Risk Assessment - cvxCRV Collateral Asset on FiRM

Useful Links

- Coingecko: https://www.coingecko.com/en/coins/convex-crv
- Website: https://www.convexfinance.com/
- Github: https://github.com/convex-eth/platform
- Blog: https://convexfinance.medium.com/
- Twitter: https://twitter.com/ConvexFinance
- Main Discord: https://discord.com/invite/TTEVTqY488
- Bug Bounty: https://docs.convexfinance.com/convexfinance/faq/bug-bounties
- Docs: https://docs.convexfinance.com/convexfinance/
- Voting: https://vote.convexfinance.com/#/
- Prime Rating Report: https://primerating.mypinata.cloud/ipfs/QmRnegKm3uGpipKYDDsh5KiEDJfQXuemKPF9sx8ibLR6NN

Background

Speaking with the Curve team, we have been informed that the curve stableswap (for pegged assets) liquidity pools have had a couple of upgrades recently, that apply to all newly deployed pools. The main update is the inclusion of an EMA price feed for token 2 in the pool relative to token 1.

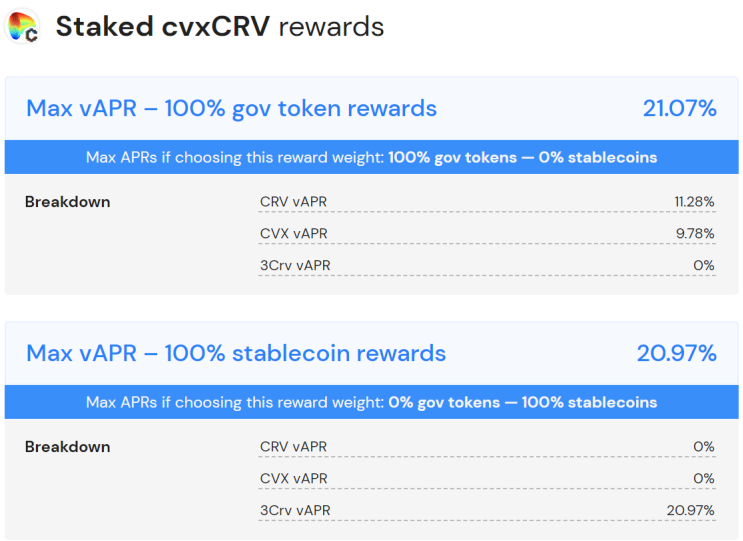
The opportunity this presents to us is that we can now enable the Curve liquid lockers (yCRV, sdCRV, cvxCRV) as collateral on FiRM in a risk-managed way that makes sense for both us and potential borrowers. In our oracle implementation, we'd cap the max price using the CRV chainlink price feed, and use the EMA when it reads prices below 1 CRV. The CF on the FiRM markets would likely be very low (~50%), with low supply ceilings and low daily borrow limits to manage risk appropriately.

CurveFinance veToken model allows users to lock $crv for up to 4 years and receive admin fees (paid in stables) and allows them to vote for CRV emissions for the pools. Protocols seeking liquidity have the option to bribe veCRV holders to stream CRV emissions to their pools. But locking CRV for 4 years is not a very attractive option for the holders. What's the solution? Liquid wrappers.

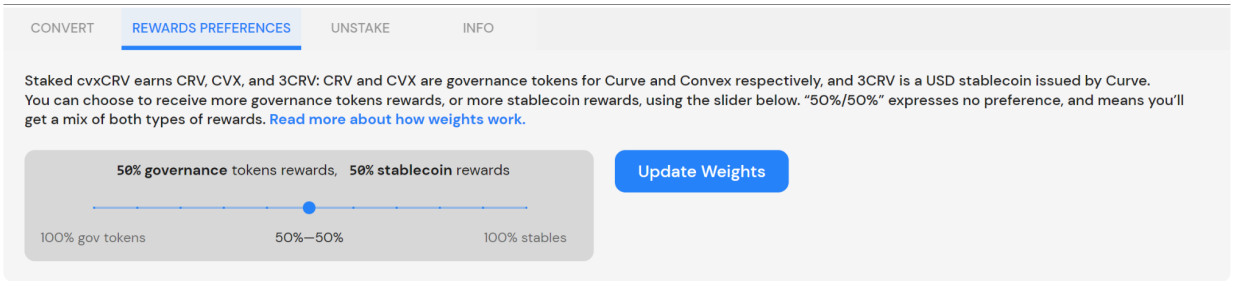
- **cvxCRV** from ConvexFinance
- **sdCRV** from StakeDAO
- **yCRV** from Yearn Finance

Liquid wrappers allow CRV holders to receive fees and/or bribes without locking it for 4 years and provide a chance to exit the position. We will be focusing on study on **cvxCRV**.

