PolkaFi
The Decentralized Stablecoin Platform on Polkafoundry

Contents

1 Introduction

PolkaFi is a project to implement a cross-chain, multi-collateral stablecoin on Polkafoundry network.

It aims towards a complete decentralized operation, where the stablecoin is created using assets from blockchains connected to the Polkafoundry network as collaterals. It can be used by any blockchains and their applications on the Polkafoundry network.

Holders of the crypto assets supported by the Platform can generate pUSD tokens by depositing the assets into a Collateralized Debt Position (CDP) through the pUSD stablecoin protocol. pUSD tokens are also available for purchases from brokers or exchanges.

2 Token Utility

PolkaFi's system has three tokens, two are operational tokens: pUSD – the stablecoin and cFi – the convertible token. Another token is for governance of the system, named Fi token.

2.1 pUSD – The Stablecoin

pUSD is the stablecoin issued by PolkaFi Platform (the Platform) via CDP contracts. As a stablecoin, pUSD is designed with the main functionality of money, including being a store of value and a medium of exchange.

The Target Price of 1 pUSD is $1 (US Dollar).

2.2 cFi – The Convertible token

cFi is the convertible token of the Platform, which is a stability mechanism implemented to monitor changes in the supply of pUSD. cFi token will be put on sale to pUSD holders at an expected price of below 1 pUSD.

cFi tokens can be traded/transferred between wallets like any other regular tokens, with no expiry dates nor interest payout. Under certain conditions, cFi holders are able to convert their cFi tokens to pUSD tokens at a 1:1 ratio from the PolkaFi Keep (the Keep), expected to make a profit from their purchases of cFi tokens at less than 1 pUSD previously.

Further information about the convertible mechanism can be found in "PolkaFi Keep and the Convertible Mechanisms" section.

2.3 Fi – The Governance token

Fi is the governance token of the PolkaFi Platform. Fi holders can vote for a number of changes to the Platform as well as receive profits gained from the successful operation of the Platform.

In addition to its governance role, the Fi token also serves as one of the recapitalization resources of the Platform. If the debt exceeds the surplus, the Fi token could be created and auctioned to recapitalize the system, resulting in diluting Fi token circulating supply.

Through the implementation of rights and responsibilities mentioned above, Fi holders is incentivized to contribute to the management of the Platform in an efficient and decentralized way. Further information can be found in "Governance Mechanisms" section.

3   The pUSD Stablecoin Protocol

The Platform's protocol includes 2 main mechanisms: Collateralized Debt Positions and Convertible Mechanism. The former involves the issuance of pUSD and the latter is mainly for the monitoring and stabilization of pUSD as a stablecoin.

The CDP mechanism design is inspired by the decentralized stablecoin project MakerDAO, while the Convertible mechanism partly reflects the real-life bond operation in financial markets.

3.1   Collateralized Debt Positions (CDPs)

Figure 3.1 CDP

All accepted collateral assets can be leveraged to generate pUSD and cFi tokens in the Platform's Protocol through CDP smart contracts. The ratio of pUSD and cFi created in each CDP is pre-determined and subject to changes voted by Fi token holders in the future. The deposited collateral assets inside each CDP are locked and cannot be withdrawn by the user until the associated pUSD and cFi tokens – which the user withdrawn – is paid back with interests.

On the Platform, the value of pUSD is always set at $1 and the value of cFi is set at a price below 1 pUSD at the time of borrowing. The value of all tokens created in each CDP is expected to be less than the value of collateral assets so that the pUSD created in active CDPs is backed by excess assets.

Collaterals can be either native Polkafoundry assets or other popular assets like Bitcoin (BTC) and Ether (ETH), as long as they are approved by Fi token holders through voting. pUSD can leverage on the cross-chain features of the Polkafoundry network and be transferred to all chains in the network, resulting in greater liquidity and adoption rate which usually takes a long time for a single chain stablecoin to achieve.

The CDP process:

1. **Opening a CDP**: a user can deposit accepted cryto assets and lock them as collateral to generate pUSD and cFi tokens. Once the assets are locked, the user becomes the holder of the particular CDP. While multiple assets can be used to create multiple CDPs, 1 CDP can only lock 1 type of assets as its collaterals.
2. **Borrowing tokens:** the CDP holder can borrow up to a maximum number of pUSD and cFi tokens (determined by the Risk Management Mechanisms) against the collaterals. The borrowed tokens are marked as debts in the CDP.
3. **Paying back the debt:** the CDP holder can retrieve a portion or all their deposited assets when a corresponding portion or all of the debts is paid back with Stability Fee – the accumulated interests. The Stability Fee can be paid in either pUSD or Fi tokens.
4. **Closing the CDP**: Once all the debts and Stability Fee of an active CDP are paid back and the CDP holder retrieves all collaterals, the CDP is closed automatically.

