MOV Stable Financial System

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Version: 1.0
Date: January 15, 2020

Abstract

This article proposes a stablecoin financial system based on the MOV cross-chain protocol. From basic economic and MOV infrastructure-building perspective, the system consists of a diversified collateral framework, stability mechanism and clearing system. Through the introduction of risk bonds. A brand-new onchain finance and multilateral trading mechanism is constructed on the basis of n the risk control models and theories in the traditional financial industry.

Keywords: MOV, cross-chain, stablecoin

1 Cross-chain and Stablecoin

A sound cross-chain ecology not only includes "crossing", but also "connecting". An onchain financial system is formulated by connecting diversified assets multilateral transactions, settlement and trade, and allowing organic linkages and interactions between discrete digital assets. The prosperity of a digital multilateral trading platform is inseparable from the construction of many onchain financial infrastructures, from transactions to lending, from pricing to settlement, from trading tender to storage of value, from currency issuance to financial intermediation. It has far-reaching significance for a cross-chain complexes to build a unified stablecoin system and clearing infrastructure on top of diversified and high value digital assets.

Hayek had systematically elaborated that individuals could issue currency ("The Denationalization of Money"), which, however, was not feasible due to boundaries of current times. Crypto-based stablecoins have greatly reduced the cost of private coinage, custody and circulation losses (almost zero). At the same time, due to the prosperity and development of the digital asset market for more than a decade, the value accumulation effect has made it possible for the rise and development of blockchain-based private currency. In recent years, a pattern of diversified competition has gradually emerged. The stablecoin system in the digital asset world should not overstep the boundaries of its liabilities. Instead of replacing the national currency payment / settlement / delivery system, the digital stablecoin could play a supplementary role in the early days of central bank digital currency (DCEP), finding an accurate positioning in the native digital assets realm that is dedicated to them, cultivating a stable clearing system, transaction medium and value storage in their own world.

Currently, stablecoins are mostly based on collateral digital assets, establishing a complete on-chain balance sheet and risk diversification mechanism. There are also well-known USDT-like offshore digital stablecoins that directly nest the balance sheet of the real financial system, promising a full amount of fiat currency liquidity reserve and 100% reserve mechanism, and even some stablecoin projects that stay in the theoretical stage are committed to building an algorithmic central bank based on the quantity theory of money (coin tax share), which varies between following rules and discretion. The first two are far superior to the third in terms of distribution mechanism, stability control, and application scenarios. They are also constantly competing and moving forward in their early areas of expertise, and the boundaries between them are gradually blurring. To sum up, the design of the stablecoin mechanism needs to consider core elements such as the balance sheet, qualified collateral, liabilities and equity, the stability mechanism and risk transfer, and unique ecological scenarios.

The MOV stablecoin system was born, served and beyond cross-chain. A robust decentralized federal gateway brings rich high-value asset liquidity to the MOV ecosystem. A set of diversified and qualified collateral frameworks is the prerequisite for the creation of stablecoins. It creates value and liquidity for high-value distributed assets on multiple dimension. The core of stablecoin system is to establish a unified value coupling, pricing and clearing infrastructure. It also means discovering new cross-chain boundaries and truly establishing a stable MOV financial system. Most of the current stablecoin projects start from the stablecoin itself, constantly telling the story of the stability mechanism and algorithm regulation, earning short-term benefits of replacing currency issuance or participating in the lending market, failing to build a complete ecosystem and the overall supporting facilities that stablecoin should have, which led to shortage of infrastructure dependency, rich collateral framework and application scenario expansion. Therefore such stablecoin system lost its positioning on being a lending matcher or a transaction medium, ignoring the core meaning of establishing a stablecoin- the right of clearing and pricing.

MOV will consider the design philosophy of stablecoins more from its complete ecological architecture and development blueprint, so that infrastructure can promote the construction of stablecoins, and stablecoins push back the evolution of infrastructure, and eventually form a standard pricing unit widely accepted by the ecology. Another difference from other stablecoin projects is the incentive cycle. MOV stablecoins will fully take into account all the roles of direct and indirect participation in the stable financial system and feedback the earnings of the stable system to the ecological builders to promote the positive operation of the ecosystem scaling.

2 MOV Stable Financial System Design

2.1 Qualified Collateral Framework

The MOV stablecoin is issued based on the excess mortgage model. The unit of account is MOV, which is 1: 1 floating anchored to the exchange rate of RMB to USD, that is, 1 USD = 7.03 MOV (5:02 AM UTC on November 26, 2019), allowing short-term two-way fluctuation. MOV's manageable floating exchange rate and currency autonomy will serve the construction of a modern onchain financial system, controlling the free flow of capital, actively embracing the process of compliance and leading the industry to positive development.

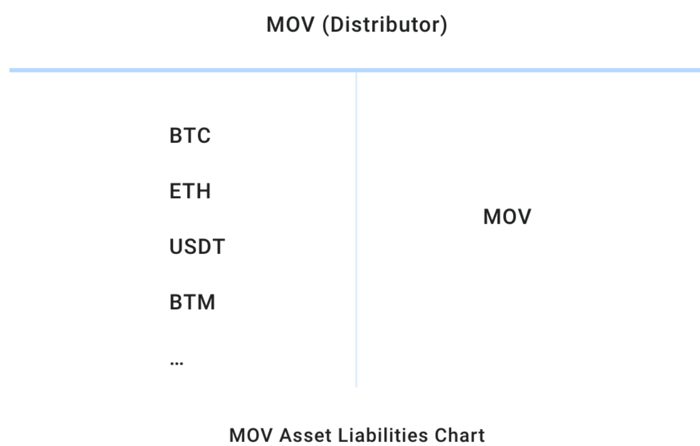


Figure 1: MOV Framework of Qualified Collateral

Cross-chain provides a diversified source of qualified mortgage assets for the collateral framework. The first batch of qualified collateral assets include BTC, ETH, USDT and BTM. The four types of digital assets have different liquidity risks and market risks, and the correlation risk between them will not be too high. Users can choose the type of collateral independently. The four types of assets are independently mortgaged and risk is isolated. From high to low, the haircut rate is ranked as BTM, ETH, BTC, USDT. Valuation haricut rate is an important tool to reduce system risk loss. It is also a dynamic change process. In the calculation formula of haircut rate, MOV follows the traditional VaR (Value at risk) calculation method and a more flexible parameter model (risk matrix). However, taking into account the unique value rules and instantaneous high fluctuation characteristics of the digital asset trading market Changjia and Lijun (2013) , professional manual statistical decisions will affect the confidence and variables (the holding length will affect the difference in distribution. In fact, we do not tend to adopt a purely normal distribution. Perhaps the t distribution will be more meaningful.) Guidelines on Bank Collateral Management ". Therefore, the real-time adjustment of liquidation mortgage multiples and benchmark mortgage multiples (measured in terms of every 6 hours, every hour, every 15 minutes) will be an advantage and also a challenge in the design and implementation of MOV stablecoins. Another important consideration is the settlement liquidity of mortgage assets. Efficient asset liquidation helps the system to respond to market risks as quickly as possible, thereby reducing the risk and loss suffered by the entire system. The ideal combination is definitely a stable market with instant liquidity. MOV will fully evaluate and simulate the settlement ratio, settlement rate and market affordability of each asset under different market fluctuations based on its own risk measurement model, define the liquidity factor for liquidation, and combine with the VaR calculation factor to form the final liquidation mortgage Rate calculation model.

$$W^* = W(1 + R^*) \tag{1}$$

$$VaR = E(W) - W^* = -W(R^* - \mu) \tag{2}$$

Among them, the initial value of W assets, the minimum value at the end of W^*, the expected return at the end of R, the mathematical expectation and standard deviation of R are μ and σ, and R^* is the minimum rate of return.

$$VaR_\alpha = \inf\{l \in \mathbb{R} : P(L > l) \leqslant 1 - \alpha\} = \inf\{l \in \mathbb{R} : F_L(l) \geqslant \alpha\} \tag{3}$$

Confidence interval $a \in (0, 1)$, the probability of loss L exceeding the minimum value l does not exceed $(1 - \alpha)$.

$$\frac{d\mathcal{L}(x)}{dx} = \frac{M^2(x)}{V(x)G(x)} \tag{4}$$

$$\mathcal{L}(x) = \frac{\int_a^b \frac{M^2(x)}{V(x)G(x)} dx}{b - a} \tag{5}$$

$\mathcal{L}(x)$ represents the calculation function of the liquidity factor in the interval $[a, b]$ under the influence of the market volatility variable x, with the liquidation rate V, the number of liquidated proportions M, and the current market affordability (the ratio between the total amount to be liquidated to the market depth G without causing much price fluctuation)

$$LiquidationRate \simeq 1 + VaR_\alpha * \mathcal{L} \tag{6}$$

Each type of collateral corresponds to a different debt ceiling, which helps to adjust the debt ceiling of the entire stablecoin system flexibly and avoid centralized risk exposure. The total debt ceiling will be established in accordance with the business scale and category. Four different debt ceilings will be set according the asset value consensus and risk resistance, that is BTC, ETH, USDT, BTM.

