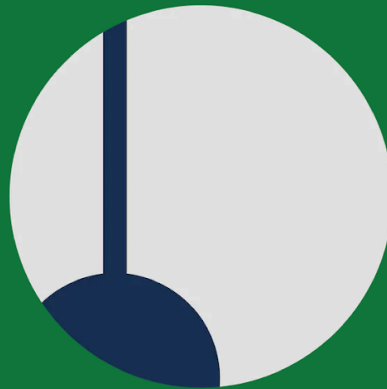


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Oregon

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P E N D L E

## General Background on Protocol

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Pendle, a yield-trading protocol established in 2020 and headquartered in Denver, CO, is built upon the robust lending infrastructure of DeFi giants Aave and Compound. This Ethereum-based protocol allows users to implement diverse yield-management strategies, offer liquidity, and participate in governance decisions through \$vote-escrow-PENDLE or "\$vePENDLE." Comprising yield tokenization, Pendle AMM, and \$vePENDLE, the protocol distinguishes itself from competitors like 88 MPH, Notional, SENSE, and IPOR Labs, particularly with the enhancements of Pendle V2, offering simplicity and efficiency. Pendle's core functions involve yield tokenization and the trading of future yield tokens via AMMs. Liquidity providers tokenize future yields into XYT tokens, enabling them to supply liquidity to time-decaying AMMs and earn fees while facilitating trading of future yield positions. These yield positions resemble bond stripping in TradFi. Bond stripping is when a bond is separated into two pieces creating two new commodities, its yield, and its principle. The yield is then sold at a premium because it is essentially guaranteed income until the maturity of the bond, and the principle is sold at a discount because it is a speculation of the good at the date of maturity. This innovative approach ensures real yields and avoids inflationary tokens, making Pendle a prominent player in the yield tokenization landscape.

## Macro Factors Impacting Protocol

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Within DeFi, there are plenty of variable rate instruments and opportunities for yield farming. However, often time yield farming involves inflationary tokens and risky projects or token volatility where impermanent loss is a large issue, especially for unsophisticated farmers. Two prominent projects that we will look at in the context of fixed rates are GMX's GLP and Lido's stETH. Both of these generate "real yield", which is rewards, or interest, paid in a cryptocurrency that is not inflationary. For now, a project is considered to have real yield when it pays interest in ETH, although in the future it is possible for other DeFi tokens such as ARB or OP to be considered real yield. Both of these instruments generate variable yield. The ETH staking rewards vary and so do the fees generated by GMX.

Global fixed income bond markets totaled \$133 trillion in 2022, and interest rate swaps from variable to fixed rates, or fixed to variable rates, is the largest global derivative market. Clearly there is demand for fixed rate instruments and the ability

to swap between fixed and variable rates in traditional finance, so it is safe to say that it is likely this market will gain traction in the future.

Bond stripping is an important function as it allows market participants to hedge against interest rate risk. It is already possible to hedge against price risk in crypto with positions like shorts, options, leverage, etc. However, there is not yet a robust market for hedging against changes in yield. GLP is a great asset to generate yield while having minimal volatility in the underlying asset because the token is a basket of 50% crypto and 50% stablecoins. What if I want to collect this yield without worrying about whether or not it will change? The only way to do that is by buying a fixed rate GLP instrument.

Yield generated from DEXs like GMX and staking rewards are subject to change with market conditions as they are dependent on transaction volume. Pendle removes exposure to this interest rate risk by allowing market forces to determine a fixed rate.

## Who's the Team Building the Protocol

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TN Lee is the co-founder, and CEO of Pendle Finance. TN Lee started his web3 journey at a crypto trading hub, Kyber in 2016, where he became the head of business. He then co-founded a semiconductor manufacturer called Dana Labs. In 2020 Tn Lee co-founded Pendle Finance. According to PitchBook, Pendle has 13 employees. Pendle is privately backed, and has raised 3.7 million, with their largest backer being VC firm Binance Labs. TN Lee has 8 years experience in the web3 world building and creating value with different protocols which makes him a veteran in the space and more than capable of creating the next crypto FAANG.

## General Auditing Background for Protocol

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Pendle was audited in 2021 by Least Authority, a security consulting company that specializes in web3 protocols. The audit was centered around the protocol's smart contracts, where Least Authority issued a report that encapsulated risk mitigation and remediation instructions. Pendle has made significant changes since April 2021, so as important as the audit was, it is somewhat outdated. In the audit's "Issue/Suggestion" section, nine out of thirteen of the suggestions have been "resolved" the four unresolved suggestions revolve around simplifying the protocol. The Auditors recommended simplifying the contracts as it decreases "the ability for

auditors to review the code more easily and reduces overall risk to the system.” The Audit covered security risks and types of attacks they would expect to see. In that section they said that “Pendle had demonstrated a serious consideration for security in the design of the Pendle protocol.” They go into further detail about the idiosyncrasies of Pendle’s security, the big take-aways are that Pendle shares the same risk factors other “DeFi smart contracts on the Ethereum blockchain are inherently vulnerable to.” Overall, we do not believe that the audit should cause any concern for future users or investors of the protocol. The audit showed the strength and meticulous thought that TN Lee has put into Pendle since its inception.