An active CDP which is deemed risky due to the price collapse of its collaterals can be Forced Liquidated and closed automatically by the Platform. Further details are explained in the Risk Management Mechanisms section.

3.2   PolkaFi Keep and the Convertible Mechanisms

Figure 3.2a Selling cFi tokens

Figure 3.2b Convert cFi token to pUSD

PolkaFi Keep (the Keep) is a set of smart contracts which exercises the convertible mechanism with the purpose of monitoring the stability of pUSD through supply and demand.

The Convertible Mechanism includes:

1. When the user withdraws cFi tokens created from a CDP, an equal number of pUSD is generated and stored in the Keep. This pUSD is to serve the future conversion of corresponding cFi tokens generated from each CDP. When a CDP is closed (either the user pays back the debt or the CDP is Forced Liquidated by the Platform) and its associated cFi tokens are retrieved and burned, the corresponding pUSD in the Keep is also burned.
2. The Keep allows cFi tokens to be auto-generated and sold to pUSD holders under certain conditions (see no. 3), at expected prices of below 1 pUSD. When a cFi token is sold, a pUSD token is generated and stored in the Keep for future conversion. All pUSD tokens received from selling cFi are burned immediately.
3. The Keep will allow cFi token holders to convert their cFi tokens into pUSD at the 1:1 ratio in a first come first serve basis under following conditions:
    a. The price of pUSD is greater than $1
    b. The Keep's balance of pUSD is greater than 0.
   All of the converted cFi tokens then are burned immediately.

4. In the event of Forced Liquidation of a CDP, a portion of pUSD in the Keep may be burned to cover the incurred losses resulting from said event. Further information about the event can be found in "Forced Liquidation of a risky CDP" section.
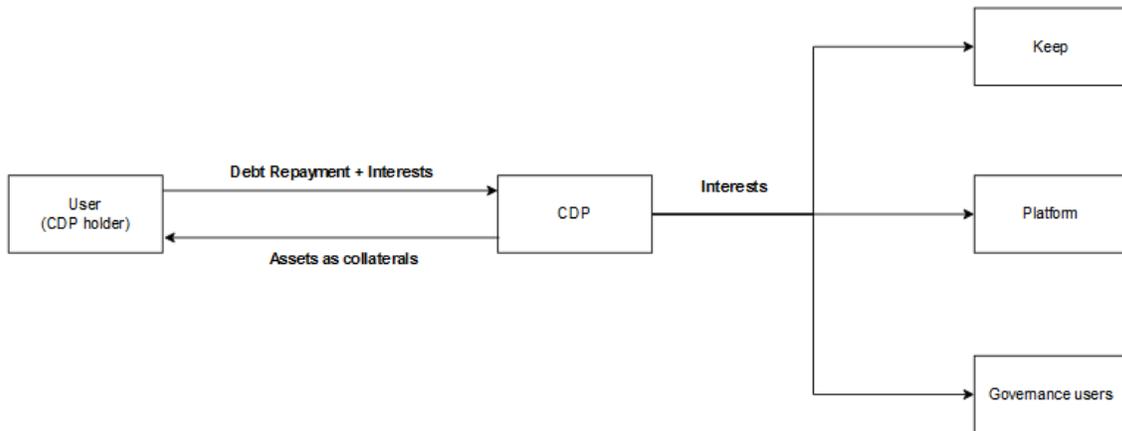
3.3   Profit Sharing

Figure 3.3 Profit Sharing

The profit earned from the Platform's operation shall be shared between the following parties with the respective priorities:

1. The Keep: the main portion will be allocated to the Keep until the Keep is sufficiently full, meaning the Keep 's balance of pUSD is equal to the balance of cFi tokens circulating on the market (1:1 ratio). After that, the allocation ratio to the Keep will decrease gradually to a minimum of 20%.
2. Platform team: will receive a minimum of 10%.
3. Fi token holders: The portion allocated to Fi holders is the remaining amount after allocating to the Keep and Platform team. The tokens allocated to Fi holders will be automatically exchanged to Fi tokens then burned immediately, resulting in a decrease in Fi circulating supply and positively impact the price of Fi tokens.