The setup of stable fee rate (SR) and liquidation rate is related to system risk intervention and incentive feedback. In the MOV stablecoin system, the assets are pure with four types of mortgage assets and one stablecoin debt. There are no currency (equity) decision makers, and they will not maximize their own interests by affecting the stable fee rate and the settlement fee rate, and ignore the healthy operation of the entire system. The system revenue will be used for intervention and repayment of risks and incentive to all contributors in the system. The adjustment of the stable fee rate will also be used as a means to regulate the supply and demand of the stablecoin market. When the premium is reduced, the stable fee rate is reduced to promote the generation of stablecoins, and when the value is depreciated, the fee is increased to slow down the issuance. Under normal circumstances, part of the total debts borne by users comes from the accumulated stability fee. It is not a fixed value, but is positively related to the amount and time pledged. The actual cumulative stable rate change does not have a simple linear relationship with the time variable. At the same time, the impact of the new round of adjustment of the stabilization rate on the calculation of the accumulated stabilization fee (the stabilization rate becomes an independent variable) must be considered.

$$exp(SR) = \lim_{time \to \infty} (1 + \frac{SR}{time})^{time} \qquad SR(round) = SR_0 \prod_{i=r_0+1}^{round} SR_i \tag{7}$$

In addition, when actively defending against fluctuations of collateral value, we may consider choosing an advanced collateral model, hedging liquidation risks and asset depreciation by introducing operations such as hedging and additional margin. However, given the immature and high-risk nature of the digital asset futures market, such measures are not used as standard operation.

For diversified pledges of users, a comprehensive risk assessment coefficient θ (referred to as "comprehensive coefficient") is established. The comprehensive coefficient itself is not used as the principle and basis for system settlement. It reflects the risk differences experienced by users who choose different (category and quantity) mortgage asset portfolio baskets in the face of overall market fluctuations. Given the variation of liquidation efficiency and loss avoidance for four different assets, the coefficient helps users to determine the best mortgage portfolio, avoid suffering greater liquidation and saving much maintenance effort. The comprehensive coefficient will be combined with the four types of real-time feed price set RP and real-time mortgage rate set RCR to form a user risk index $\mathbf{H}$, and a user's sensitive feedback mechanism on market risks will be established. (coefficient θ will combine asset weighing, real-time risk of independent asset, liquidation losses and efficiency, anti-market temporary parameters).

$$\theta = \frac{\sum_{i=1}^{n} w_i x_i}{\prod_{i=1}^{n} x_i^{-1} \gamma_i} \qquad \mathbf{H} = \{\theta\} \cup RP \cup RCR \tag{8}$$

2.2 System Roles and Architecture

The stablecoin system empower assets to create value storage and form [total assets = assets + liabilities], and value storage can also cooperate with multi-level leverage cycle operations to form [total assets = assets + liabilities * [multi-level leverage multiples]], maximize leverage. The initial stage of the MOV stable financial system will mainly focus on the revenue-generating effect of multi-level synthetic assets (lending market) on users. On-chain financial infrastructure will be built to serve liquidity and application scenarios will not be fixed so that ecological developers and applications can be connected freely.

The system roles are categorized as follows:

1). *Loaner*

Participants who obtain stablecoin through mortgage of four assets.

2). *Lender*

Participant who engaged in asset synthesis and loaning trade. He is a solid provider of system liquidity while expanding the system's business boundaries.

3). *Third Party Clearing Arbitrage*

Contributes liquidity to the stablecoin system. He is the guardian of the system and earns considerable profits.

4). *Third-party oracle*

Provide real-time pricing feeds, connecting the on-chain and off-chain worlds, and expand MOV financial boundaries.

5). *Creditors*

When the system encountered gray rhinos and black swans, they purchase bonds and inject confidence into the system and restored stability to earn more profits in the future.

6). *Market maker*

Provide liquidity for the lending and asset synthesis market, improving on-chain financial mechanisms, and expand to relevant third-party applications outside the system.

7). *Application developer*

They build stable financial system based on MOV by expanding more innovative scenarios and is committed to the multi-level release and circulation of assets and stablecoin value.

8). *Stablecoin system*

- Stablecoin contracts: a decentralized mortgage issuance and settlement mechanism based on on-chain smart contracts. The operations are completely open and transparent with controllable risks;
- Risk intervention system: the risk intervention mechanism advocated by the MOV when the system encounters high risks;

- MOV on-chain oracle: a unique on-chain oracle system that cooperates with a third-party oracle group to provide more real-time and accurate feeding and information interaction;
- Venture capital pool: A rescue pool consisting of system operating revenue, which is coordinated with the risk intervention system to ensure system stability.

9). *Lending Pool*

Actively cooperate with the market maker mechanism to provide rich liquidity for the asset synthesis and lending market, and accelerate the expansion of the stablecoin application scenario.

10). *Stablecoin Lending*

The lending market supports stablecoin lending services, encourages users to participate in stablecoin mortgage to obtain profits, and at the same time accepts feedback and coupling to the stablecoin system so that on-chain financial parameters can be automatically discovered and adjusted under market rules. The lending market also provide considerable stablecoin pool liquidity services for third-party onchain and offchain applications, allowing the market to participate in the process of discovering new scenarios. It is also one of the monetary policy tools of the entire MOV stablecoin system, which can increase / decrease interest rates to expand / suppress demand to maintain price stability.

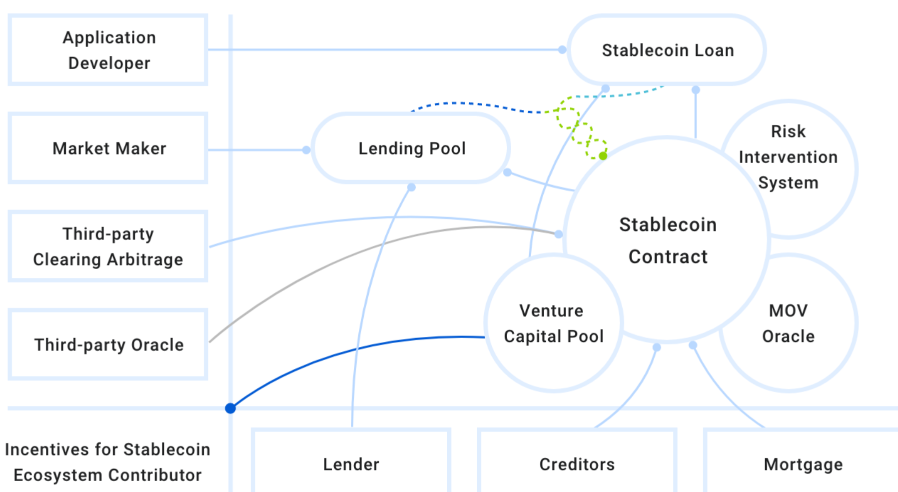


Figure 2: MOV Architecture and Composition

In the diagram above, we have actively created three liquidity pools, which not only provide liquidity support for the creation and distribution of stablecoins, but also encourage external third-party developers and applications to actively and conveniently participate in the entire MOV financial system, whether it is the four high-value mainstream consensus assets or the stablecoin debts based on the qualified collateral framework. They are all-natural good assets and digital currencies. MOV is the asset compound of business and valuable assets. Instead of breaking into other ecosystems, MOV would rather promotes the formation of a multilateral community, shares liquidity and clearing infrastructure, blurs the boundaries of stable financial systems among each other and expands common competition and interest patterns.

2.3 Stability Mechanism and Risk Liquidation

The internal stability mechanism of MOV is based on risk clearing and risk bonds. It not only encourages the market to participate in the spontaneous response to liquidation arbitrage, but also reduces user losses and black swan prevention through risk intervention and reserve mechanism.

MOV sets up a three-level clearing system:

- Level 1: market arbitrage clearing. This level of risk is relatively local with controllable market changes. External third party arbitrageurs are encouraged to participate in the liquidation process. They have the right to determine the bidding items and price, and autonomously connects the trading market and counterparties by earning market spreads. A good clearing market cannot be separated from the protection of third-party arbitrageurs;
- Level 2: The system is liquidated as a whole. At this time, the system is often subject to higher risks. The system is completely frozen, and the liquidity of third-party clearing is insufficient to cope with the deficit. The system will be involved in clearing and settlement (market making and risk intervention fund pool) and become the largest market arbitrage clearer. As a result, liquidation profits are obtained, which further strengthens the official market making capability and consolidates system security;
- Level 3: liquidation of risk bonds. This is the ultimate liquidation mode initiated when the black swan event occurs. The system will minimize user loss through the issuance, auction, repurchase and other operations of credit bonds. Bonds will be created through the communal effort of MOV system, federal nodes, consensus nodes, and Bytom jointly.

