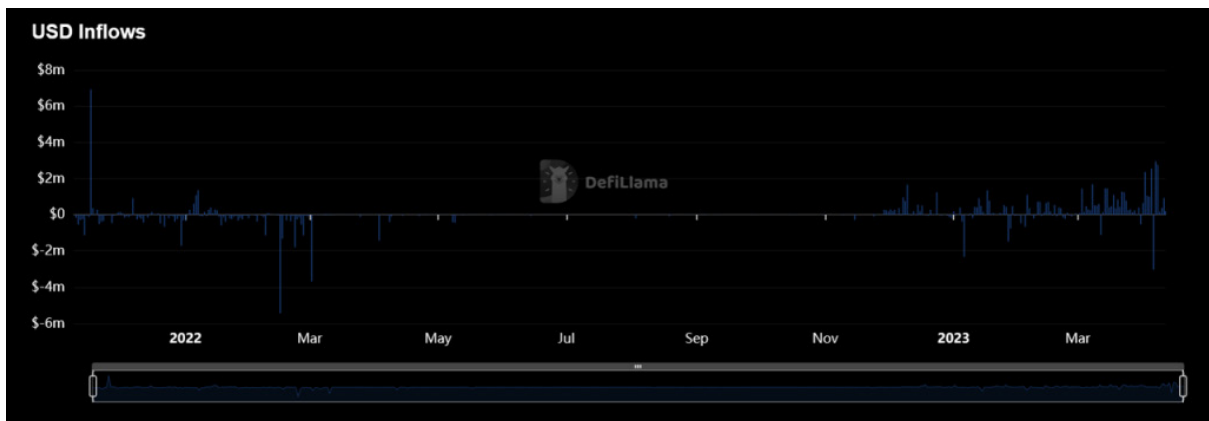
Source: <https://app.pendle.finance/pro/pools>



Pools	Maturity	Liquidity	Base APY	Boosted APY
PT USDT Pool Stargate	27 Jun 2024 442 days	\$2,115,664.49	22.6%	54.4%
PT stETH Pool Lido	29 Jun 2023 78 days	\$4,963,658.67	13.4%	26.1%
PT stETH Pool Lido	26 Dec 2024 624 days	\$4,300,038.31	30%	67.1%
PT stETH Pool Lido	25 Dec 2025 988 days	\$7,623,439.94	30.4%	66.2%
PT sfrxETH Pool Frax	26 Dec 2024 624 days	\$5,372,662.15	25.4%	51.1%
PT rETH-WETH Pool Aura	28 Dec 2023 260 days	\$1,181,880.53	33.5%	36.4%
PT wstETH-WETH Pool Aura	27 Jun 2024 442 days	\$1,069,254.55	26.7%	29.2%
PT ankrETH-WETH Pool Aura	28 Mar 2024 351 days	\$625,510.19	24.1%	28.4%
PT sAPE Pool ApeCoin	29 Jun 2023 78 days	\$350,621.28	76.4%	78.6%

Source: <https://app.pendle.finance/pro/pools>

The current weekly trading volume is around \$1 million, reaching a peak of nearly \$1.1 million per week.



Source: <https://defillama.com/protocol/pendle>

3.7 Competition Landscape

Other projects centered around yield tokenization and deeply involved in the fixed revenue market include Swivel Finance, Delv (Element Finance), APwine and Sense Finance. Their differences can be seen in two simple dimensions: Total Value Locked(TVL) and product line.

3.7.1 TVL

Following the 2022 bear market, the TVLs of many projects plummeted, Pendle and its rivals were no exception. Currently, only Pendle boasts a TVL in the 10 million tier, while Delv has a TVL in a million tier, and the other three projects have seen their TVLs hover in the hundreds of thousands dollars or even lower.



Source: DeFi Llima & Mint Ventures. Updated time: April 11, 2023.

3.7.2 Product Lines

Projects	Low-risk Market	Relatively Low-risk Market	Medium-risk Market	High-risk Market
Pendle	LSD	LSD LP Stablecoin LP	GLP gDAI	APE LOOKS
Swivel Finance	LSD	Stablecoin Lending Assets	-	-
Sense Finance	LSD	Stablecoin Lending Assets	-	-
APWine	-	Stablecoin Lending Assets, Stablecoin LP	-	SUSHI
Delv	-	Stablecoin Lending Assets, Stablecoin LP, Non-stablecoin Lending Assets	-	-

Made by Mint Ventures. Updated time: April 11, 2023.

Judging from product line distribution, APWine and Delv may not have chosen the right underlying assets. In the current crypto ecosystem, LSD is the only one with no counterparty risk that can support long-term value capture.

Swivel Finance and Sense Finance's adoption of LSD in their underlying assets is a strategic move. However, they could also consider integrating LSD LP tokens or LSD-based lending tokens into their ecosystems. For instance, 15% of Lido's stETH is in Curve as LP, and nearly 30% is in Aave as collateral.

Using LSD as the underlying assets for the low-risk market ensures that a project can maintain a relatively good yield during bear markets. Simultaneously, utilizing "medium-risk" and "high-risk" assets for more aggressive strategies can cater to users' needs during the bull market. This distribution of asset pools is quite suitable. Pendle currently offers the most extensive product lines, and new product lines such as GLP and gDAI are gaining market recognition with faster TVL growth. Overall, Pendle stands out as the leader in the space of yield tokenization.