## Specific on What Protocol Does

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Pendle offers fixed yield on a variety of yield bearing assets such as sDAI, stETH, and GLP. Each of these assets generates yield from some locking mechanism. For example, sDAI is DAI deposited in Maker’s DAI Saving Rate (DSR) module as a part of Spark Protocol. stETH on the other hand generates its yield from staking rewards.

To create fixed yield, Pendle wraps the original yield bearing asset into a standardized API. For stETH, this would mean wrapping it to SY stETH. This SY token is then bifurcated into two separate tokens: the yield token (YT) and the principal token (PT). These two tokens then go into an advanced AMM. Buying PT is like buying a zero-coupon bond and buying YT is like buying the coupon payments.

The price of YT and PT and inversely related. For example, if the price of stETH is \$1,500, and the price of PT stETH is \$1,400, then the price of YT stETH must be \$100. The PT and YT tokens come with a maturity date. What this means for PT is that the value of PT stETH will approach the value of stETH and they will reach parity at maturity. YT will gradually reduce in value until it hits zero at maturity and the last interest payment (coupon payment) is paid. Going back to our example, if the maturity date was 1 year from now and we use the given prices, the effective interest rate (denominated in ETH) is 7.1%. Deposit 0.93 stETH today to receive 1 stETH in a year.

## Why the Protocol Offering Matters to Consumers

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Traders can use many different strategies and open new types of positions based on what they expect the price of ETH to do, their expectations for ETH staking rewards,

or DAI savings rates. Fixed rates give more opportunities for both passive investors and active traders, in addition to giving more optionality for yield farmers.

## Protocol Versus Competitors Chart

	TVL (DeFiLlama)	Assets offered	Chains offered
Pendle	\$157,746,851	17	4
88MPH	\$479,871	16*	1
Notional	\$24,856,648	4	1
Yield Protocol	\$2,280,000	10	2
Sense	\$554,458	1	1
IPOR Labs	\$13,571,601	3	1

\*88MPH doesn't offer the same function as Pendle

## Protocol Go To Market Strategy Versus Competitors

Pendle's edge against its competitors are its variety of chains and tokens available for use. Many fixed rate platforms only offer one or two tokens outside of staked Eth, some only offer staked Eth. Additionally, competitors of Pendle often only operate on mainnet. Pendle's variety of assets and chains compared to competitors shows in their stats. Pendle offers fixed APY and yield trading on mainnet, Arbitrum, Optimism, and BNB Chain. Assets available to trade yield on include stETH, OETH, rETH, GLP, sDAI, gDAI, HLP, among others.

## How Token Extracts Value

Pendle's token, \$PENDLE is a multifunction token that offers an avenue for investors to collect dividends through fees, as well as for investors to vote for the protocol's liquidity pools. When a \$PENDLE owner locks up their \$PENDLE for a stated duration, they receive vote-escrow-PENDLE, \$vePENDLE. Users can take their \$vePENDLE and vote for the flow of rewards into the pool they voted for, effectively incentivizing liquidity in the pool they vote for. For example, if a majority of

\$vePENDLE votes are counted for the stETH pool, the APY for that pool will increase and users facing higher returns will then place more stETH into the pool, stakers get better returns from the pool, and voters will collect more fees from the pool as the transaction amount increases.

\$vePendle LP stakes can be held at maximum for 2 years. The longer you stake your \$vePENDLE for the more the staked value will be worth. Each wallet is tied to one position so any change to a position will reset your whole wallet's position and rewards. Once a staked position has matured it will be converted back into its PENDLE amount. Votes are counted weekly on Thursday at 00:00 UTC. It's important to note that vePENDLE holders are entitled to 80% of the swap fees collected by the pool which are distributed pro rata between voters of the pool.

The protocol collects a 3% fee from all yield accrued by Yield Tokens. 100% of the fees are distributed to vePENDLE holders but that is subject to change in the future. A portion of yield from matured unredeemed principle tokens will also be distributed pro rata to \$vePENDLE holders as well. This matured principle token will be converted into a stable coin, then collected by the protocol as revenue, and finally distributed to \$vePENDLE holders.