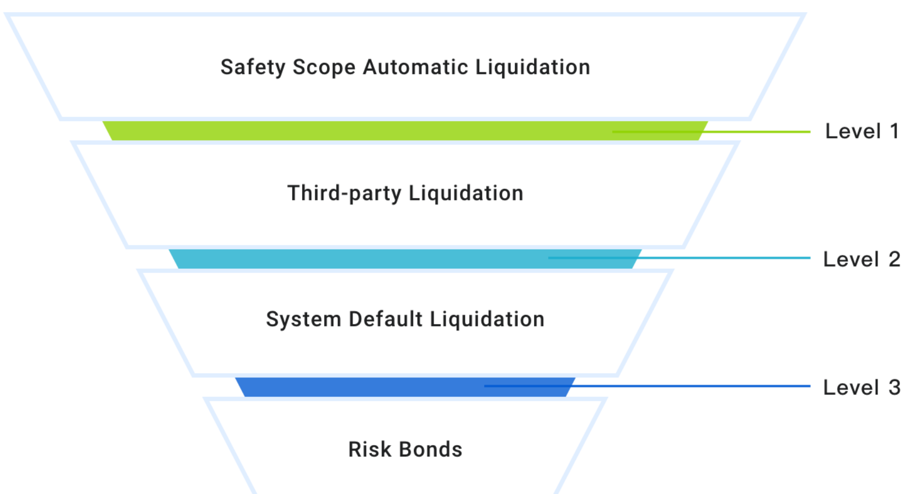


Figure 3: MOV Three-level Clearing System

MOV risk bonds are not a dual currency / equity system, and do not rely on the minting tax brought by the issuance of equity tokens Mikko (2018). It is also different from the bonds issued by the central bank of the fiat currency system. It is a credit bond issued at the time of crisis to maintain stability through the absorption of liquidity to tighten supply. As the market picks up, stablecoins will be issued to repurchase bonds, supporting the repurchase policy, and giving benefits to creditors. The bond is tentatively named after Fisher (to pay tribute to Fisher's equation on macro-control) and supports two types of auction mechanisms:

- Debt auction: The system issues the credit debt Fisher, and sells it in an open auction to raise a sufficient amount of stablecoin MOV, and redeems the mortgage assets from the system.
- Reverse auction of collateral: The system will sell these mortgage assets in the form of open auction, and the MOV (debt part + liquidation penalty part) raised will be used to repurchase and destroy Fisher (if there is sufficient MOV to pay the debt in addition to the liquidation penalty, the mortgage auction will be converted to the reverse auction mechanism, the least amount of collateral will be sold, and any remaining collateral will be returned to the original mortgagor).

The following flow chart shows a detailed Level 3 liquidation, which involves participants like risk interference systems, mortgage contract systems, creditors, mortgagors and arbitrage participants. It can be seen from the bookkeeping records of each role that if Level 3 liquidation respond promptly, every participants are allowed to maximize profits and minimize liquidation losses.

2.4 Debt Arbitrage and Stability

Price fluctuations can only be dispersed and transferred but cannot be eliminated. The total assets equal the total liabilities. Both ends of the balance sheet will face market risks and runs, especially the liability side as there is space for arbitrage. As mentioned earlier, MOV is based on a manageable floating exchange rate system. The arbitrage space of stablecoins can stimulate market participation to some extent:

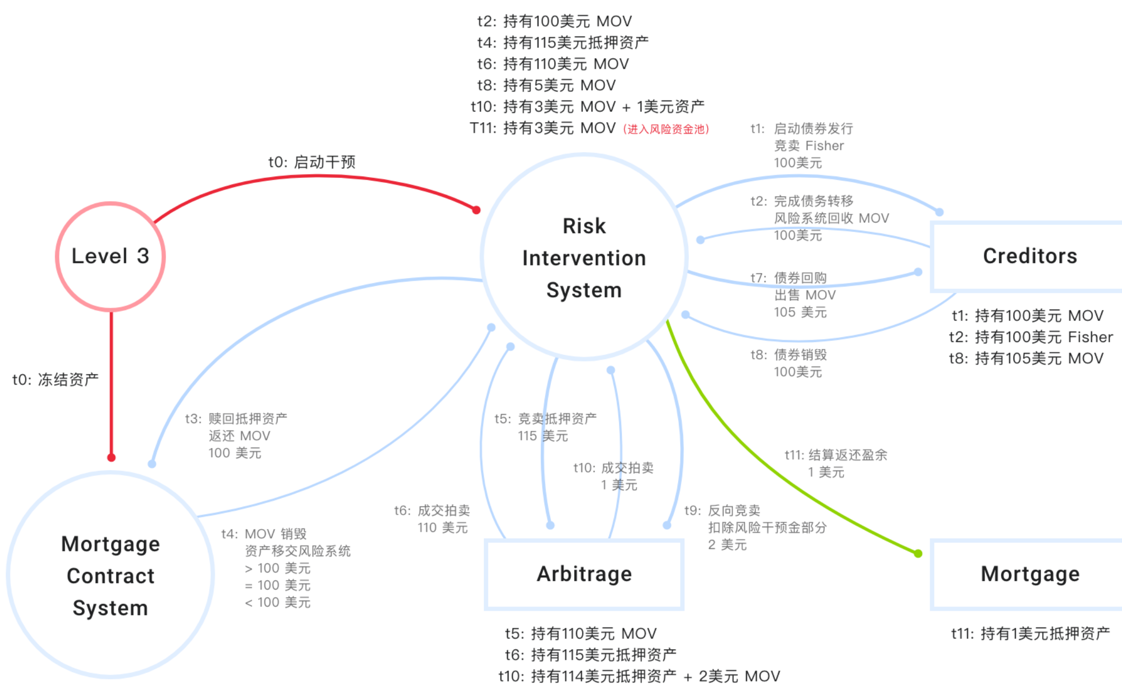
- Sell MOVs that they bought before when the current market price is higher than the anchor price, or you can borrow MOVs and sell short;
- Buy MOV when the current market price is lower than the anchor price and sell it after its value returns to the anchor value.

But this will also amplify the volatility of the liability side, while requiring market participants to have confidence in the return of prices. To this end, MOV will also support corresponding monetary policy tools and liability-side stability mechanisms (on the premise of asset-side stability):

1). *Asset-side intervention (mortgage intervention*

Readjust the mortgage ratio (or stable fee rate) to suppress / increase the MOV supply.

- When the market price is lower than the anchor price, increase the mortgage ratio, so that fewer MOVs are generated;
- When the market price is higher than the anchor price, the mortgage ratio is reduced so that more



交易行为	时间	风险干涉系统	债权人	抵押合约系统	套利参与者	抵押者	总价值
冻结资产/启动干预	t0	0	100 美元 MOV	115 美元抵押资产	110 美元 MOV	–100 美元 MOV	225 美元
启动债券发行，竞卖 100 美元 Fisher	t1	100 美元 Fisher（发行）	100 美元 MOV	115 美元抵押资产	110 美元 MOV	–100 美元 MOV	225 美元 + 100 美元（虚拟）
完成债务转移，风险系统回收 100 美元 MOV	t2	100 美元 MOV	100 美元 Fisher	115 美元抵押资产	110 美元 MOV	–100 美元 MOV	225 美元 + 100 美元（虚拟）
返还 MOV，赎回抵押资产	t3	115 美元抵押资产	100 美元 Fisher	100 美元 MOV	110 美元 MOV	–100 美元 MOV	225 美元 + 100 美元（虚拟）
合约系统销毁 MOV	t4	115 美元抵押资产	100 美元 Fisher	0	110 美元 MOV	0	225 美元 + 100 美元（虚拟）
竞卖 115 美元抵押资产	t5	115 美元抵押资产	100 美元 Fisher	0	110 美元 MOV	0	225 美元 + 100 美元（虚拟）
成交拍卖 110 美元	t6	110 美元 MOV	100 美元 Fisher	0	115 美元抵押资产	0	225 美元 + 100 美元（虚拟）
债券回购，出售 105 美元 MOV	t7	110 美元 MOV	100 美元 Fisher	0	115 美元抵押资产	0	225 美元 + 100 美元（虚拟）
回购成功，销毁 100 美元 Fisher	t8	5 美元 MOV	105 美元 MOV	0	115 美元抵押资产	0	225 美元
扣除 3 美元风险干预金，剩余进行反向竞卖	t9	5 美元 MOV	105 美元 MOV	0	115 美元抵押资产	0	225 美元
成交拍卖 1 美元资产	t10	3 美元 MOV + 1 美元资产	105 美元 MOV	0	114 美元抵押资产 + 2 美元 MOV	0	225 美元
结算返还盈余（资产）	t11	3 美元 MOV	105 美元 MOV	0	114 美元抵押资产 + 2 美元 MOV	1 美元抵押资产	225 美元

Figure 4: The bookkeeping of Fisher Risk Bond Process

MOVs are generated.