Users stake their cvxCRV in order to receive rewards (all usual veCRV rewards, plus 10% of all Convex deposits boosted CRV earnings, and also CVX on top), once staked they get to choose the weightings of their rewards between gov tokens (CRV and CVX) and stablecoins (3pool), this can be shown below:



Users update the weighting of each reward on-chain using the UI, shown below:



What are the tradeoffs? cvxCRV doesn't offer voting power nor does share bribe revenue. Normally, protocol fees are charged by the protocol for the service they provide (they are deducted from the displayed APR). However for cvxCRV fees are set to 0%.

Protocol Analysis

Org. Structure

- ☐ **Is the Protocol a DAO? How is it governed eg. delegates , snapshot (10)**

Convex's core principle is to act as a proxy for a group of CRV holders that want to jointly influence Curve decision-making to improve rewards for Liquidity Pools of their choosing. Convex provides additional DeFi returns to Curve liquidity providers and CRV stakers. By pooling together individual users, the protocol provides the users with higher rewards and earning with the only downside being that the users lose their voting rights on Curve.

For governance, voting occurs on the Snapshot platform (which is the governance forum) and there are also debates on the discord channel. The governance process is well formalized and documented in the Convex docs under Voting and Gauge Weights.

- ☐ **Does Protocol publish analytics / transparency via Dune or similar? (0)**

No

- ☐ **Working group structure (3)**

Since the team is not clearly identified, working group structure is unclear as well. A single 3 of 5 multisig performs several functions which are outlined here.

- ☐ **Are core contributors compensated / Doxed? (5)**

There is no clear identification of the team neither on the website nor in the documentation. Harry has a working relationship with the Convex Founder C2tP. Kendrick Llama, Winthrope, and Charlie are also identified on Discord as being part of the team.

- [ ] **Any known controversies in crypto space (10)**

None.

- [ ] **Do they have a security or risk management team (0)**

Unclear for the same reason outlined in working group structure section.

Multisig Structure

- [ ] **Is protocol transparent of multisigs and signers, List/links of multisigs, purpose, and setup x of x (10)**

The admin controls the protocol through the multisig; the multisig has five members two of which are from the convex team. The multisig admin have the following capabilities: update the stash factory and the pool manager, control the arbitrator vault, change platform fees allocated to takers with hard-coded ranges, set up the treasury address and allocate up to 2% of the platform fees back to this address, control the treasury account, vote for proposals and gauge weights, et distribution weights on the master chef, shutdown and/or pause new deposits to pool staking contracts and others, apply a new operator the whitelisted proxy if the current operator is completely shutdown and add and/or remove rewards.

- [ ] **Can multisigs interfere with collateral options? EOA minting (10)**

Admin control information and ownership is documented here. The relevant contracts are clearly identified as immutable. Smart contract change capabilities are well identified for all Convex contracts. Pause control documentation is present.

Influence, Reputation, and Partnerships

- [ ] **How long has the protocol been around , have they endured long bear markets? (8)**

Since its launch mid-May of 2021, the protocol has gained a lot of traction and has amassed a TVL of around $3.7B (ATH > $20B). They are major players in the Curve Wars along with Yearn and StakeDAO. Convex can count on 222,934,188 CRV deposits and 28,642 depositors. The protocol is enduring their first bear market.

- [ ] **Have they been exploited and how was it handled , was value restored to users if affected. (10)**

No previous exploits.