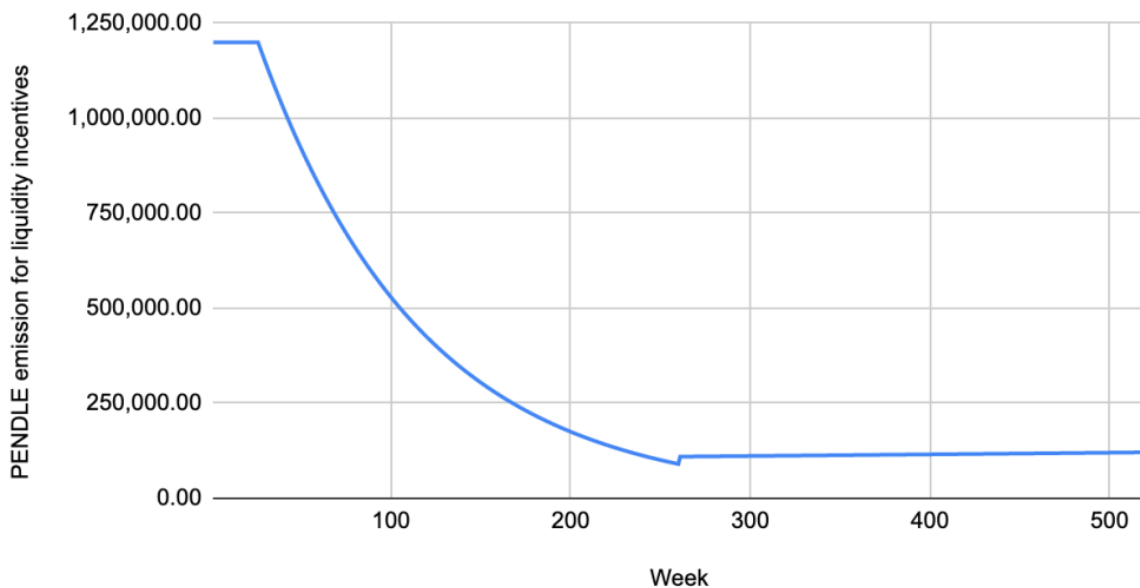
3.8 Tokenomics Analysis

3.8.1 Token Circulation and Distribution

The supply of PENDLE tokens is unlimited and follows a three-phase emission plan:

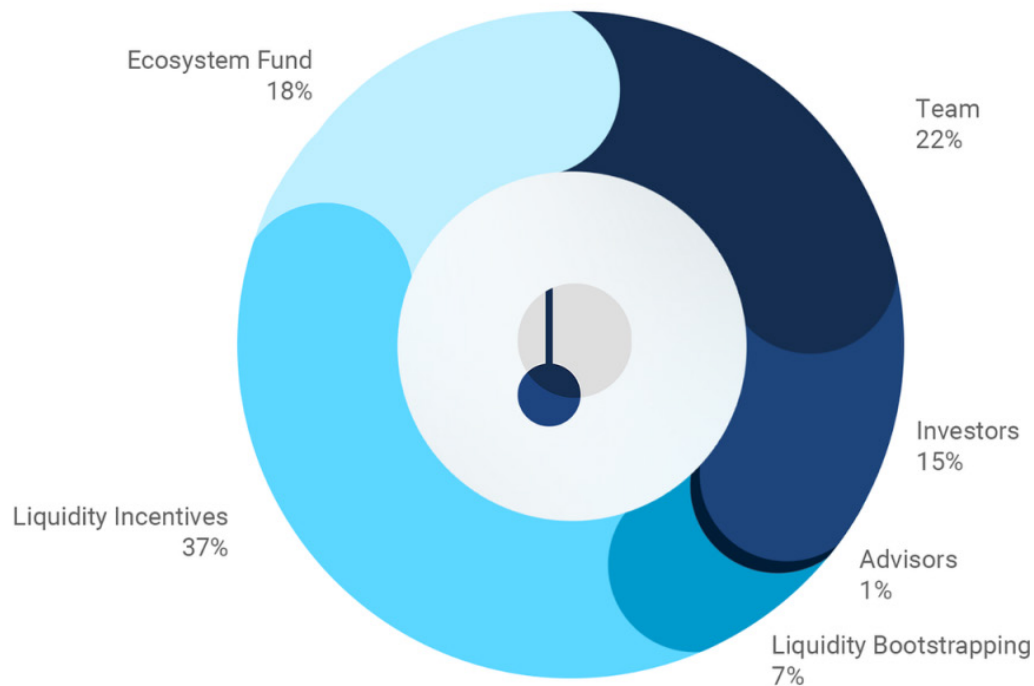
1. In the first 26 weeks, a stable incentive of 1.2 million PENDLE tokens will be distributed weekly.
2. Token emission will decay 1% a week until week 260.
3. After that, there will be an inflation rate of 2% per annum for incentives.