2). *Debt intervention (stablecoin side intervention)*

The system sells debt when the price is low, and buys back when the price is high, so the system will bear a portion of the cost (a debt auction mechanism can be introduced to reduce costs).

- When the market price is lower than the anchor price, the system will repurchase the stablecoin circulating in the market by issuing bonds at a discount price of the stablecoin to suppress supply;
- When the market price is higher than the anchor price, the system generates new stablecoin, and first repurchases all current debt. The longer the debt is issued, the higher the priority that it will be bought back.

3 MOV All-weather Risk Measurement System

The key parameter settings and adjustments of the MOV stable financial system need to be established under the guidance of comprehensive model theory to form a comprehensive all-weather risk measurement system based on the trinity of experience, data and models.

3.1 Risk Rating Model Based on Markov Chain

In terms of risk management David (1999) and predictive analysis theory, MOV expands the Markov chain model that is widely used in the field of modern financial risk control, and considers the liquidation (default) process as a Markov in a limited state and space. Based on the classic Jarrow-Lando-Turnbull (JLT) model Robert et al. (1997), MOV first proposed and established an on-chain decentralized financial market-to-market (MTM) risk model, exploring the theoretical basis for the orderly development of stablecoin and DeFi. As on-chain finance based on smart contracts and excessive mortgages has a natural, fair, objective, and unified standard of credit levels, laying a solid foundation for building on-chain credit risk measurement models. MOV draws on and integrates with mainstream modern credit risk measurement (Rating) model, which combines market risk, credit risk, operational risk and macro factors while reflecting the quality of loans in the stablecoin system and future trends, measures loss distribution, and rationally allocates system assets (portfolio) and parameters. It is a MOV monetary policy tool and an important feedback aid to the risk management framework. The model is not static, nor is it just regression analysis based on historical data. Especially in the early days of the cryptocurrency market, the model needs to be matched with more market risk information, market cycles, subjective experience, and even macroeconomic factors (Both of the global negative interest rate, trade war in 2019 have a high degree of consistency with the crypto market cycle in 2019.) Only then will it have the value of assisting decision-making. The model is only a tool for risk management. Excessive dependence will also bring certain model risks. At the same time, the verification of the model is also a very important part of the MOV all-weather risk measurement system. In particular, the distribution characteristics of the variables should not be determined upon historical window data, the crypto market has its own unique distribution characteristics (for example, bearish reactions are more intense and diffuse).

3.1.1 Transition Probability Matrix

The Markov chain model is very suitable for describing and predicting the risk status of the entire life cycle of a loan contract. According to the characteristics of the MOV stablecoin system, the aperiodic continuous-time homogeneous Markov chain model is used to first define the finite state space:

$$S = \{Safe, Danger, Repay, Clean\} \tag{9}$$

Among them, Repay (active repayment) and Clean (passive liquidation) belong to the absorbing state, Safe and Danger are in a very returning state, and MOV stablecoin loans are in the Safe state when they are created. When the real-time mortgage rate exceeds the minimum clearing mortgage rate, it changes to Danger state (Danger is divided into three status: L-Danger, M-Danger, and H-Danger according to the MOV three-level clearing system in a more complex model. The H-Danger state occurs in the market under extreme (black swan) circumstance when system fails to complete the liquidation as the market takes sharp decline instantly. The value of the remaining mortgage assets was lower than the value of outstanding loans. The rescue mechanism is triggered in the risk bond. Strictly speaking, the life cycle of the loans was not limited to Clean. Subsequent operations like the system auction of the mortgaged assets and the future repurchase of bonds need to be considered. Since this is an event with a very small probability, in order to simplify the model, it does not appear in the definition of state space for the time being).

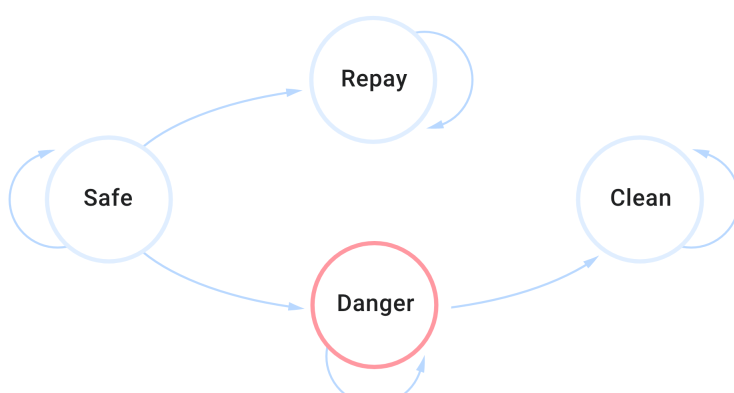


Figure 5: MOV Markov Chain Model State Space

Next define the generator matrix of the aperiodic continuous-time homogeneous Markov chain chain:

$$Q = \begin{array}{c} \\ Safe \\ Danger \\ Repay \\ Clean \end{array} \begin{array}{c} \begin{array}{cccc} Safe & Danger & Repay & Clean \end{array} \\ \begin{pmatrix} -q_s & q_{sd} & q_{sr} & q_{sc} \\ q_{ds} & -q_d & q_{dr} & q_{dc} \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \end{array} \tag{10}$$

$$q_i = \sum_{j=1, j\neq i}^{4} q_{ij} \text{ for } i \in \{s, d, r, c\} \tag{11}$$

where for any $i, j \in \{s, d, r, c\}$ and $i \neq j$, $q_{ij} \geq 0$.

The off-diagonal elements of the matrix represent the transition rate from state i to state j. In actual scenarios, it can be calculated based on historical data statistics Robert et al. (1997):

$$q_{ij} = \frac{N_{ij}(T)}{\int_0^T Y_i(s)ds} \tag{12}$$

$N_{ij}(T)$ is the total number of transfers from i to j during the time period of $[0, T]$, $Y_i(s)$ is the number of loans at i at time s.

The transition rate q and transition probability p have the following equation relationship. The transition probability matrix $P(t)$ in period t can be further obtained from generator matrix Q through the matrix exponential (the only solution of Kolmogorov's forward and backward equations) Robert (2016) :

$$q_{ij} = q_i p_{ij} \tag{13}$$

$$\mathbf{P}'(0) = \mathbf{Q} \tag{14}$$

$$\mathbf{P}(t) = exp(t\mathbf{Q}) = \sum_{n=0}^{\infty} \frac{1}{n!}(t\mathbf{Q})^n \tag{15}$$

$$\mathbf{P}(t) = \frac{d}{dt}e^{t\mathbf{Q}} = \mathbf{Q}e^{t\mathbf{Q}} = e^{t\mathbf{Q}}\mathbf{Q} = \mathbf{P}(t)\mathbf{Q} = \mathbf{Q}\mathbf{P}(t) \tag{16}$$

Based on the above definition, the limit distribution and steady-state properties of the MOV continuous-time Markov chain are analyzed. This has a great significance for exploring the potential long-term behavior (convergence) of the MOV stable financial system. "Always make a correct judgment one second in advance". Define a steady-state probability distribution:

$$\lim_{t\to\infty} \mathbf{P}_{ij}(t) = \pi_j \tag{17}$$

There are two kinds of absorption states, Repay and Clean, in the MOV state space. From the initial state Safe, which absorption state is reached after a long-term convergence is completely random, and the absorption probability distribution depends on the initial state. Accurate estimation of absorption time and absorption probability helps MOV to grasp the loan repayment and liquidation status in the system in a timely manner.

