MATRIX: DECENTRALIZED RESERVE CURRENCY

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Matrix presents decentralized, over-collateralized and capital-efficient reserve protocol using Cosmos SDK. Matrix enables liquid, capital efficient convertibility between stable assets and collateral using front-running resistant oracle to achieve the swapping.

I. INTRODUCTION

Decentralized Finance stablecoins can help 1.7 billion adults who lack access to the banking system. Current stablecoin protocols remain incomplete. USDT and USDC which have the largest market capitalization remain centralized projects. Discretionary choice of parameters of decentralized protocols minting and burning stable assets using collateralized debt positions makes it capital inefficient and unstable. Algorithmic/Under-collateralized stablecoin capital efficient designs have experienced bank-run situations and liquidity crises.

Currently, there is still no decentralized reserve currency protocol on Cosmos. Matrix protocol allows swaps at oracle value between speculative assets and collateral. The volatility of the collateral in the reserves hedged using perpetual futures.

Matrix achieves stability by transferring collateral volatility to third party users seeking leveraged long exposure with no funding rates. Matrix aims for over-collateralization by incentivizing Liquidity Providers (**LPs**)[1], that is extra agents that bring collateral to the protocol and help it manage its risk. Matrix introduces two different types of LPs: Leverage Agents (**LAs**) and Insurance Agents (**IAs**) to collateralize minted stablecoins.

The rest of the paper is as follows. Section II explains the importance of the Neo token. Section III introduces the various LPs in the Matrix protocol. Section IV explains the Matrix DAO designed to incentivize the various LPs and drive value and utility of the Neo token. Section V summarizes the major contributions of the Matrix protocol.

II. NEO TOKEN

The goal of Matrix's protocol is to mint stable assets tradable on the Cosmos eco-system. Matrix will mint NEO stablecoin pegged to USD using OSMO as collateral[2].

Matrix let users mint stablecoins with the collateral of their choice and vice-versa at oracle value for minimal fees[3].

A. Mint and Burn

1. To mint NEO a stable asset, the user must send to Matrix a whitelisted collateral. An oracle determines how many stablecoins need to be minted and sent to the user.

2. If the oracle price for OSMO is 10$, and if the fees are 0.3% of the transaction, then a user sending Matrix 1 OSMO will receive 9.7 NEO.

3. For users looking to cash out: they must send NEO back to the protocol, specify the whitelisted collateral they want and receive the chosen collateral; specified by the oracle post transaction fees.

4. NEO received by the protocol is burnt. If the oracle price for OSMO is 10$, and if the transaction fees are 0.3% then a user giving Matrix 10 NEO will receive in exchange 0.97 OSMO. The 10 NEO received is burnt by the protocol.

5. The mint and burn transactions are executed without slippage on the price, regardless of the size of the transaction.

6. The fees Matrix protocol is to remunerate LPs which guarantee the robustness of the system and depend on the collateral from users that is hedged by LPs on Matrix.

7. Direct arbitrage opportunities arise whenever NEO trades at a price different from its peg. If 1 NEO trades at a price above 1$. The incentive is to mint NEO for 1$ worth of collateral and then sell these newly minted NEO for more than 1$ on the market, reducing the price of NEO closer to 1$. Opportunities for arbitrage are reduced when there are transaction fees.

8. A stable seeker will use Matrix to convert collateral to NEO[4].

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[1] In the current paper we refer to the liquidity providers as **LPs**

[2] OSMO will be the first collateral which will be accepted. Governance will decide on all future whitelisting of collateral

[3] The issuance of the stablecoins with collateral and burning the stablecoins for collateral is that of a swap from a user perspective.

[4] Matrix does not let you over-collateralize the loan.

B. Need for LPs

1. If the protocol has 1 OSMO worth 10$ and 10 NEO was minted, the collateral ratio is 100%. If the price of OSMO decreases to 5$, the collateral ratio is now 50%. A user could come with 5 NEO and get 1 OSMO from Matrix and reducing the exchange collateral and be left with 5 NEO. The intrinsic value of NEO is then no longer 1$.