Weekly emission rate



Source: <https://medium.com/pendle/pendle-tokenomics-3a33d9caa0e4>

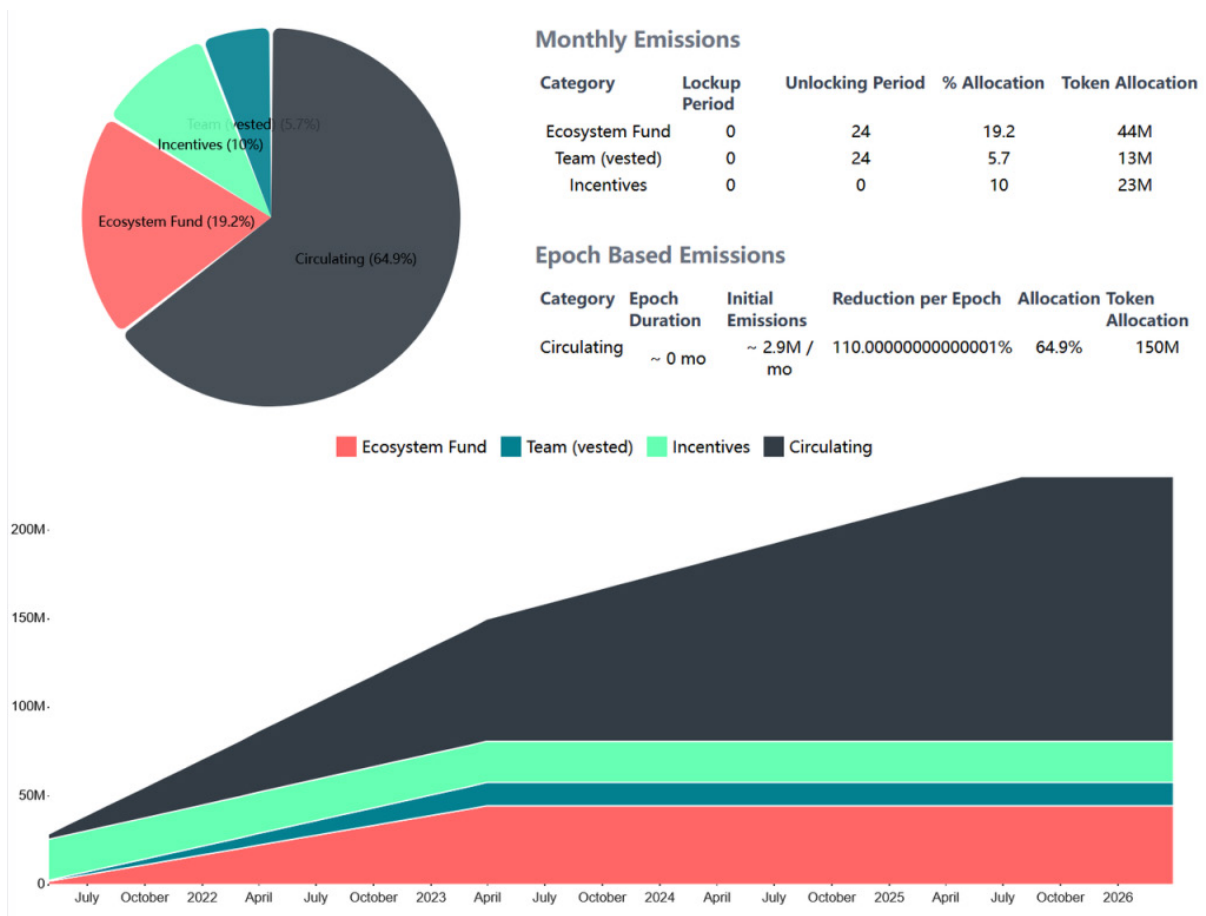
Two years after PENDLE's launch, token distribution can be summarized as follows:



Source: <https://medium.com/pendle/pendle-tokenomics-3a33d9caa0e4>

All investors and team members are under a vesting schedule as below:

- **Team:** 2-year vest and 1-year cliff followed by quarterly release and will be fully vested by April 2023.
- **Investors and Advisors:** 1-year vest with quarterly release starting 3 months after liquidity bootstrapping event and now has been fully vested.
- **Ecosystem Fund:** 50% no vest and 50% unlocked linearly after a year.