Block the generated matrix (a is the set of absorbing states, T is the set of non-absorbing states, and V is a 2 2 matrix):

$$Q = \begin{array}{c c} & \begin{array}{cc} a & T \end{array} \\ \begin{array}{c} a \\ T \end{array} & \begin{pmatrix} 0 & 0 \\ * & \mathbf{V} \end{pmatrix} \end{array} \tag{18}$$

The average time can be obtained by inverting the transfer rate q, so further obtain the basic matrix $\mathbf{F}$ to reflect the average absorption time:

$$\mathbf{F} = -\mathbf{V}^{-1} \tag{19}$$

$$\mathbf{F} = -\begin{pmatrix} -q_s & q_{sd} \\ q_{ds} & -q_d \end{pmatrix}^{-1} = \frac{1}{q_s q_d - q_{sd} q_{ds}} \begin{pmatrix} q_d & q_{sd} \\ q_{ds} & q_s \end{pmatrix} \tag{20}$$

where F_{ij} is the expected time from state i to state j to be absorbed, and the average time from safe state to absorption $\frac{1}{\kappa} = F_{11} + F_{12}$

$$\frac{1}{\kappa} = \frac{q_d + q_{sd}}{q_s q_d - q_{sd} q_{ds}} \tag{21}$$

To calculate the absorption probability, first build an embedded chain based on the generation matrix (each term represents the transition probability from state i to j):

$$\tilde{P} = \begin{array}{c c} & \begin{array}{cccc} Safe & Danger & Repay & Clean \end{array} \\ \begin{array}{c} Safe \\ Danger \\ Repay \\ Clean \end{array} & \begin{pmatrix} 0 & p_{sd} & p_{sr} & p_{sc} \\ p_{ds} & 0 & p_{dr} & p_{dc} \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \end{array} \tag{22}$$

The standard form of the transition probability matrix obtained by partitioning is:

$$\tilde{\mathbf{P}} = \begin{pmatrix} \mathbf{T} & \mathbf{A} \\ \mathbf{0} & \mathbf{I} \end{pmatrix} \tag{23}$$

Where $\mathbf{T}$ is the non-absorptive state matrix, $\mathbf{A}$ is the matrix that transitions from the non-absorbing state to the absorbing state, $\mathbf{0}$ is the zero matrix, and $\mathbf{I}$ is the identity matrix.

Record n steps as:

$$\widetilde{\mathbf{P}^n} = \begin{pmatrix} \mathbf{T}^n & (\mathbf{I} + \mathbf{T} + \cdots + \mathbf{T}^{n-1})\mathbf{A} \\ \mathbf{0} & \mathbf{I} \end{pmatrix} \tag{24}$$

According to the steady state probability limit distribution and the absorption chain properties of the Markov chain are:

$$\lim_{n\to\infty} \widetilde{\mathbf{P}^n} = \begin{pmatrix} \mathbf{0} & (\mathbf{I} - \mathbf{T})^{-1}\mathbf{A} \\ \mathbf{0} & \mathbf{I} \end{pmatrix} \tag{25}$$

The element in $(\mathbf{I} - \mathbf{T})^{-1}$ represents the average number of transitions from the non-absorbing state $\mathbf{T}_i$ to another non-absorbing state $\mathbf{T}_j$.

$$t = (\mathbf{I} - \mathbf{T})^{-1} \cdot c \tag{26}$$

Where c is a column vector with all elements 1, the i-th component of the column vector t is the average number of transitions from the i-th non-absorbing state to a certain absorbing state. Finally, the matrix $\mathfrak{B}$ is constructed to represent the absorption probability from the non-absorbing state to the absorbing state:

$$\begin{aligned} \mathfrak{B} = (\mathbf{I} - \mathbf{T})^{-1}\mathbf{A} &= \begin{pmatrix} 1 & -p_{sd} \\ -p_{ds} & 1 \end{pmatrix}^{-1} \begin{pmatrix} p_{sr} & p_{sc} \\ p_{dr} & p_{dc} \end{pmatrix} \\ &= \frac{1}{1 - p_{sd}p_{ds}} \begin{pmatrix} p_{sr} + p_{sd}p_{dr} & p_{sc} + p_{sd}p_{dc} \\ p_{dr} + p_{ds}p_{sr} & p_{dc} + p_{ds}p_{sc} \end{pmatrix} \end{aligned} \tag{27}$$

Then the absorption probability from Safe to Repay is $\frac{p_{sr}+p_{sd}p_{dr}}{1-p_{sd}p_{ds}}$, and the absorption probability from Safe to Clean is $\frac{p_{sc}+p_{sd}p_{dc}}{1-p_{sd}p_{ds}}$.

So far the basic model of MOV has been set up. According to the basic theoretical properties of the Markov chain model and accurate assumptions on some distribution characteristics, it is possible to predict and adjust key system global characteristics, which is essential for the orderly operation of the entire stablecoin system.

3.1.2 Queueing Model and Global Characteristics of the System

The MOV stablecoin system is like a naturally growing ecosystem. There are births and deaths, and the creation of stablecoin loans will eliminate the stablecoin loans. Therefore, it is necessary to build a process of birth and death model that is in line with reality to predict the global state and trend of a system. The process of birth and death depends on the determination of three important factors: birth rate, mortality rate, and the upper limit of the total ecological amount (that is, the upper limit of the loan size). Among them, the mortality rate D is related to the expected absorption time and the initial ecological total amount W obtained in the previous calculation:

$$D = W \cdot \kappa \tag{28}$$

The MOV stablecoin system is under the influence of the entire crypto market. The creation rate (that is, the birth rate) of stablecoin loans cannot be predicted. Its distribution characteristics is diversified under different macro market fluctuations. It is described by approximate Poisson distribution or Erlang distribution, and in the case of extreme fat tail, it needs to be transformed into generalized hyperbolic distribution and even uses a power law distribution that is used to predict realistic extreme financial risks ZHANG et al. (2004).

According to the general distribution characteristics, the MOV birth and death process model based on the queuing theory is as follows:

$$M/M/\infty \tag{29}$$

This is a no-queue and no-wait (∞) queuing model. M represents a negative exponential distribution, that is, the loan creation time interval is a negative exponential distribution, and the loan elimination time interval is a negative exponential distribution. Build the transition matrix:

$$\mathfrak{Q} = \begin{pmatrix} -\lambda & \lambda & & & \\ \kappa & -(\kappa+\lambda) & \lambda & & \\ & 2\kappa & -(2\kappa+\lambda) & \lambda & \\ & & 3\kappa & -(3\kappa+\lambda) & \lambda \\ & & & & \ddots \end{pmatrix} \tag{30}$$

Where λ is the birth rate followinging the Poisson distribution, and the extinction time follows the exponential distribution with the parameter κ.

Assuming the system is in state 0 at time 0, the probability that the system is in state j at time t is Kulkarni and Vidyadhar (1995):

$$p_{0j}(t) = \exp\left(-\frac{\lambda}{\kappa}\left(1-e^{-\kappa t}\right)\right)\frac{\left(\frac{\lambda}{\kappa}\left(1-e^{-\kappa t}\right)\right)^j}{j!} \text{ for } j \geq 0 \tag{31}$$

Calculate the expected queue length at time t according to the probability formula, that is, the total number of loans $N(t)$ of the MOV system at time t:

$$\mathbb{E}(N(t)|N(0)=0) = \frac{\lambda}{\kappa}\left(1-e^{-\kappa t}\right) \text{ for } t \geq 0 \tag{32}$$

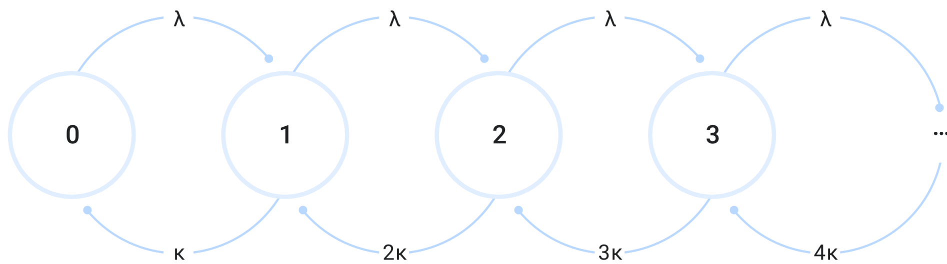


Figure 6: MOV Birth and Death Process Model

$$\text{when} t \longrightarrow \infty, \quad \mathbb{E}(N(t)) = \frac{\lambda}{\kappa} \tag{33}$$

In the actual operation of stablecoins, it is often necessary to control the number of system loans to avoid unlimited risk to the system and to avoid excessive supply of stablecoins. MOVs are assigned with the ability to transfer matrix to the queuing model then the global features mathematically, such as the expected number of loans and the absorption probability matrix at time t, can further predict the number of loans C_t eliminated at time t and the number of liquidated loans $NC(t)$:

$$C_t = \lambda t - \frac{\lambda}{\kappa}\left(1 - e^{-\kappa t}\right) \tag{34}$$

$$NC(t) = C_t \frac{p_{sc} + p_{sd}p_{dc}}{1 - p_{sd}p_{ds}} \tag{35}$$

Combined with the system's settlement rate parameter f and the expected value of each loan V, the system can predict the settlement fee income $\mathcal{LF}(t)$. Similarly, based on the stability rate parameter r, the total stabilization fee income $\mathcal{SF}(t)$ can be predicted. It should be noted that the calculation of the MOV's cumulative stable rate is in the form of compound interest, not a fixed interest rate (the model is further simplified here, and frequent stable rate adjustments are not considered).

$$\mathcal{LF}(t) = f \cdot V \cdot NC(t) \tag{36}$$

$$\mathcal{SF}(t) = V \cdot C_t \cdot \int_0^{\frac{1}{\kappa}} e^{-rt} dt \tag{37}$$

At this point, the prediction and analysis of the global characteristics of key systems such as the total number of open loans, the total number of cleared loans, the total settlement fee, the total stability fee, and even the total supply of stablecoins have been completed. With these quantitative scientific estimates, it will further Strengthen the specialization and improvement of the MOV risk intervention reserve mechanism and money supply control measures.

$$\mathcal{LF}(t) + \mathcal{SF}(t) \geq \mathcal{SJ}(t) + \mathcal{IF}(t) \tag{38}$$

The formula says the income and expenditure balance in period t, $\mathcal{SJ}(t)$ is the affordable loss distribution in period, $\mathcal{IF}(t)$ represents Incentive Fee of ecosystem.