- ☐ **Current and notable past partnerships , are they a net positive on the DEFI space (10)**

Convex holds close ties to both Curve and Frax. The ties between Convex Finance, Curve Finance, and Frax Finance are beneficial for all three projects. Convex Finance is able to offer users higher yields and boosted rewards, which attracts more users to the platform. Curve Finance is able to attract more liquidity, which makes it a more attractive exchange for users. Frax Finance is able to increase its adoption and reach a wider audience.

The ties between Convex Finance, Curve Finance, and Frax Finance are a positive development for the DeFi ecosystem. It shows that the DeFi community is working together to build a more robust and user-friendly ecosystem.

Audits & Bug Bounties

Previous and Ongoing

- ☐ **Audits & Bounties (7)**

Convex was audited once before deployment.

Convex offers a bug bounty of up to $250K.

Reward Payouts

- ☐ **Rewards paid, vulnerabilities found with severity**

One past case, where a non-critical bug was disclosed and a payout issued. Details here.

Collateral Analysis

Oracles

- ☐ **EMA vs TWAP**

The EMA oracle (Exponential Moving Average oracle) is a type of oracle called "exponential" because it uses a weighting factor that exponentially decreases the influence of older data points on the moving average. The EMA oracle works by taking a series of recent prices for a particular asset and calculating an average price, giving more weight to the more recent prices. The result is a moving average price that is updated over time.

Whereas EMA calculates the average price based on a weighting factor that exponentially decreases the influence of older data points on the moving average; TWAP, on the other hand,

calculates the average price based on the time-weighted average of prices over a specific period of time. This means that each price is given equal weight in the calculation, regardless of when it was recorded. The main difference between EMA and TWAP is in their responsiveness to changes in market conditions. EMA is more responsive to changes in market conditions (depending on half-life setting), while TWAP provides a more stable and predictable reference price over a longer period of time.

- ☐ **Does the asset have a backup oracle**

There is a MA Price built into the LP as well.

- ☐ **Any advanced oracle implementation required**

In our oracle implementation for cvxCRV, we'd cap the max price using the CRV chainlink price feed, and use the EMA reading from the new cvxCRV/CRV LP when it reads prices below 1 CRV.

Using the chainlink price feed for CRV as a "price ceiling" for cvxCRV makes sense since there are no scenarios aside from malicious ones where the price of cvxCRV would ever be greater than CRV. Together with FiRM's PPO safety feature, we believe these measures are enough to protect against upward price manipulation of the cvxCRV asset.

As for downward price manipulation, something to consider is the EMA half-life. The new Curve stablepools are deployed by default (using the UI) with an EMA Half-Life of 10 minutes. For our intents and purposes, a half-life of 30 minutes would result in a more resilient EMA price reading in the context of a malicious actor trying to manipulate the price downwards (in order to profit from liquidations). EMA Half-Line can be adjusted by Curve gov after deployment, or it can be set on deployment using this proxy admin contract.

Other safety measures (that carry obvious cons) the PWG might consider here are:

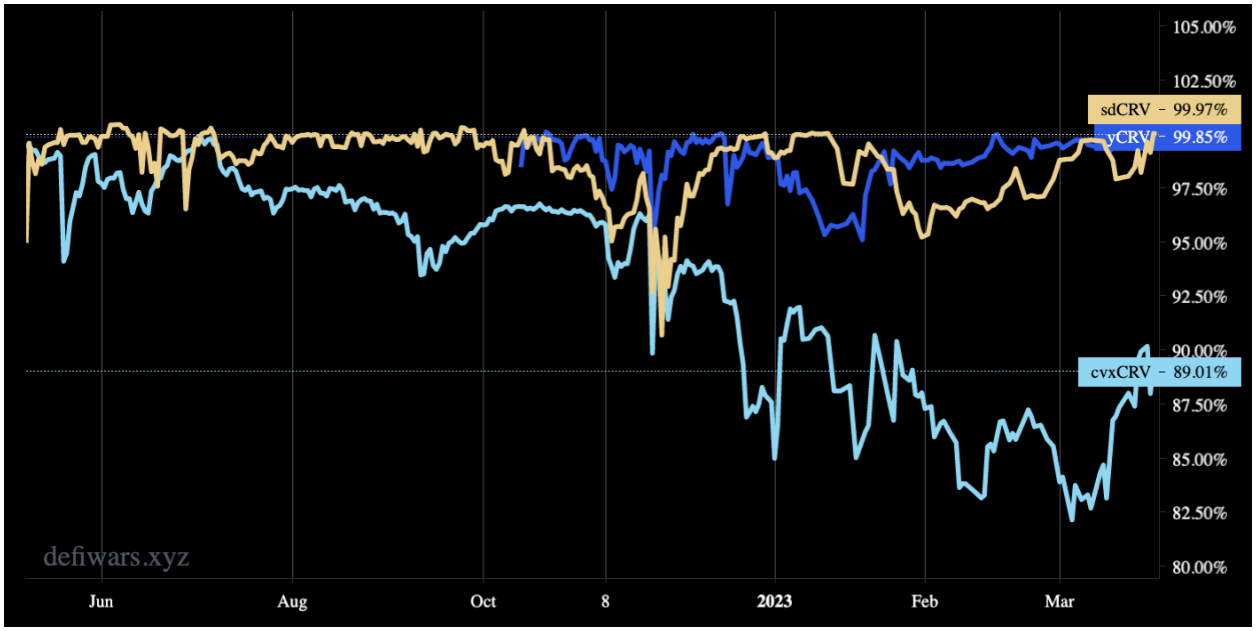
- Using an EMA that gives more weight to older price readings.
- Using a consensus mechanism though this would require multiple trusted oracles.
- Implementing a circuit breaker though inefficient as it would require governance to intervene and 5+ days to reactivate the market (especially a problem if triggered incorrectly)
- Exploring the use of comparing last used price with EMA price, and causing reverts if the difference is too large.

- ☐ **Liquidation Routing, Do liquidations require a wrapper?, accessibility**

cvxCRV>CRV>USDC>DOLA
cvxCRV>USDC>DOLA

- ☐ **Peg Risk if any**

The introduction of competition to the CRV liquid wrapper market brought about a slow gradual de-peg of cvxCRV relative to CRV. Alternative products such as yCRV and sdCRV offer better yield, and it is likely cvxCRV peg will continue to lag until the yield matches it's counterparts. One can assume healthy use of the cvxCRV market on FiRM will positively affect the peg.



Token Statistics

- ☐ **Contracts, upgradable?**

The relevant contracts are clearly identified as immutable as identified here.

- ☐ **Price / Market Cap / Circulating Supply / Locked Supply / True Circulating / Total / Max**