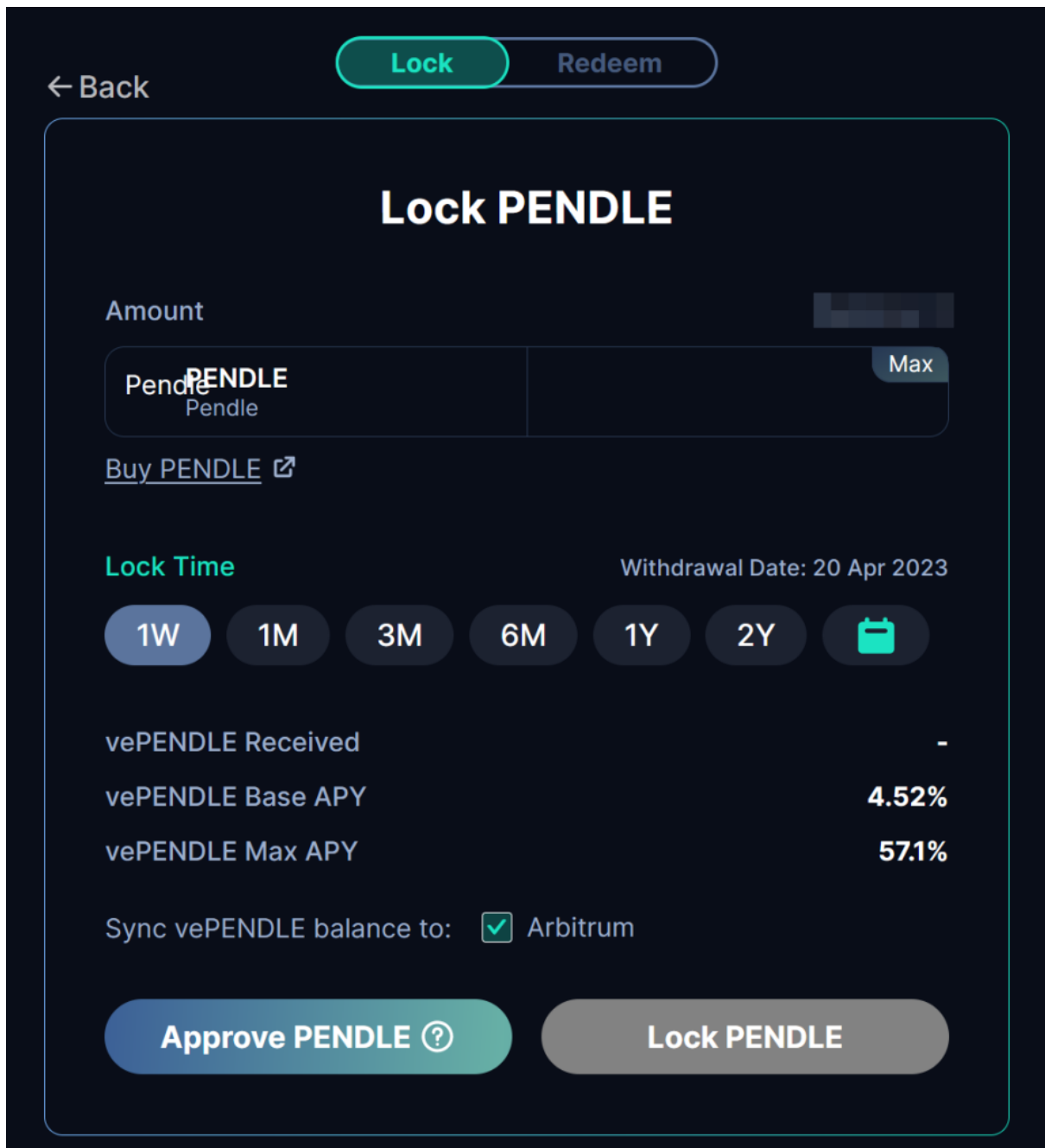


Source: <https://www.tokenomicshub.xyz/posts/pendle>

3.8.2 Token Value Capture

In the V1 version, Pendle primarily functioned as a utility and governance token, with its main purpose being participation in project governance. Even then, the Pendle team recognized the benefits of the Ve model for governance and considered the possibility of incorporating this model to enhance their token mechanism.

In the V2 version, the Pendle team formally integrated the Ve model into the PENDLE token, effectively enabling the token to capture value.



← Back

Lock Redeem


Lock PENDLE

Amount ██████████

Pendle **PENDLE** Max
Pendle

[Buy PENDLE](#) ↗

Lock Time Withdrawal Date: 20 Apr 2023

1W 1M 3M 6M 1Y 2Y 

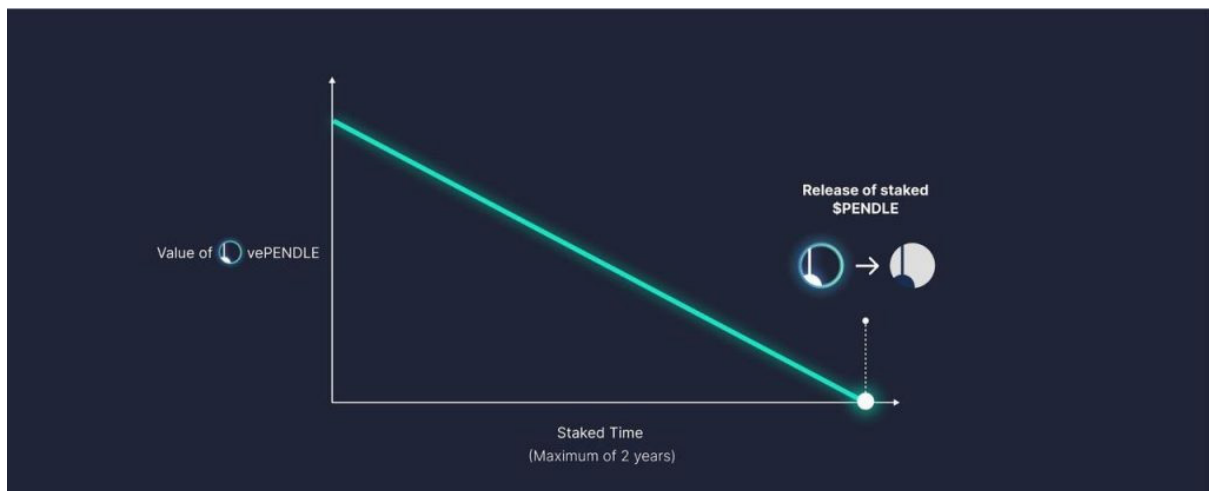
vePENDLE Received	-
vePENDLE Base APY	4.52%
vePENDLE Max APY	57.1%

Sync vePENDLE balance to: Arbitrum

Approve PENDLE ? Lock PENDLE

Source: <https://app.pendle.finance/vependle/lock/update>

Users can now choose a lockup period ranging from a minimum of one week to a maximum of two years. Similar to veCRV, the value of vePENDLE will decay over time.