3.1.3 Covariates and Monetary Policy Tools

MOV has two very critical monetary policy tools, stable rates and minimum clearing mortgage rates, which have played a vital role in the robust operation of the entire system. Its important and the mission of the model to accurately and scientifically predict quantitative impact of the adjustment of these covariates to the overall system behavior. There are four covariates in the entire Markov chain model: stable fee rate, minimum liquidation mortgage rate, mortgage asset type (MOV is based on diversified mortgage), and total loan size (or debt ceiling).

The survival analysis method in the classic disease model can effectively predict the effect of these covariates on the transfer matrix (system behavior). The transformation matrix is appropriately deformed, and the two states Safe and Danger are merged into Open, and only the transfer of Open to Repay and Clean is concerned Alex (2019), so it can be further reduced to the Cox competitive risk model *Cox Proportional-Hazards Model* (n.d.):

1. Define the risk function and survival function of the covariate minimum liquidation mortgage rate $c(t)$ on the transfer rate from Open to Clean *Cox Proportional-Hazards Model: Survival Models* (n.d.) respectively (considering that the minimum mortgage rate has the most significant effect on the Clean state):

$$q_{oc}(c(t)) = q_{oc}^0 exp(\beta_{oc1}c_1 + \cdots + \beta_{ocn}c_n) = q_{oc}^0 e^{\beta_{oc}^T(c(t))} \tag{39}$$

   Where q_{oc}^0 is the baseline risk rate, $c(t) = \{c_1, \cdots c_n\}$ defines the liquidation mortgage rates at different levels.

$$S_{oc}(c(t)) = (S_{oc}^0)^{exp\{\beta_{oc}^T(c(t))\}} \tag{40}$$

   Where $S_{oc}^0 = exp\{-q_{oc}^0\}$ is the baseline survival function.

2. Define the risk function and survival function of the covariate stable rate $r(t)$ on the transfer rate from Open to Repay (considering that the stable rate has the most significant effect on Repay status):

$$q_{or}(r(t)) = q_{or}^0 e^{\beta_{or}^T(r(t))} \tag{41}$$

$$S_{or}(r(t)) = (S_{or}^0)^{exp\{\beta_{or}^T(r(t))\}} \tag{42}$$

3. Define the covariate type of mortgage asset CT The risk function and survival function of the effect of CT on the transfer rate from Open to Repay are (short-term mortgage behavior of different types of assets):

$$q_{or}(CT) = q_{or}^{0} e^{\beta_{or}^{T}(CT)} \tag{43}$$

$$S_{or}(CT) = (S_{or}^{0})^{exp\{\beta_{or}^{T}(CT)\}} \tag{44}$$

4. Define the risk function and survival function of the covariate mortgage asset type CT on the transfer rate from Open to Clean (system stability of different types of assets):

$$q_{oc}(CT) = q_{oc}^{0} e^{\beta_{oc}^{T}(CT)} \tag{45}$$

$$S_{oc}(CT) = (S_{oc}^{0})^{exp\{\beta_{oc}^{T}(CT)\}} \tag{46}$$

The establishment of a competitive risk model can quantify the impact of covariates on the rate of state transition. For example, when adjusting the stabilization rate, it can be estimated how much the increase in loan closing rate will increase with the rise of stabilization rate; when adjusting the minimum liquidation mortgage rate, the reduction of which would bring positive activity to the system. Different types of asset mortgages have different purposes and stability of market behavior.

The mortgage rate is also closely related to the default rate. In the on-chain stablecoin system, a default can be regarded as a smart contract that triggers the liquidation of mortgage assets. There are different levels of default. For example, when the system clearing system is fast and complete, the system can reduce user losses and system losses to the minimum. When extreme market risks occur and the system has a large operational risk, it often brings serious losses to the system. For the relationship between the mortgage rate and the probability of default under the influence of market risk and operational risk, a conditional loss distribution function (LDA) Antoine et al. (2001) can be used for quantitative analysis, and it is also one of the most important theory to make and adjust system minimum liquidation mortgage rate: at the start time t_0 of period t, according to VaR and Haircut calculating a rough minimum liquidation mortgage rate LR_0^t, and one period can be divided into N sections for segmenting market risk, then piecewise calculate and adjust LR_i^t; before a new period $t+1$ start, calculate the whole loss distribution in the period t, quantify operational risks and evaluate small probability events, then select reasonable confidence, readjust VaR according to loss distribution and risk reserve, make sure the next period minimum liquidation mortgage rate LR_0^{t+1}. In simple model, the probability of default is independent of the mortgage rate condition. The probability can be expressed as $p_{oc} = q_{oc}/q_o$. For a given number N of loans, the proportion of liquidated loans obeys a binomial distribution with a probability of success of p_{oc} Bomfim (2016):

$$Prob\left(U=\frac{K}{N}|c\right)=C_N^k\cdot p_{oc}(c)^k(1-p_{oc}(c))^{N-k}\approx e^{-Np_{oc}(c)}\frac{(Np_{oc}(c))^k}{k!} \tag{47}$$

It makes approximate calculation using Poisson distribution, however, more rigorously each loan has different risk feature, so the parameter $q = Np_{oc}(c) > 0$ of Poisson should be a random variable, suppose it follows Gamma Distribution:

$$\mathrm{f(q)}=\frac{\beta}{\Gamma(\alpha)}\mathrm{e}^{-\beta q}(\beta \mathrm{q})^{\alpha-1},\quad \mathrm{q}>0 \tag{48}$$

then the marginal distribution of clean loans numbers K:

$$\begin{aligned}\mathrm{P(K=k)}&=\int_0^{+\infty}P(K=k|q)f(q)dq\\&=\int_0^{+\infty}\frac{e^{-q}q^k}{k!}\frac{\beta}{\Gamma(\alpha)}e^{-\beta q}(\beta q)^{\alpha-1}dq\\&=\mathrm{C}_{\alpha+k-1}^k\left(\frac{\beta}{\beta+1}\right)^{\alpha}\left(\frac{1}{\beta+1}\right)^k,\mathrm{k}=0,1,2,\ldots\ldots\end{aligned} \tag{49}$$

Complete loss distribution should include loss frequency distribution and loss severity distribution Antoine et al. (2001). The liquidation status Clean is further divided into different levels: first-level liquidation status $1-Clean$, second-level liquidation status $2-Clean$, third level bond liquidation status $3-Clean$ and fourth level liquidation status $Loss-Clean$ when the mortgage rate is lower than 100%. $1-Clean$ and $2-Clean$ loss distribution can reflect whether the system's clearing system is fast and the percentage of losses recovered by users. $3-Clean$ reflects the system's risk bond intervention, and the state $Loss-Clean$ will directly reflect the system's loss. The crypto market's loss data has a more obvious thick-tailed feature, it is reasonable to use combination distribution:

$$\mathrm{F(x)}=\begin{cases}\Phi\left\{-\frac{(\ln \mathrm{x}-\mu)^2}{2\sigma^2}\right\} & 0<\mathrm{x}<\mathrm{c}\\ 1-\frac{\mathrm{N_c}}{\mathrm{N}}\left(1+\alpha\frac{\mathrm{x-c}}{\beta}\right)^{-1/\alpha} & \mathrm{x}\geqslant \mathrm{c}\end{cases} \tag{50}$$

where N_c is the numbers of loss beyond threshold c, N is the number of risk events, c, α,β are parameters of GPD. Using sample mean excess plot to calculate Mean Excess Function(MEF), and MEF is the mean excessing threshold c Naisheng (n.d.):

$$e_n(c)=\sum_{i=1}^{n}(x_i-c)^+/N_c \tag{51}$$

where $(x_i-c)^+ = \max(0, x_i-c)$, c in the horizontal axis, $e_n(c)$ in the vertical axis, if starting from a high threshold MEF is a straight line with a positive slope, then points follow GPD and that point is c, meanwhile $e(c)=\frac{\beta+\alpha c}{1-\alpha}$. About parameters α and β, with the help of ML and PWM calculating, and considering a group of excess $y_i: y_1=x_1-c, y_2=x_2-c,\cdots,y_n=x_n-c$, in ascending order $y_{1:n},y_{2:n},\cdots,y_{n:n}$. According to PWM Fabio (2012):

$$\hat{\alpha} = 2 - \frac{\bar{y}}{\bar{y} - 2t} \qquad \hat{\beta} = \frac{2 \cdot \bar{y} \cdot t}{\bar{y} - 2t} \tag{52}$$

$$\bar{y} = \sum_{i=1}^{n} y_i \qquad t = \frac{\sum_{i=1}^{n} y_{i:n} \cdot (1 - p_{i:n})}{n} \qquad p_{i:n} = \frac{i - 0,35}{n} \tag{53}$$

Algorithm 1 Loss Distribution with Monte Carlo method.