The above allocation is subject to changes voted by Fi holders.

4   Price Stability Mechanisms of pUSD

4.1   Soft-peg to US Dollar

pUSD is designed to soft-peg to US Dollar at 1:1 ratio, meaning that 1 pUSD is target to have value of approximately 1 US Dollar at all times.

When the value of 1 pUSD is below $1:

1. Users is incentivized to buy pUSD to terminate existing debts in active CDPs at a cheaper price

2. cFi tokens will be sold at prices below 1 pUSD to all pUSD holders with the expectation of future profits upon conversion of cFi to pUSD at 1:1 ratio.

All above mentioned activities will encourage the decrease in pUSD circulating supply, thus resulting in increases in pUSD price, pulling it closer to $1.

In the situations that the price of pUSD keep falling despite above-mentioned activities, The Keep will allow Fi tokens to be auto-generated and sold on the market and buy back pUSD, thus diluting the governance tokens and further decreasing the supply of pUSD.

When the value of 1 pUSD exceeds $1:

1. Users is incentivized to put more cryto-assets into CDP to create more pUSD and sell them to the market, earning the profits between $1 creation price and current market price.
2. If the conversion conditions are met, the Keep will open and allows cFi be converted to pUSD at the 1:1 ratio. Further details of the conversion conditions are explained in "PolkaFi Keep and the Convertible Mechanisms" section.

All above mentioned activities will encourage the increase in pUSD circulating supply, thus resulting in decreases in pUSD price, pushing it closer to $1.

In the situations that the price of pUSD keep rising despite above-mentioned activities and the Keep's balance is greater than the circulating supply of cFi, The Keep will sell its surplus pUSD on the market and buy back Fi to burn, thus further decreasing the supply of G and increase the supply of pUSD.
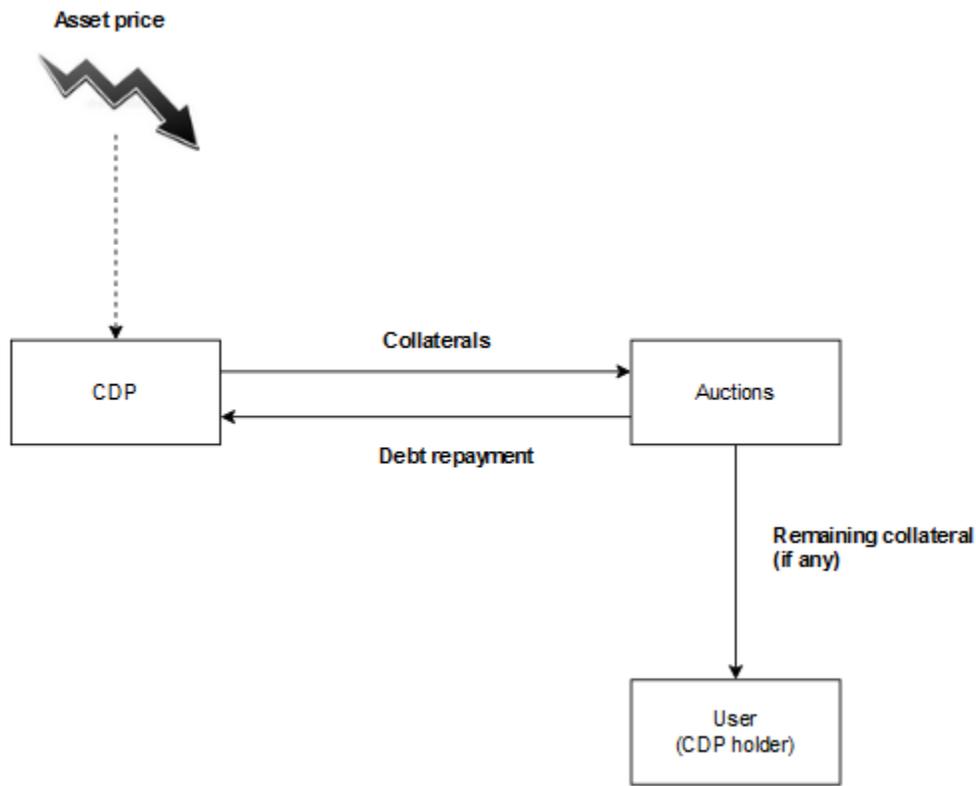
4.2   Risk Management Mechanisms

Figure 4.2 Risk Management

4.2.1   Forced Liquidation of a risky CDP

As the pUSD is backed by the associated collateral assets in each CDP, the price fluctuation of underlying collateral assets affects the risk of the borrowed pUSD, hence comes a need of managing the liquidity risk in the collaterals. The liquidity risk which is represented by the collateral-to-debt ratio of each active CDPs is monitored constantly by the system, by dividing the current market value (in USD) of the collateral locked in the CDP by the outstanding debt balance.