Source: <https://docs.pendle.finance/Governance/vePENDLE>

In terms of value capture, vePENDLE holders can primarily benefit from participating in the distribution of fees and yields.

vePENDLE holders vote for and direct the flow of rewards to different pools, effectively incentivizing liquidity in the pool they vote for. Voting for a pool also entitles vePENDLE holders to share the swap fees. Pendle collects a 3% fee from all yield accrued by YT. Currently, 100% of this fee is distributed to vePENDLE holders. A portion of yield from matured unredeemed PTs will be distributed pro rata to vePENDLE holders as well.

Currently, the majority of pools on Ethereum are liquidity-staked derivatives of ETH with a TVL of approximately \$24 million. Assuming these assets offer an APY of 5%, vePENDLE holders would receive: $\$24,000,000 * 5% * 3% = \$36,000$.

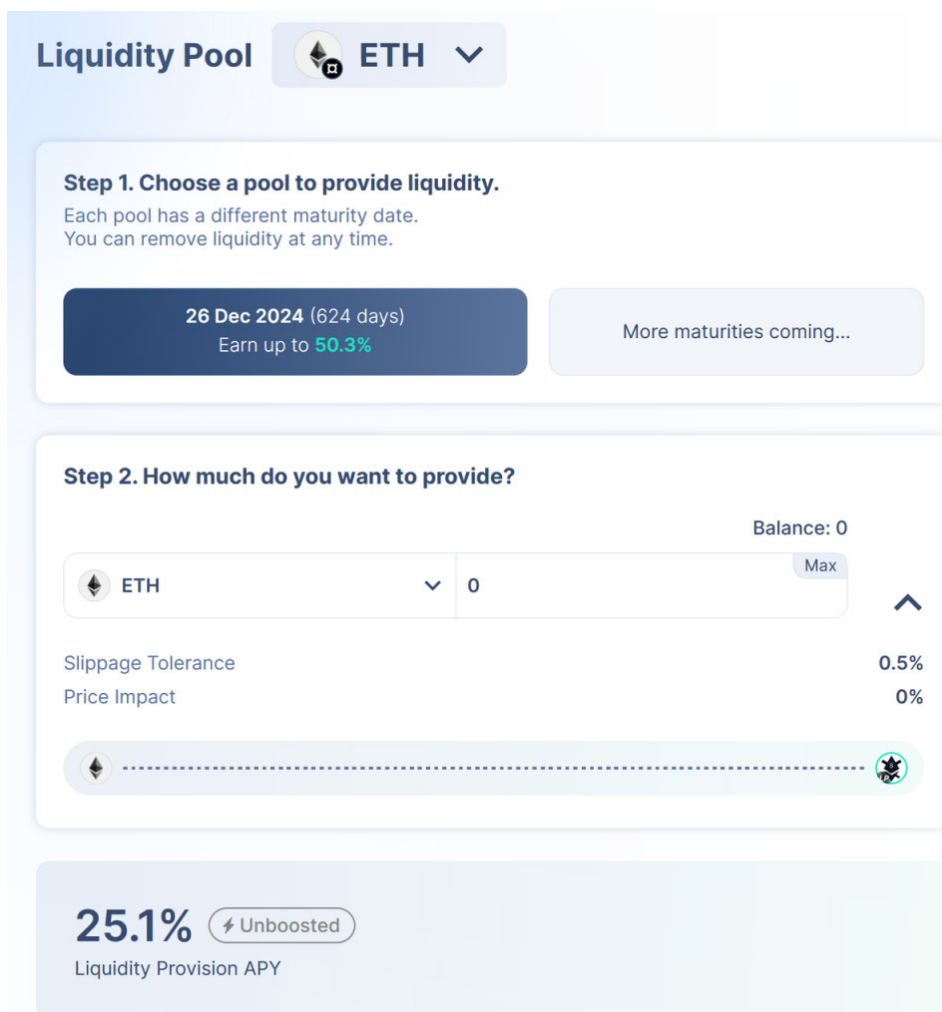
The pools on Arbitrum are GLP and gDAI, with a TVL of approximately \$20 million. Based on history data of the two projects and assuming that these projects can provide an APY of 15%, vePENDLE holders would receive: $\$20,000,000 * 15% * 3% = \$90,000$. Additionally, 80% of the swap fees collected by the pool will be distributed to the vePENDLE holders who voted for that pool.

From the beginning of the year till now, Pendle's average daily trading volume has been about \$400,000, and the swap fee ratio is 0.1%. Assuming the average daily trading volume and the ratio remains unchanged, the annual incentives for

vePENDLE holders would be: $\$400,000 * 365 * 0.1\% * 80\% = \$117,000$.