Input: Number of simulated annual losses, $nSim$; Threshold body-tail, H; Parameter of Poisson body, λ; Parameter mu of lognormal (body), $theta1$; Parameter sigma of lognormal (body), $theta2$; Shape parameter of GPD (tail), $theta1.tail$; Location parameter of GPD (tail), $theta2.tail$; Scale parameter of GPD (tail), $theta3.tail$;

Output: Loss Distribution, sj;

// Quantile function of lognormal-GPD severity distribution.
function QLNORM.GPD($p, theta, theta.gpd, c$)
  $Fu \leftarrow plnorm(c, meanlog = theta[1], sdlog = theta[2])$
  if $p < Fu$ **then**
    $x \leftarrow qlnorm(p = p, meanlog = theta[1], sdlog = theta[2])$
  else
    $x \leftarrow qgpd(p = (p - Fu)/(1 - Fu), alpha = theta.gpd[1], mu = theta.gpd[2], beta = theta.gpd[3])$
  end if
  return x
end function
// Random sampling function of lognormal-GPD severity distribution.
function RLNORM.GPD($n, theta, theta.gpd, c$)
  $r \leftarrow$ QLNORM.GPD($runif(n), theta, theta.gpd, c$)
  return r
end function
// Annual loss distribution inizialization.
$sj \leftarrow rep(0, nSim)$
// Random sampling from Poisson.
$freq \leftarrow rpois(nSim, \lambda)$
// Convolution with Monte Carlo method.
for $i = 1$ to $nSim$ **do**
  $sj[i] \leftarrow sum($ RLNORM.GPD($freq[i], c(theta1, theta2), c(theta1.tail, theta2.tail, theta3.tail), H$))
end for
return sj

3.1.4 Consideration of Complex Models

The risks of the financial industry generally come from market risks, credit risks and operational risks. Such risk also applies to the prospering onchain financial industry. The convergence of risks often indicates that the two worlds' finances are continually spiraling together. MOV is the first to boldly try to integrate many classic probability theories, operational research theories, and modern financial risk management models in decentralized on-chain financial systems. In this white paper, the general basic model theory based on Markov chain helps to test the system robustness, timely control of the key global data and assist in formulating rate policies to move towards a professional on-chain modern financial risk management mechanism.

In order to analyze the deficit-filling capability of the MOV's unique risk intervention mechanism and risk bond mechanism, a model similar to the default exchange Cihan (2015) can also be established for quantitative analysis. The figure below shows a simple model of Swap during the liquidation period. Assuming a mortgage rate of 105% as the benchmark rate, when the mortgagor chooses Swap for third-level liquidation protection, if the system completed clearing at a mortgage rate of 110% , then the system will receive the additional 5% of the proceeds. When the system completes the liquidation at 102%, the system will compensate the mortgagor an additional 3% of the shortfall.

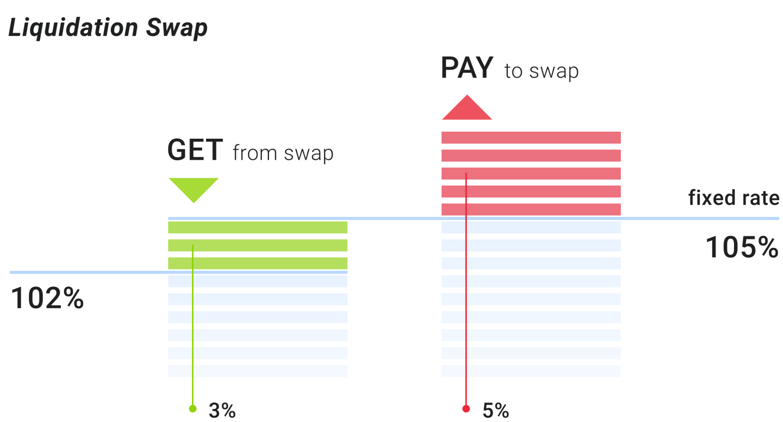


Figure 7: A Liquidation Swap Model

In a more complex modeling (as the size and impact of onchain stablecoin scale up, financial instability factors gradually increase), the covariates are not fixed, but change with some distribution characteristics over time Lu et al. (2011). Therefore, in the loss distribution model, the calculation of conditional probability should actually take a probability-weighted average, and it may even be necessary to construct a non-homogeneous transition matrix and a more complex dual time series model Alex (2019).

3.2 Considerations of Extreme Risk Model

The VaR mentioned earlier (Chapter 2) is a precise, intuitive and easy-to-operate risk measurement and management technology, which can more effectively predict the maximum value fluctuation and probability of the mortgage asset side in the future, but it needs to follow market effectiveness assumptions and market fluctuations are assumed to be random (when market conditions are normal). As for predictions of spikes and fat tails, volatility clustering Cont (2005) and extreme risk situations (in fact, these situations are more frequent), the model need to be coordinated with other models or higher-order stochastic simulation methods (such as the GARCH family model and Monte Carlo simulation method Hao et al. (2012)) in order to avoid underestimating the possibility of small-probability events and more accurately assess losses probability. As shown in the figure, the Cauchy Distribution Bright and Johnson (2011) is a famous type of fat tail distribution, which is suitable for the prediction of small probability events such as the financial crisis, and is different from the normal distribution.

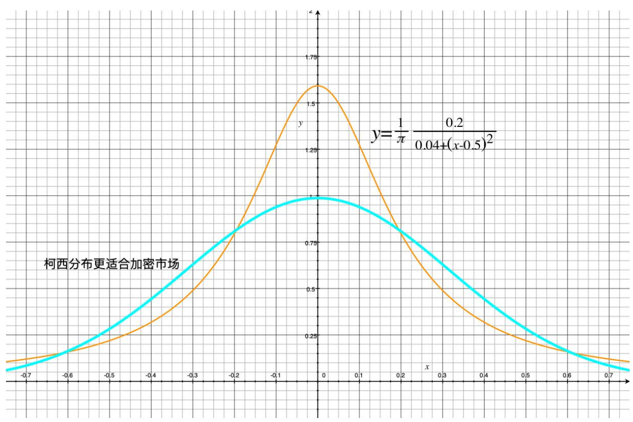


Figure 8: MOV probability event and Cauchy distribution

The CVaR model Wenlin and Yongjian (2006) is often used to monitor the "black swan" event (extreme event on the left), pointing out that the loss exceeds the conditional mean of VaR, and is more sensitive to extreme risk assessment on the asset side.

$$CVaR = (1-\beta)^{-1} \int f(x,y)p(y)dy \tag{54}$$

$$f(x,y) \geqslant VaR \tag{55}$$

The function f is the loss function, p is the distribution function of the yield y, and β is the confidence level.

Although the MOV collateral framework has tried to select four assets that are not particularly relevant, their tail correlation may suddenly increase when facing extreme risks Rachel et al. (2002) (when no one can stand alone when the crisis comes) and thus loss cannot be diversified. For the measurement of tail extreme risks, MOV will establish a corresponding tail risk parity model suitable for the on-chain financial system Eduard et al. (2017), the core of which is to rationally allocate the weight of the portfolio assets to distribute tail risk evenly.