Coingecko

Price	Market Cap	Circulating Supply
$0.863	$251M	290,739,696

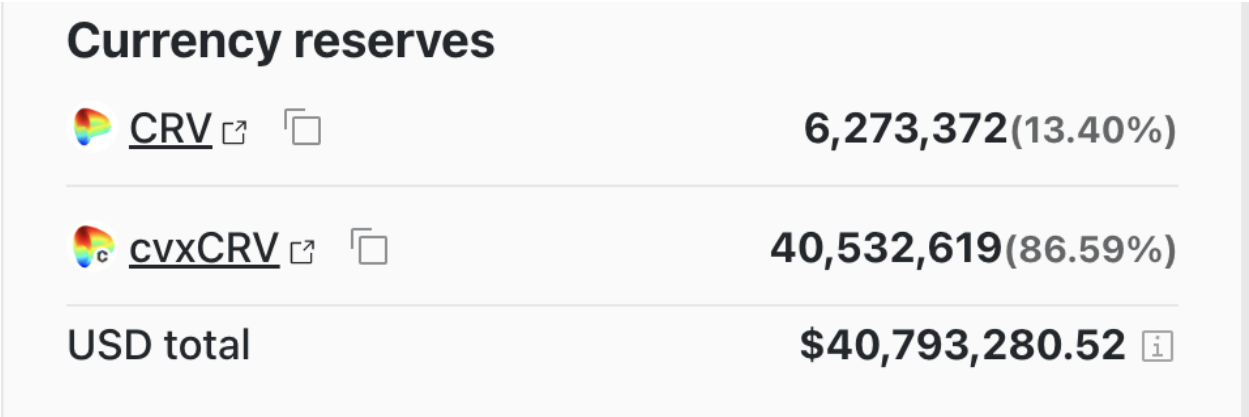
Liquidity

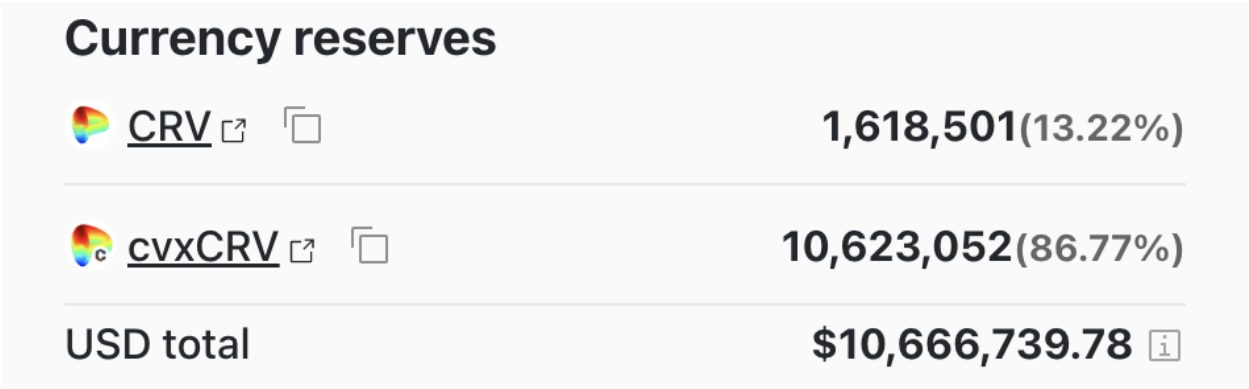
- ☐ **Mainnet Dex Liquidity**

LP	Protocol	Liquidity	24 Hour Volume

cvxCRV/CRV (old)	Curve	$40.7M	$1.5M
cvxCRV/CRV (new)	Curve	$10.6M	$442.5k
cvxCRV/FRAXBP	Curve	$3.7M	$177.2k
cvxCRV/CRV	UniswapV2	$9.7k	$39k
cvxCRV/wETH	Sushiswap	$67k	$6.8k
cvxCRV/CRV	Sushiswap	$39k	$195

Liquidity migration from the curve pool with deepest liquidity to an upgraded Curve pool with the new price oracle is underway. The Curve LPs are the deepest, however they are not equally weighted. In our case, the paired asset ($CRV) is heavily underweight (see below), hence cvxCRV being off-peg.