2. To enable swapping collateral against stablecoins and stablecoins against collateral, Matrix protocol aims for over-collateralization by incentivizing Liquidity Providers (**LPs**).

III. LIQUIDITY PROVIDERS (LPS)

A. Leverage Agents (LAs)

1. When a stable seeker gives 1 OSMO to the Matrix protocol, the protocol is subject to the volatility of OSMO. To insure the protocol against the volatility of the collateral backing the stablecoins, Matrix created a way to transfer the volatility to other actors willing to get leverage on collateral: the Leverage Agents (**LAs**).

2. **LAs** get perpetual futures from the Matrix protocol. The futures are leveraged exposure on the collateral backing NEO. **LAs** insure Matrix against drops in collateral price ensuring that the protocol has reserves to reimburse stable holders. The **LAs** bring some collateral, and choose the leverage ratio to insure the amount of collateral from stable seekers [5].

3. If 1 OSMO is worth 10$, if the **LAs** bring $\mathcal{M} = 10$ and $\mathcal{A} = 50$, then the **LAs** takes the variation of 50 OSMO with their 10 OSMO. If OSMO goes to 12$, the **LAs** will earn a leveraged return of $10 + 50 \times (1 - 10/12) = 18.33$ OSMO. On the opposite, if the price for one OSMO drops to $50/60 \times 10 = 8.33$, the **LA** will have lost her investment, which will be absorbed by the protocol to stay collateralized[6]. .

4. **LAs** pay transaction fees when they come in and exit the protocol. Matrix does not incentivize the **LAs** with funding rate like centralized exchanges. Entry and exit costs to the protocol depend on the coverage ratio on the collateral from stable seekers. Low coverage ratios make it expensive to enter/exit the protocol and vice-versa.

5. **LAs** position cannot be modified. A single address can own multiple **LAs** positions within a same pool or within different pools within the protocol. There is a time lock after each update on the position of a **LA** to prevent **LAs** from taking advantage of potential oracle failures or advantages.

6. In the entry/exit of **LAs** insuring the protocol collateral brought by stable seekers, there may be mismatches and not all users positions may be completely insured, using perpetual futures. A new type of liquidity providers is therefore needed to account for these temporary imbalances and to serve as a buffer between stable-seekers and the leverage agents; they are called Insurance Agents **IAs**.

B. Insurance Agents (IAs)

Insurance Agents (**IAs**) act as a buffer for the moments when Leverage Agents do not fully insure the protocol's reserves (collateral brought by users). **IAs** entrust Matrix with their liquidity so that they automatically accrue interests on the assets they brought. The risk for them is to incur a slippage when the protocol is not well collateralized.

1. *Incentive Design*

When lending money to over-collateralize the protocol, **IAs** are taking risk, they should be incentivized for taking this risk:

1. A fraction of the transaction fees obtained when minting or burning NEO are redistributed to IAs in proportion to how much they contribute to the protocol. **IAs** will be able to stake their positions to receive governance tokens.

2. **IAs** earn interests not only on the collateral they lent but also on the collateral brought by stable seekers[7].

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[5] If a stable-seeker brings $\mathcal{A}$ OSMO, **LAs** can choose $\mathcal{M}$ OSMO to hedge collateral; where $(\text{A+M})\frac{}{\mathcal{A}}$ is a leverage multiplier. **LAs** get gains or have to pay for the loss from the $\mathcal{M}$ OSMO. They get from the protocol: $\mathcal{A} + \mathcal{M} \times (1 - \frac{initialprice}{currentprice})$. **LAs** gets liquidated when the the price drops to: $currentprice\frac{\mathcal{A}}{(\mathcal{A}+\mathcal{M})} \times initialprice$.