We still use VaR to infer tail correlation, that is, to calculate the combined VaR (VaR-implied tail correlation) by the respective VaR value and combination weight of each asset John and Francois (2006) Jinjing (2016):

$$VaR_{port}^{agg} = \sqrt{x_1^2 \cdot VaR_1^2 + x_2^2 \cdot VaR_2^2 + 2 \cdot x_1 \cdot x_2 \cdot \rho_{12} \cdot VaR_1 \cdot VaR_2} \tag{56}$$

ρ_{12} represents the correlation degree of changes in the prices of various assets. If the asset-side price changes obey the Gaussian distribution, the correlation coefficient is equivalent to the classic Pearson Correlation Coefficient. As mentioned earlier, VaR has limitations. In order to accurately describe the left fat tail of the income distribution, VaR can be replaced with ES (Expected Shortfall, same as CVaR) calculation method Jinjing (2016), which can describe mean value(conditional expectations)of the left tail risk more effectively.

$$ES_{\alpha} = -\frac{1}{\alpha}\int_0^{\alpha} VaR_{\gamma}(X)d\gamma \tag{57}$$

Given the expected gap is the worst percentage α expectations, $X \in L^p(\mathcal{F})$represents the future earnings.

Algorithm 2 VaR with Monte Carlo method.

Input: Array of ETH/USD price fetching from the coinmarketcap api, $value$; Number of simulations, k; Days of every simulation, y; Confidence, α;

Output: Value at risk, VaR;

// The selected recent time window including significant market should be large and reasonable, 300 days

// Calculate daily yield from the second day to the 300th day.

$value0 \leftarrow value(1:299)$

$value1 \leftarrow value(2:300)$

$rate0 \leftarrow (value1 - value0)./value0$

// Calculate the mean and variance of daily yield.

$u \leftarrow mean(rate0)$

$vol \leftarrow std(rate0)$

// 1000 times Monte Carlo simulations and 30 days each simulation.

$s0 \leftarrow value(end)$

$rand('state', 0)$

$randn('state', 0)$

$k \leftarrow 1000$

$y \leftarrow 30$

for $i = 1$ to k **do**

  $s \leftarrow s0$

  for $j = 1$ to $y - 1$ **do**

    // Build the variable wt of Random Walk based on the mean and variance.

    $s = s + s * (u + vol * randn(1, 1))$

  end for

  $value2(i) \leftarrow s$

end for

// Calculate the daily yield of simulations.

$rate \leftarrow (value2 - s0)/(s0 * y)$

$rate1 \leftarrow sort(rate)$

// Calculate the VaR with confidence 0.05.

$\alpha \leftarrow 0.05$

$VaR \leftarrow rate1(k * \alpha)$

return VaR

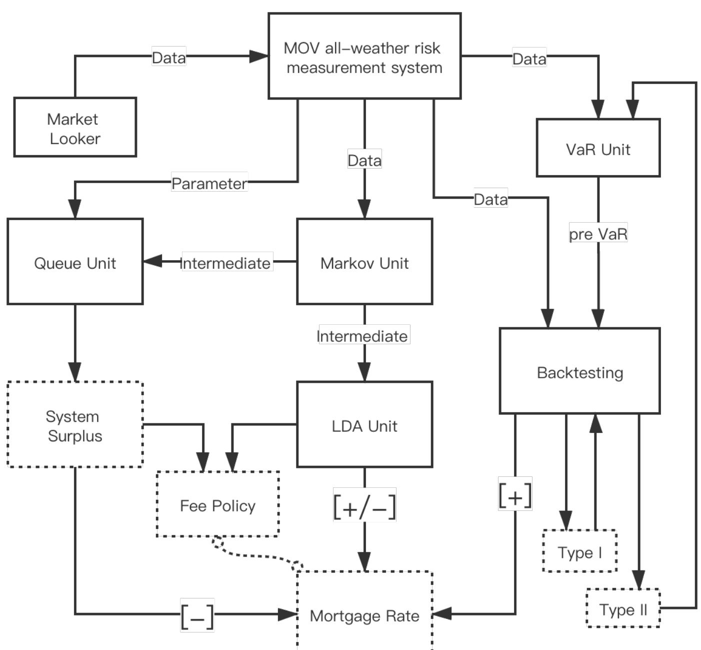


Figure 9: MOV all-weather risk measurement system

Overall, MOV risk measurement model will take full account the measurement of Convergent risks (modeling can be quantified) and Divergent risks (not a good metric). In order to complete progressive risk control model from no "default", quantifiable "default", predictable default and default loss reduction (9). It is worth emphasizing again that models and theories are not right or wrong, nor are they static. The key is to always grasp the most essential knowledge of the crypto market and the future, establishing a model and methodology, developing from phenomenon to direction. MOV is to become an integrated field supported by more professionals and border industries so as to continuously expand the financial boundaries and be taken to a new level.

4 Onchain Modern Financial and Multilateral Trade

In the face of treacherous financial market, the monetary policy of MOV is loosely based on four factors C, R, P, T for intervention and macro-control, which represents collateral and credit (Collateral + Credit), risk interference, stablility rates, stablecoin size in circulation. For example, when we are regulating on stablecoin side, we will maintain stability of CR on the left side, intervene T to influence P.

$$\mathcal{CR} = \mathcal{PT} \tag{58}$$

High-value stablecoin system is inseparable from the most fundamental layer of trust no matter in the real world financial system or blockchain-based financial system. Despite differences in many aspects, the pursuit of trust is the same. The cornerstone of MOV comes from decentralized gateway system and backing of four major high-value assets. With the guarantee and protection of entire MOV ecology (and Bytom), the stablecoin has advantages over Ethereum that is solely relied on application layer.

The significance of MOV stablecoin is to go beyond creating a speculative asset, allowing the formation and convergence of a diversified asset value of the mainstream consensus under the folded synthetic framework. In this way, an "Avatar" money can become "a stable debt that support economic transactions ". More business scenarios (onchain and offchain) can be explored and accelerated, bringing more social acceptance and credit expansion for cross chain assets.

In the overall design of a stable financial system, the asset synthesis and lending market mechanism is more about building a liquidity infrastructure than a single application scenario. The value boundary of MOV is related to circulation volume, circulation speed, width and diversity. More scenarios and financial roles and financial alliances need to be integrated into the ecosystem, such as digital asset trading platforms, digital asset futures platforms and on-chain payment systems. With the continuous enrichment of the application scenarios, the stability, liquidity and circulation of stablecoins will increase, the market demand for stablecoins and the loan synthesis business will usher in a period of rapid growth and then promote the expansion of the entire stable financial system. MOV has more opportunity to become a unit of accounting with pricing and clearing capacity that is widely circulated on blockchain for transactions and payments, which will truly open a new pattern of stablecoin competition and development.

Multilateral trade not only exist in the real-world trading system, it is also a new development pattern pursued by isolated onchain ecological entities. After all, no one would exclude the mainstream high-value assets (such as BTC) and mobility infrastructure. The pursuit of multilateral trade is essentially free flow of trade parties, eliminating barriers between each other, reducing friction costs, following common rules, constructing multilateral clearing system, responding to common crisis. The onchain financial system has many types like centralized and distributed, futures-trading and lending synthesis, payment system and the real application. There are numerous independent public blockchain and cross-chain assets with different scenarios, consensus and business models. The direct output of local mainstream assets also means the loss of their own (cross-chain) assets, so there is often a variety of barriers. Stablecoin system has the advantage when connecting different systems. It can quickly input and output of high-value assets with multilateral clearing capabilities, serving like international currency in terms of free conversion, input/output balance and fee.

MOV stablecoin will not be limited to its own system. It will be integrated with more third-party applications and financial assets (such as centralized lending) while delivering high-value assets (liabilities) and accelerating MOV circulation. The MOV obtained by the corresponding cooperative ecosystem also gain support from the backing of four mainstream high-value assets, which has a direct effect on expanding its own business categories and platform assets.

For cooperation with digital asset trading platforms, MOV will become its high-quality alternative accounting unit and circulation medium. The boundaries between the two ecosystems will become increasingly blurred as MOV fully circulates between the two. Users can transfer MOVs in real time to earn leverage or lending fee, leveraging through circular pledges and encourage more (new) users to lend MOVs on exchanges. It will be a win-win situation.

In the on-chain payment system (including on-chain virtual service payment, cross-border payment, physical supply chain finance, etc.) or trading with other cross-chain ecosystems, a unified and stable pricing asset is indispensable. Clearing means and transaction medium. Suppose MOV cooperate with A cross-chain ecosystem (mainly supporting EOS assets) , they can infiltrate into each other's on-chain business through the (respective) stablecoin system, and users on MOV who need EOS asset business can use MOV to participates in the EOS lending business of the A ecology and vice versa. In a more complex multilateral trade alliances, the efficient connection of stablecoins will truly become a bridge and messenger for cooperation and interaction between ecosystems on different blockchains.

MOV is beyond cross-chain. The continuous prosperity and development of on-chain finance is bound to push back the evolution and upgrade of blockchain infrastructure. Therefore, when constructing a stablecoin, MOV will start from the perspective of comprehensive ecological construction, not only to create a more stable digital stability. Bitcoin is also building a stable financial infrastructure that is truly in line with the future development of the blockchain, and promotes the formation of a wider on-chain multilateral trading system.

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