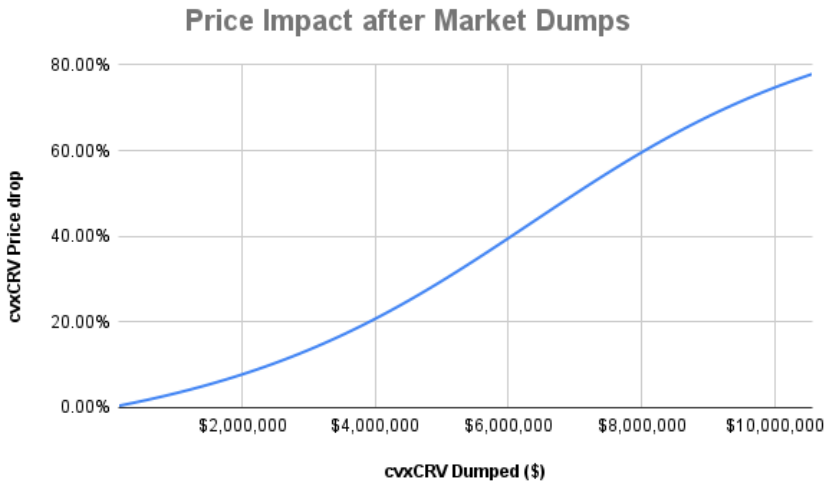


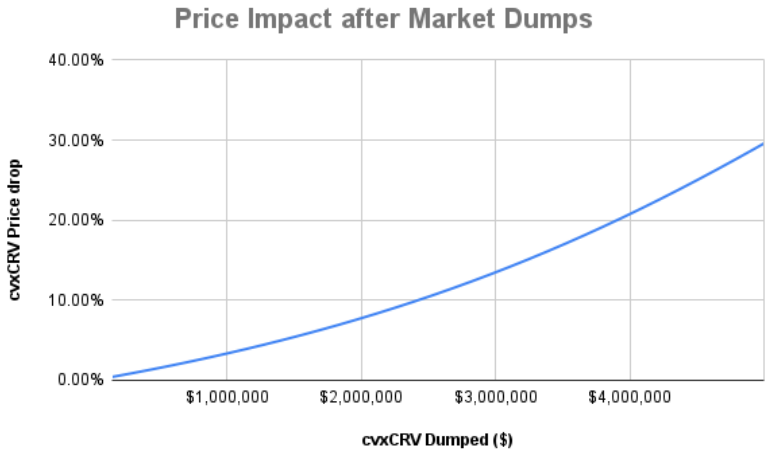
A more insightful metric to consider, therefore, is total CRV paired with cvxCRV. This currently stands at 7,891,873 $CRV (assuming full migration occurs between the two LPs) or ~$7.7M at current prices. An additional $1.7M (in USDC and FRAX) support the FraxBP.

- ☐ **On-Chain Slippage**

Trade (cvxCRV -> DOLA)	Slippage (cvxCRV -> CRV)	Slippage (CRV -> USDC)	Slippage (USDC -> DOLA)	Slippage TOT
$10,000	0.05%	0.02%	-0.16%	-0.09%
$25,000	0.13%	0.10%	-0.15%	0.08%
$50,000	0.26%	0.11%	-0.14%	0.23%
$100,000	0.53%	0.08%	-0.13%	0.48%
$250,000	0.71%	0.07%	-0.13%	0.65%
$500,000	1.48%	0.16%	-0.12%	1.52%
$1,000,000	3.22%	0.21%	-0.09%	3.34%
$2,500,000	10.59%	2.79%	-0.03%	13.35%
$5,000,000	28.76%	4.05%	0.03%	32.84%
$7,500,000	45.61%	6.90%	0.09%	52.60%

☐ **Price Impact**





☐ **Token Holders**

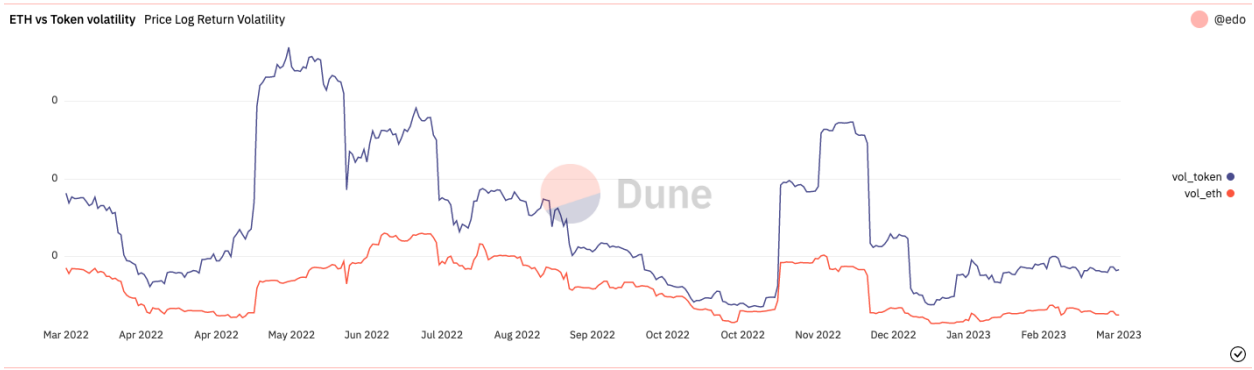
Holders: 3,725

Holder or Protocol	Percent supply
Convex Finance: cvxCRV Rewards	79.97%
0x9D0464...EDf279e8	17.35%
0x31c325...96D797A0	0.74%
0x72a193...e32db86E	0.47%
Convex Finance: Treasury Vault	0.23%