[6] **LAs** will not be able to back-any amount greater than the collateral brought by stable-seekers. Derivation on the constraints for **LAs**

[7] For the **IAs** to get the extra yield, part of the Matrix reserves need to be transferred for getting yield on it (i.e., lending to protocols). Suppose the protocol owns 1.5 OSMO out of which 1 comes from users who minted and 0.5 comes from **LPs**. If the whole protocol reserves are put into lending strategies, **LPs** will be receiving interests on 1.5 OSMO although they just brought 0.5 OSMO: they receive 3 times more interests than they would get by lending directly to other protocols. Because of the mul-

3. Not all the transaction fees and lending returns are given to IAs: the [**?**] Matrix DAO decides on the distribution of the fees between the **LPs** and the treasury.

4. **IA** receives a token for contributing to a collateral pool[8].

5. **IAs** ensure the collateralization of the protocol in the situations when there are no perfect matches between users and **LAs**. If the protocol is not collateralized enough, they are at risk of not being able to get all their money back, there will be slippage when the protocol is not enough collateralized[9].

IV. MATRIX DAO

Matrix DAO uses an incentive pendulum for the optimal allocation of the rewards (fees, yield governance tokens) between the **LPs** and an Insurance Fund (**IF**) to make sure the protocol is stable and the users can get their collateral back during market stress events.

A. Incentive Pendulum

The objective of the design is to prevent the Matrix DAO from becoming **inefficient**, (majority of rewards to **LPs** and not enough funds in the (**IF**) for payout during bear markets) or **under-utilized** (majority of assets in the (**IF**), increasing bankruptcy risk due to under-collateralization).

Scenario	LP Assets	IF Assets	Ξ	LP Rewards	IF Rewards
Optimal	67%	33%	3	67%	33%
Under-utilized	50%	50%	-	0	100%
Inefficient	100%	0	1	100%	0

TABLE I. Incentive Pendulum: Allocation of the capital between the LP and the IF, where $\Xi = \frac{LP+IF}{LP-IF}$; LP = LP assets, IF = IF assets.

The on-chain redistribution of the assets and the rewards between the (**LPs**) and the (**IF**) is automated. The IF is a reserve fund created and seeded at genesis in the DAO to guarantee payouts to (**LPs**). At Genesis, the assets in the DAO are divided between the LPs and the IF, where the IF is seeded at genesis, and the LPs are contingent on user validation and delegation. The DAO profit split is calculated as (Ξ) where $\Xi = \frac{LP+IF}{LP-IF}$; LP = LP assets, IF = IF assets. The DAO uses the inverse of the Ξ to distribute the funds between LP and IF. The incentive pendulum monitors the distribution of the assets and rewards between the LP and the IF to make Matrix operate and allocate between the following states.

Table(I) provides the split between SF and IF at genesis.

(a) **Optimal** This is the desired state, where LPs 67% of the assets and the IF 33% of the assets. In such a situation, the system income is distributed as follows: 33% for the IF and 67% for the LP. (b) **Under-utilized** The system may become unsafe where LPs 50% of the assets and the IF 50% of the assets. In such a situation, the system income is distributed as follows: 100% for the IF and 0% for the LP. The unsafe scenario needs to be explained in further detail to completely understand the design of the DAO; the balances of Matrix in the Insurance Fund is a function of the bankruptcy risk[10]. (c) **Inefficient** The system can also become inefficient, where LPs 100% of the assets and the IF 0% of the assets. In such a situation, the system income is distributed as follows: 0% for the IF and 100% for the LP. This situation would not be helpful in bear-markets, Matrix DAO would balance the imbalance by re-allocating between LP and IF to pursue maximum yield. The Matrix incentive pendulum will help maintain the protocol at near-optimal states. Ultimately Matrix stakers can vote to re-capitalize the Insurance Fund.

tiplier effect the Matrix protocol can guarantee higher yield to **IAs** than other lending platforms. The transaction fees, governance tokens and interests which the **IAs** receive is based on the over-collateralization ratio of the Matrix protocol.