If there are no significant changes in operations, the total revenue generated by vePENDLE in a year would be around \$243,000 (including both swap fees and incentives). Additionally, vePENDLE holders who are also LPs can receive up to 250% of the incentive provided by Pendle.

Taking the sfrxETH pool as an example, the base APY for LPs is 25.1%, and the maximum APY available along with the vePENDLE incentive is 50.3%.



Liquidity Pool ETH

Step 1. Choose a pool to provide liquidity.
Each pool has a different maturity date.
You can remove liquidity at any time.

26 Dec 2024 (624 days)
Earn up to **50.3%**

More maturities coming...

Step 2. How much do you want to provide?

Balance: 0

ETH 0 Max

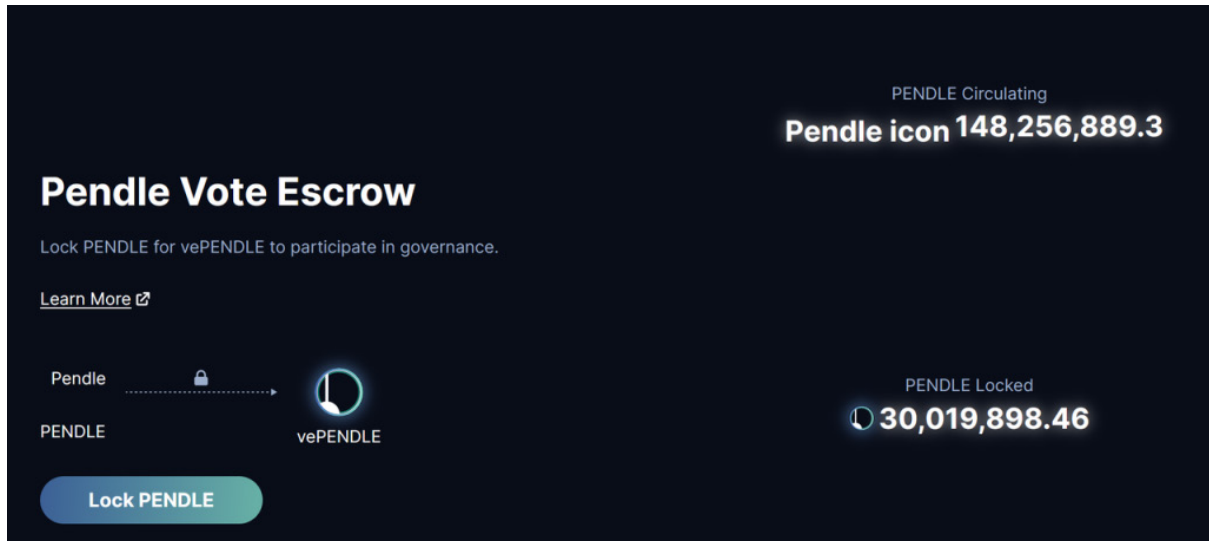
Slippage Tolerance 0.5%

Price Impact 0%

25.1% Unboosted
Liquidity Provision APY

Source: <https://app.pendle.finance/simple/pools/0xfb8f489df4e04609f4f4e54f586f960818b70041>

The significant boost in APY has spurred the growth of locked PENDLE on the platform. Currently, about 30.02 million Pendle tokens have been locked, which is close to 20% of the total circulating supply of PENDLE tokens.



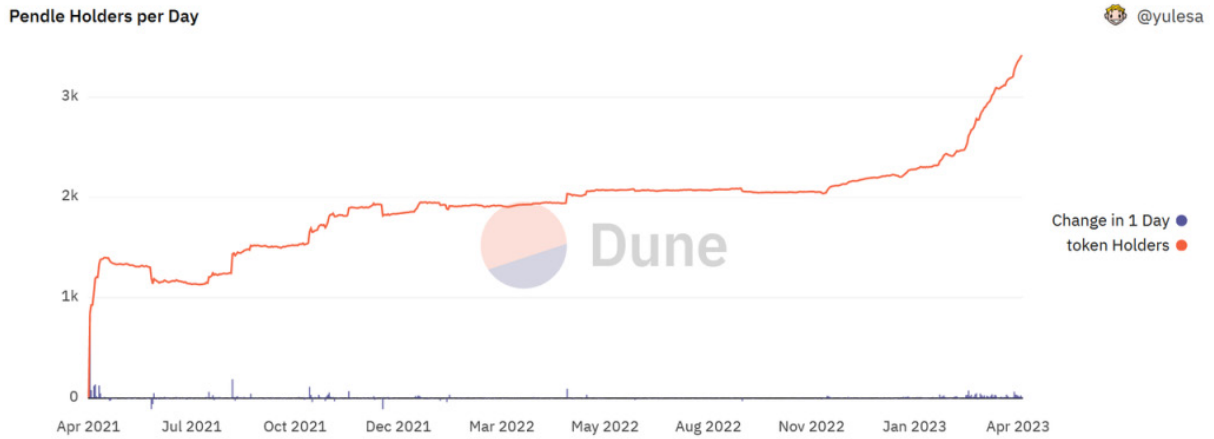
Source: <https://app.pendle.finance/vependle/overview>

3.8.3 User Base of Pendle

Following the adoption of the vePENDLE model, the PENDLE ecosystem has become more diverse in its user base:

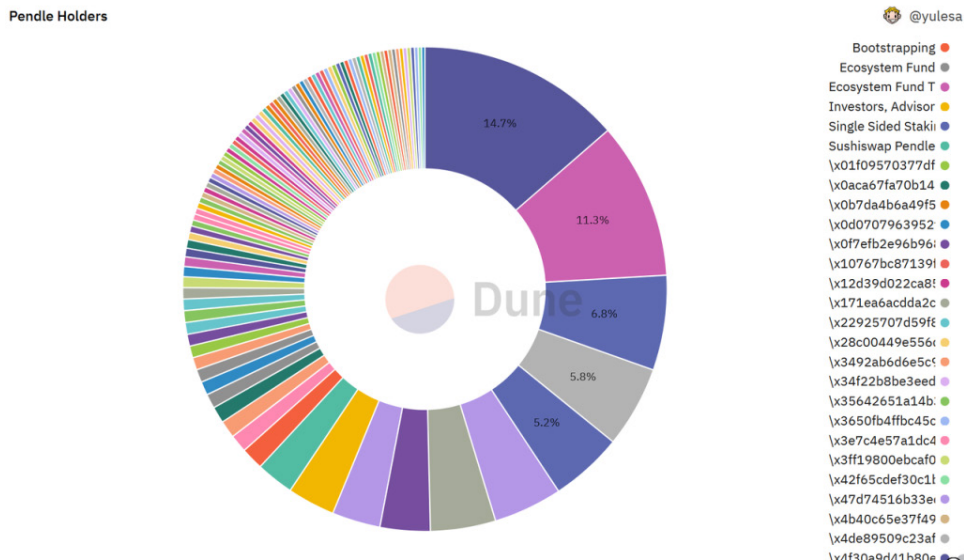
- **Liquidity Providers (LPs):** The vePENDLE model has proven beneficial for LPs, who now experience a substantial increase in yields. Consequently, a segment of investors may opt to acquire PENDLE tokens and lock them, simultaneously holding vePENDLE to capture pool yields and a proportion of swap fees.
- **Long-term PENDLE Investors:** PENDLE's appeal to investors seeking long-term cash flow is growing, thanks to the distribution of fees and yield shares. Although the current estimated annual revenue for vePENDLE stands at roughly \$200,000, a relatively insignificant sum compared to the number of locked PENDLEs, token holders are primarily focused on the potential for future growth.

Following the launch of V2, the number of PENDLE holders has experienced a significant increase, with nearly 50% growth, amounting to 3,415.

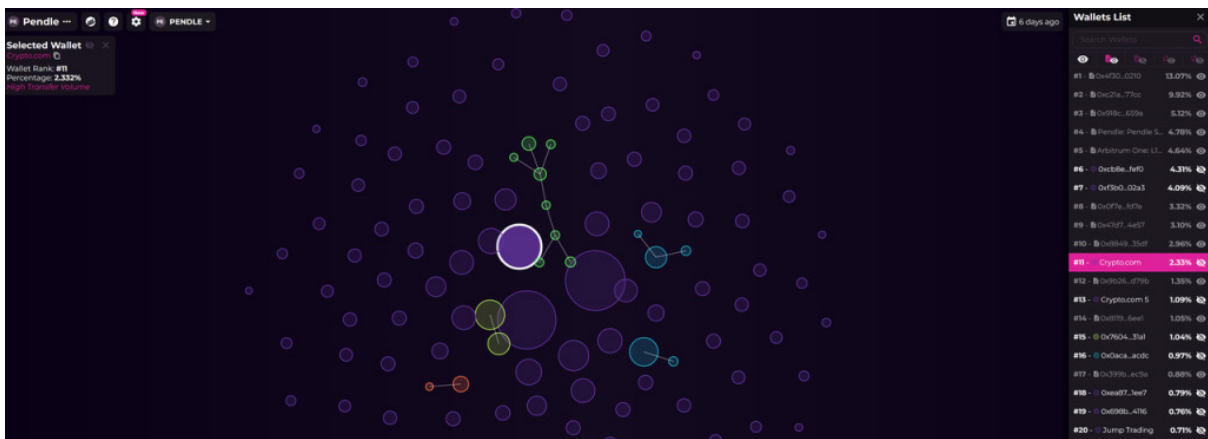


Source: <https://dune.com/yulesa/Pendle>

When examining distribution of holders, it is evident that TOP 5 holders possess approximately 44% of PENDLE tokens. The top address is associated with the locked PENDLE tokens. Some private sale investors, such as Crypto.com, continue to hold tokens at this stage. According to Bubblemaps, about 3.4% of PENDLE tokens are held by Crypto.com.