Volatility

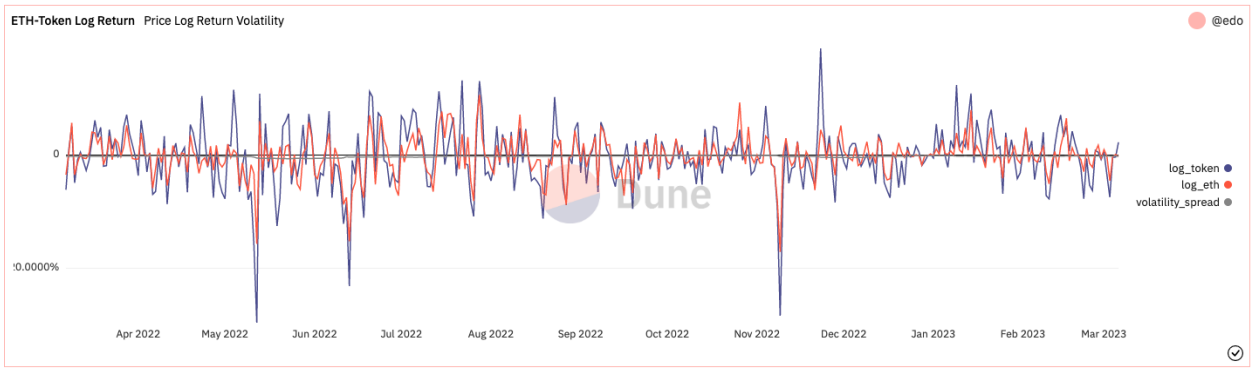
☐ Price Log Return Volatility

The charts below show that cvxCRV is generally more volatile than ETH (our base case) over time. There also appears to be a correlation between the two, which makes sense. cvxCRV's volatility is, in part, due to its shallow liquidity, as well as its tight correlation with CRV which itself is a volatile asset.



The volatility of the token's price is assessed by calculating the daily log returns of the median price using the natural logarithm of the ratio between the current day's and the previous day's median price. The variation coefficient of the token is then computed as the ratio between the volatility (standard deviation) and the mean of log returns over a specific number of days (7/30).

Below, we see there is generally an acceptable volatility spread over a year long time period between cvxCRV and ETH.



Emissions

- ☐ **Emissions Policy, what are emissions used for?**

N/A

Utility & Use Case

- ☐ **Does the Token have utility, Can it retain the utility while supplied to FiRM? (10)**

In January 2023, the Convex team announced updates to cvxCRV. Notably, these are:

- 2% platform fees directed to buy/lock $cvxCRV/weekly (estimated 3M $cvxCRV/year)
- Rewards earned by locked $cvxCRV will go to stakers
- Ability to use staked $cvxCRV as collateral (ERC-20 compatibility)
- Increase CVX emission rewards
- Adjustable reward payout (game theory amongst stakers)

Important to note that this is not replacing the $cvxCRV token — this functions as a new staking wrapper.

A new salvo in the Curve wars for Convex.

- ☐ **Liquid or locking feature (10)**

cvxCRV is tokenized veCRV. If a user deposits CRV into Convex, that CRV is locked forever on the platform as veCRV. A tokenized version of veCRV, cvxCRV, is returned to the user at a 1:1 rate. cvxCRV conversion is 1-way. Liquidity pools exist that allow users to swap cvxCRV for CRV tokens.

- ☐ **Goal of the token, where is value derived from? (10)**

Convex purpose is to scoop up as much CRV as possible. cvxCRV value is derived by how much CRV Convex hold and the future prospects of them increasing their bag.

Conclusion

In conclusion, the due diligence conducted by Inverse Finance's Risk Working Group has determined that cvxCRV is a suitable collateral for the fixed-rate lending market, FiRM. Convex is a staple name in the Cryptocurrency space and an active player in the Curve wars and we have little reason to believe this won't continue being the case. The team has demonstrated a strong commitment towards cvxCRV with the latest upgrades announced earlier this year. cvxCRV's new utility being showcased on FiRM will surely garner much attention from the Convex Team and DeFi community as a whole.

Some points to improve upon… while we can assume that the Convex team has implemented appropriate risk management measures to ensure the safety and security of user funds, little is known of the team itself, and quality audits are lacking. The Bug Bounty program is also somewhat lacking compared to peers in the space with similar TVL, with only a maximum payout of $250k and unclear amounts of total available rewards. cvxCRV liquidity remains thin, which will require the market to launch in a "guarded-mode". The oracle solution described above is elegant and, while not as simple as a chainlink price feed, is a sufficiently appropriate solution for the market.