\$vePENDLE APY, the interest collected from matured YT and PT rewards constitute the \$vePENDLE base APY. Voters are also entitled to receiving 80% of the swap fees from voted pools which constitutes voters APY. Voters APY plus base APY determines the rewards one will receive from voting using \$vePENDLE. The base APY is 0.23% and the max voters APY is 12.4% making the highest annual yield from staking \$PENDLE ~12.7%.

There is a way to maximize returns with vePENDLE. You can do this by offering liquidity in the pool that you are voting in. By doing this, your rewards from the pool will stay constant throughout the duration of the time your vePENDLE is staked, this is significant because the value of your "staked" or voted vePENDLE decays over the life of the contract. Effectively, you can maximize your returns from the pool you are voting in by also adding liquidity to that pool.

This boosting function will be done automatically for the user after staking their vePENDLE and adding liquidity, or can be done manually if the user was already offering liquidity then decides to vote in the pool. For clarity reference Figure 1.

## Tokenomics/Vesting Schedule

Pendle’s token, \$PENDLE is their means of generating income for their ecosystem fund, operating their voting system, generating interest in the protocol. On its own, \$PENDLE operates like any other currency. PENDLE has about 270 million coins with 65% in circulation, and 19% in an ecosystem fund. PENDLE began emitting rewards in October 2022 with an initial weekly emission of 677 thousand on a 1.1% decrease weekly, which will continue until April 2026 where PENDLE will allow for a terminal inflation rate of 2% per fiscal year. The inflation rate this year is roughly 22%.

## Modeling/Ratio Analysis

FDV/TVL doesn’t show us much in regards to the valuation of Pendle relative to other protocols. The FDV/Revenue suggests that Pendle is overvalued relative to its revenue by a fair amount. While this is concerning, it is possible that the fixed rate narrative could catch and Pendle to be at the forefront of this hype.

A final form of analysis we conducted involved looking at rate swaps as a derivative relative to the broader derivative market. Rate swaps are prevalent financial instruments in the traditional finance world. We believe that rate swaps in DeFi will follow a similar trajectory. To model what this might look like, we first found the total percentage of rate swaps when compared to total derivatives. We found that rate swaps accounted for 67% of the total derivatives market in traditional finance. To find an accurate

	TVL	FDV	FDV/TVL	WTD Ratio
<b>Pendle</b>	157,746,851	186,900,000	1.18	0.20
<b>GMX</b>	478,640,000	511,840,000	1.07	0.56
<b>Notional</b>	24,856,648	13,060,000	0.53	0.01
<b>Joe</b>	76,950,000	125,940,000	1.64	0.14
<b>Beefy</b>	183,830,000	29,220,000	0.16	0.03
<b>WTD Avg</b>				0.94

	TVL	FDV	FDV/Revenue
<b>Pendle</b>	157,746,851	186,900,000	1.18
<b>GMX</b>	450,320,000	511,840,000	1.14
<b>Notional</b>	-	13,060,000	-
<b>Joe</b>	80,210,000	125,940,000	1.57
<b>Beefy</b>	-	29,220,000	-

**Weighted Avg multiple for TVL to FDV**      Implied FDV      1,244,667,459.29  
 0.94      Valuation Increase      665.95%

	TVL	Implied TVL	Implied FDV
	<b>\$299,234,144 -&gt;</b>	<b>2,511,000,000</b>	
Pendle	\$157,746,851	1,323,720,409.14	1,244,667,459.29
88MPH	\$479,871	4,026,800.11	3,786,318.49
Notional	\$24,856,648	208,582,624.96	196,126,012.76
Yield Protocol	\$2,280,000	19,132,442.35	17,989,847.59
Sense	\$554,458	4,652,691.11	4,374,831.10
IPOR Labs	\$13,571,601	113,885,032.34	107,083,786.64
Fudge Factor	\$99,744,714.50	837,000,000.00	787,014,127.93

metric of market size in crypto, we decided to apply this 67% to the TVL of DeFi protocols. That is, we believe the TVL in rate swap protocols will be 67% of the TVL in all DeFi derivatives protocols. Using the existing TVL in derivatives protocols of just over \$1.2 billion and an excel solver function, we estimate that implied TVL of the aggregate DeFi rate swap market is \$2.5B.

The total TVL of our identified competitors, including Pendle, is roughly \$200 million. We then included a fudge factor of 50% of this value to be conservative with our projection and include potential competitors that have yet to emerge or that we did not include. This both dilutes the market share of Pendle and reduces the overall growth of the rate swap market. We then extrapolated what the TVL of each protocol would be given their current market share at our implied TVL of \$2.5 billion. This gave us an implied TVL for Pendle of \$1.3 billion. We used this TVL along with a weighted average rate of the FDV/TVLs found using Pendle, GMX, Notional, Joe, and Beefy to get an implied FDV of \$1.2 billion, a 665.95% increase from today's valuation.