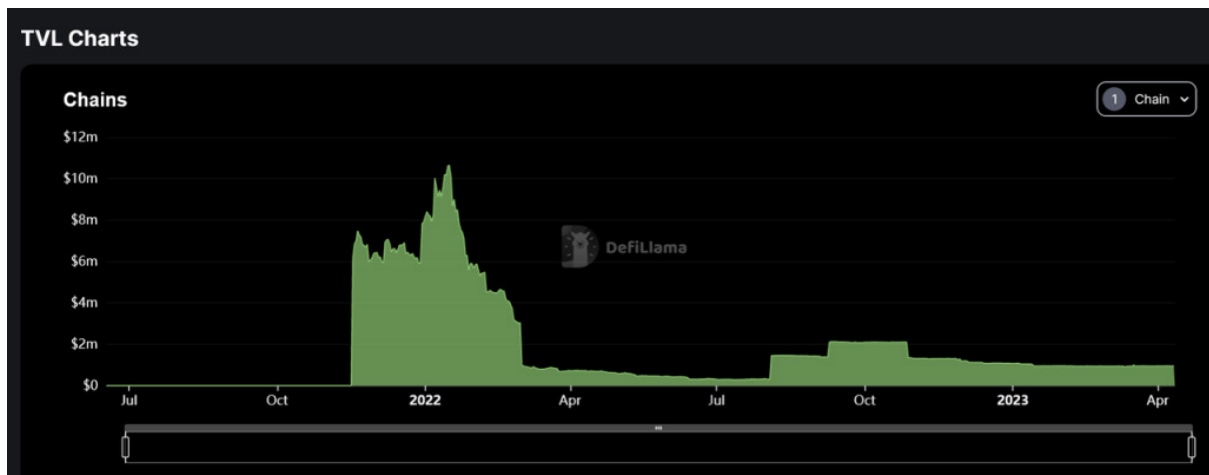
Source: <https://dune.com/yulesa/Pendle>



Source: <https://app.bubblemaps.io/eth/token/0x808507121b80c02388fad14726482e061b8da827?mode=3>

3.9 Risk Analysis

- Smart Contract Risk:** Recent hacks of hundreds of millions of dollars have raised concerns across various decentralized exchanges and lending protocols. In the event of a significant disruption, both the regular operations of a project and its token value capture could be adversely affected. This risk extends beyond Pendle itself, as its underlying assets originate from other DeFi protocols. Consequently, any contract risk stemming from these protocols could potentially impact Pendle as well.
- Strategy Risks:** Selecting the right underlying asset is crucial. If the project fails to select the appropriate assets or public chains bearing the assets, it may fall behind competitors in the next stage of competition. Pendle's choice to deploy on Avalanche appears to have been a strategic misstep, as its Avalanche business experienced a decline after an initial surge. The Pendle team did not accurately identify the optimal underlying assets and possess a clear understanding of the fierce nature of public chain competition.



Source: <https://defillama.com/protocol/pendle>

- **Market Risk:** The prices of some underlying assets, such as GLP, are not pegged to USD or public chain tokens, resulting in a relatively floating state that is not easy to hedge. This situation may not be favorable for those who consider USDT as the standard currency. If a significant market decline occurs during the project's operation, leading to a drop in the dollar-denominated GLP price, YT investors, in particular, may suffer substantial losses, prompting them to seek out other, more stable projects.

4. Valuation of Pendle

4.1 Five Core Issues

What's the Development Stage of the Project?

After approximately two years of development, Pendle has improved its ability to select appropriate underlying assets. Drawing lessons from other successful AMM models has also helped improve user experience in trading and cost saving. Although Pendle is experiencing rapid growth compared to its peers, the yield tokenization and fixed rate market are still in early stages.

Does the Project Possess a Significant Competitive Advantage? If So, Upon What Factors or Elements is This Competitive Edge Founded?

One of the advantages of DEX lies in its trading model and asset. Pendle's current AMM model demonstrates that it has some benefits. By choosing LSD as the fundamental assets, Pendle ensures a relatively stable revenue stream, even in bear markets, which helps retain some investors. To maintain a competitive edge in the yield tokenization space, Pendle must continue to enhance its model's innovative capabilities and refine its ability to screen and select underlying assets. By doing so, the project can position itself for long-term success and growth in the rapidly evolving DeFi landscape.

Is the Long-term Investment Rationale of the Project Well-defined, and Does It Align with the Overall Direction and Trends Within the Industry?

PT's yield caters to the investment preferences of conservative arbitrageurs, whereas YT addresses the market gaming interests of aggressive investors. The current selection of "low-medium-high" asset matrix of the project is appropriate and relatively close to the investors in the crypto market.

What Constitutes the Major Factors Affecting the Project's Operation, and Can These Factors be Accurately Quantified and Assessed?

The primary factors shaping Pendle's future prospects are the optimization of its AMM model and the selection of its assets. These variables can be assessed by examining trading activity and product offerings.

How is the Project's Management and Governance Structured, and What is the Nature of Its DAO?

The project is currently managed by a centralized team, with plans to gradually transition to a DAO model. Based on discussions in Pendle's Discord, it's evident that stakeholders have a deep understanding of the product. Moving forward, it will be crucial to monitor the effectiveness of DAO management in guiding the project's development and growth.

4.2 Valuation

In the current yield tokenization landscape, not all major projects have issued tokens, and those with tokens have not yet realized value capture. As a result, the "FDV/TVL" ratio serves as a reference standard for evaluating these projects. Based on available data, Pendle's valuation appears to be relatively lower compared to the other two projects that have already issued their tokens.



Million Dollars	Pendle	Swivel Finance	APwine
Fully Diluted Valuation (FDV)	118.05	8.66	17.74
Total Value Locked (TVL)	55.45	0.008	0.37
FDV/TVL	2.13	1082.5	47.95

Made by Mint Ventures. Updated time: April 11, 2023.

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