[8] **IA** brings OSMO to the protocol and receive sNEO, for its share of the OSMO-NEO based on the current exchange rate based on the oracle. On issuance of sNEO, **IAs** earn interests and rewards through transaction fees arriving to the pool and the interests from collateral being lent. **IAs** receive transaction fees from transactions from the pool they contribute to.

[9] Let's say that 100 NEO were minted with 10 OSMO backing it, where 1 OSMO is worth 10$, so the protocol is fully collateralized. Then a **IA** brings 1 OSMO to the protocol. She will earn the fees and the yield rate on 11 OSMO available plus the transaction fees accruing in the meantime. If the 1 OSMO is worth only 8$, the protocol is under-collateralized and the **IA** will not be able to get all her money back when exiting. If the slippage at this point is 90%, then the **IA** is willing to cash out 1 OSMO will only be able to get 0.1 OSMO. The slippage factor will be a piecewise linear function of the collateral ratio to make the risk predictable for **IAs** while still incentivizing them to stay in the protocol. Having a continuous function is also necessary to limit front-running effects. The smaller the collateral ratio, the bigger the slippage. Above a certain collateral ratio (for instance 120%), no slippage will be set for **IAs**.

[10] At Genesis, IF will be initialized with a percentage of the Matrix tokens. Matrix tokens will be utilized to update the weighted capital allocation policy between the LP and IF periodically through on-chain governance (proposal and voting-based governance mechanism).

B. Governance

A core principle of Matrix Protocol is its decentralized nature and the DAO that will work on it from the beginning. This DAO is responsible for using Matrix protocol at its full potential and to improve it to make it a building block of the DeFi space in the end. The DAO will be responsible for parameters tuning, for deploying new stablecoins, for accepting new collateral for a given stablecoin, for protocol upgrades and integrations.

(a) The governance token of the protocol is vNEO. The idea with Matrix's governance token is to make its owner ship decentralized and to distribute it to actors in the community which use the protocol or collateralize it as IAs or LAs. The exact token distribution is likely to change.

(b) Governance token will be distributed through staking contracts and through a bonding curve letting people buy governance tokens using the protocol's stablecoins[11].

(c) The only situation in which the total supply is likely to inflate is where governance needs to be able to sell more tokens through the bonding curve to collateralize the protocol.

(d) Governance can choose to use the bonding curve to make burning stablecoins against the protocol's governance tokens cheaper hence enabling the protocol to collateralize itself. Then there is a collateral settlement process that freezes transactions as well as oracle value affecting a collateral and lets stable holders, IAs, and LAs claim the collateral that's owed to them[12].

V. MAJOR CONTRIBUTIONS

Matrix is a decentralized protocol designed to create reserve currency in a capital efficient way. It tries to improve over centralized designs as well as over over-collateralized and under-collateralized decentralized designs. Matrix innovates by proposing full convertibility at a 1:1 rate between stable assets and collateral. Collateral can always be swapped against stablecoins, and stablecoins can always be swapped against collateral at oracle value. The protocol involves 3 agents which all benefit from Matrix: Stable Seekers and Holders who issue and use stable assets, (**LAs**), who get perpetual futures from the protocol while insuring it against the variability of the collaterals' prices and (**IAs**), who help the protocol have enough liquidity at all times, even when the protocol is not fully covered by LAs.

[1] N. D. Birell and P. C. W. Davies, *Quantum Fields in Curved Space* (Cambridge University Press, 1982).
[2] A. Einstein, Yu. Podolsky, and N. Rosen (EPR), Phys. Rev. **47**, 777 (1935).

[11] The price at which governance tokens are sold is an increasing function of the number of tokens already sold through this mechanism. The bonding curve is a cheap way to increase the collateral ratio of the protocol. Governance token distribution will be used to incentivize people to contribute more to one people than another. It may not be directly activated at protocol launch.

[12] Details of the design of the incentive pendulum and the distribution/bonding of the governance token will be published.