Overall, the Risk Working Group has evaluated cvxCRV technical and economic characteristics and has determined that it possesses the necessary attributes to be used as collateral on the FiRM platform. The RWG will reassess the market after an initial period and might recommend changes be made based on: DOLA's liquidity picture and demand, the liquidity of the asset, and whether we have evidence MEV searchers have found and integrated the market enabling automated liquidations.

Asset Score

N/A

Parameter Recommendations

Supply Ceiling	$1,000,000
Initial Fed Supply	$500,000
Daily Borrow Limit	$100,000
Liquidation Factor	50%
Firm Global Supply Ceiling	$5,000,000
Collateral Factor	50%

Supply Ceiling - Setting the supply ceiling for an asset, though influenced by such factors as market demand, collateral volatility, correlation with other assets, and overall risk appetite, should ultimately be determined by considering the overall liquidity picture and slippage figures for said asset. Put simply, If the collateral has high liquidity, then the supply ceiling can be set higher because it is easier to sell the collateral in case of liquidations. In the case of cvxCRV, liquidity is somewhat slim. Once the migration between cvxCRV liquidity to the new more reliable cvxCrv/CRV pool is complete, we can expect 7.8M CRV and 1.7M from the FraxBP or around $9M (at current prices) “backing” cvxCRV. Slippage figures are encouraging, with $100k cvxCRV trade incurring only 0.48% slippage, and $500k cvxCRV incurring 1.52% (see table above). Simulations were also ran on a 3M cvxCRV sell order (~$2.45M), which resulted in a 12% price drop. Based on the above, we recommend the initial supply ceiling for cvxCRV be set to $1,000,000. The data suggests this amount is on the lower end of what we can consider safe.

Initial Fed Supply - the amount the Fed injects to the market up to supply ceiling. The RWG recommends this amount be $500,000, a figure derived from both supply ceiling and daily borrow limit and proportionally in line with other collaterals on FiRM.

Daily Borrow Limit - Like all factors here, daily borrow limit is set to strike a balance between meeting market demand and managing risk. The RWG recommends this amount be set to $100,000 per day. This figure is derived in relation to the supply ceiling, is intentionally conservative, and we believe appropriate for a new market launch (of this kind). This figure, along with the supply ceiling, can be adjusted upward if the liquidity picture of cvxCRV is improved.

Liquidation Factor - It is important to set the liquidation factor carefully to ensure that the platform can manage its risk exposure effectively. If the collateral has a history of high price volatility, if the collateral has low liquidity, and if the platform has a low risk appetite, these are all true in our case and are grounds to set a higher liquidation factor. At the same time, it’s likely

our TWG will have to carry out liquidations for this market initially as we can't assume automated liquidations will take place by MEV liquidators (until we can prove cvxCRV is being searched). As such, we recommend the liquidation factor be set to 50%, so that the liquidation incentive matches with CF.

Firm Global Supply Ceiling - Global Supply ceiling (currently set at $4,000,000) will increase to $5,000,000 to account for the supply ceiling for the cvxCRV market.

Collateral Factor - Setting the collateral factor requires balancing the risks associated with the asset being used as collateral with the demand for loans. Assets with lower risks may have higher collateral factors, while assets with higher risks may have lower collateral factors. Ultimately, the collateral factor is closely related to, and influenced by many of the factors pertaining to the parameters presented above. While parameters above act as a backstop, the collateral factor determines whether an attack on the protocol can be profitable for the potential exploiter capable of manipulating our price oracle implementation. Given all the above and in the absence of our in house asset scoring model (still in development) the RWG recommends we launch with cvxCRV market with collateral factor set at 50%. At 50% CF, the protocol starts to take on bad debt if the cvxCRV oracle price allows for an account's collateral to become less than 10% the value of the loan position. For this to happen, a price drop of 45% or more is needed for the collateral asset before a full liquidation is able to take place (full liquidation meaning the position is brought back to health, not the entire loan being repaid).