## Road Map

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Pendle aims to deploy on the Mantle network at some time in the future, and possibly on Base once it gets a bit bigger. Pendle aims to continue its position in the LSDfi space and integrate real world assets (RWAs). Also a part of this LSDfi and RWA push is more exposure to the OKX exchange for integration. More of these types of integrations are in the pipeline.

Pendle also is also focusing on the trading experience for institutional investors, and they see limit orders as the first step to that. Current TVL is currently 20% composed of institutional investors, but the team sees that increasing to 50% by EOY. The regional focus for Pendle will be centered around China, Vietnam, and South Korea.

## Conclusion

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Pendle has shown through product development and market share that it is here to stay in the Ethereum ecosystem. Pendle Takes the uncertainty of liquid staking tokens and creates two tradable fixed derivatives. These conversions happen seamlessly and quickly using Pendle's AMM which allows for flash swaps, negligible



impermanant loss, and no slippage. Pendle's features for users of the protocol as well as owners of the token allow for multiple ways to generate yield.

## Fund Recommendation

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1.9 Eth at at a buying price of \$0.61 for a quantity of 5,000 \$PENDLE



Appendix

Figure 1: LP Reward Boost

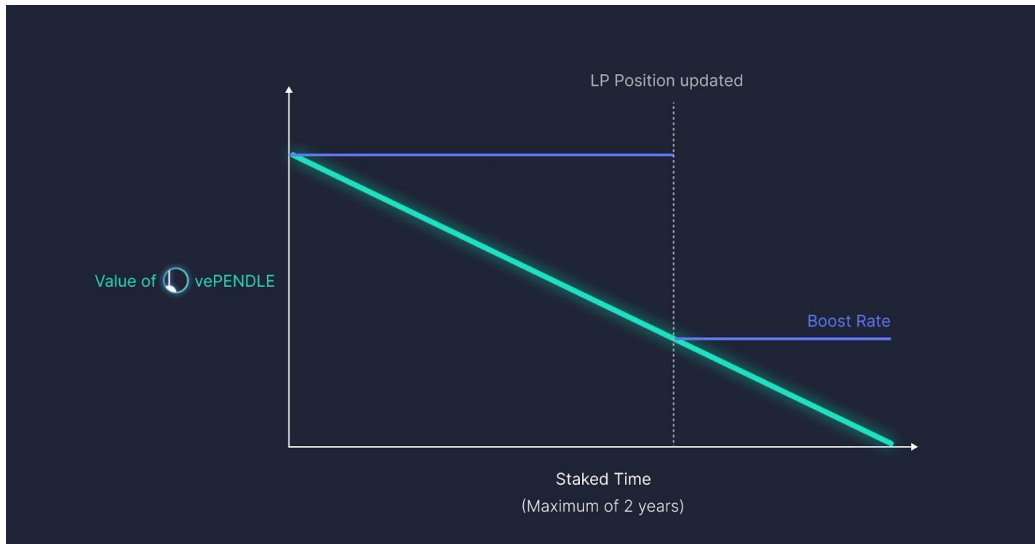


Figure 2: Inflation

		Emissions Per Week			
2022	October	667,705	660,360	653,096	645,912
2022	November	638,807	631,780	624,831	617,958
2022	December	611,160	604,437	597,788	591,213
2023	January	584,709	578,278	571,917	565,626
2023	February	559,404	553,250	547,164	541,146
2023	March	535,193	529,306	523,484	517,725
2023	April	512,030	506,398	500,828	495,318
2023	May	489,870	484,481	479,152	473,881
2023	June	468,669	463,513	458,415	453,372
2023	July	448,385	443,453	438,575	433,751
2023	August	428,979	424,260	419,594	414,978
2023	September	410,413	405,899	401,434	397,018
2023	October	392,651	388,332	384,060	379,835
2023	November	375,657	371,525	367,438	363,396
2023	December	359,399	355,446	351,536	347,669
		343,845	340,062	336,322	332,622
	Total yearly emissions	23,249,663			
	EOY circulating supply	103,944,869			
		22%			

Figure 3: Weighted Average FDV/TVL



	TVL	FDV	FDV/TVL	0.94
<b>Pendle</b>	157,746,851	186,900,000	1.18	0.20
<b>GMX</b>	478,640,000	511,840,000	1.07	0.56
<b>Notional</b>	24,856,648	13,060,000	0.53	0.01
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