In the events that the current collateral-to-debt ratio of an active CDP falls to a threshold - the Liquidity Ratio, Forced Liquidation of the CDP will be auto-executed immediately in order to protect the value of associated pUSD in the CDP. A riskier collateral asset type is usually associated with a higher Liquidation Ratio, and vice versa.

In a Forced Liquidation, the Platform will sells/auctions the collaterals and retrieves back the maximum number of associated tokens with pUSD tokens as the first priority. Any remaining tokens (after deduction of transaction fees, interests…) are returned to the user.

If the sale of collaterals does not fully cover the associated pUSD, a portion of pUSD in the Keep is burned to cover the lost pUSD.

4.2.2 Auctions

The value of collaterals in every active CDP is constantly monitored to ensure that the associated outstanding debt can be recovered anytime by selling the collateral. A Forced Liquidation is triggered automatically once an active CDP becomes too risky – when the current collateral-to-debt ratio of the CDP reaches its Liquidation Ratio.

After a Forced Liquidation is triggered, the Platform's Auction process is executed, aiming to cover the maximum amount of outstanding debt by selling the minimum proportion of the collateral as possible.

1. Total collaterals of the CDP will be auctioned automatically in pUSD to potential buyers on the market.
2. Once the current highest bid reaches the Target Amount – which is the sum of the outstanding debt, the Stability and the Liquidation Penalty. The auction switches to a Reserve Auction that allows potential buyers to bid the minimum amount of the auctioned assets for the Target Amount.
3. Once the auction ends, the part of auctioned collaterals sold is transferred to the winner, and any remaining collateral is returned to the CDP holder. The amount of the tokens that is equal to the outstanding debt of the CDP is burnt, and the remaining amount is distributed to relevant parties according to the Profit-Sharing Mechanisms. The CDP is then closed.

In situations when an auction fails to reach its Target Amount, one or all of the following activities are executed:

1. If the auction ends with no bidder, the auctioned collateral will be sold on the market via exchanges for the maximum pUSD possible.
2. If there is at least 1 bidder, the collateral will be sold to the highest bidder.
3. If there is still remaining debt:
    a. If The Keep's balance is sufficient, a portion of pUSD in the Keep is burned to cover the remaining debt.
    b. If there is any remaining debt that the Keep cannot cover, another Reverse Auction will be run with a Target Amount in pUSD enough to cover the debt and close the CDP. In the auction, potential buyers will bid the minimum amount of Fi tokens possible for the Target Amount.

4.2.3 Key Risk Parameters

Fi token holders have governance rights and responsibilities for managing risks of the Platform, including authorizing manual or automatic adjustments of risk parameters. The risk parameters of CDPs and liquidation auction parameters are set up separately for each accepted collateral type and are subject to changes from the Platform automatically or by voting of Fi token holders.

The Key Risk Parameters of CDPs are:

1. **Token Debt Ratio**: is the ratio of pUSD and cFi token to be created in a CDP. It is determined separately for each collateral type and serves as a layer of stabilization for pUSD.
2. **Debt Ceiling**: is the maximum amount of debt that can be created by a single collateral type. Every accepted collateral type is assigned a Debt Ceiling, which is used to ensure sufficient diversification of the total collateral portfolio. Once the Debt Ceiling is reached, no debt can be

created for the associated collateral type until some active CDP holders pay back all or a portion of their outstanding debt.

3. **Stability Fee**: is the accumulated interest payable by the CDP holders as a cost of borrowing tokens in a CDP. It is calculated as an annual percentage yield by the value of tokens created in the CDP. CDP holders can pay the fee in either pUSD or Fi tokens.
4. **Liquidation Ratio**: represents the expected liquidity risk resulting from the price volatility of the associated collateral. A high Liquidation Ratio means high volatility is expected and vice versa.
5. **Liquidation Penalty**: is a fee charged when a risky CDP is forced liquidated. It will be calculated into the Target Amount when the collateral is put on auction and deducted from the auction gains. It is used to encourage CPD holders to keep appropriate collateral levels in their active CDPs.

The Key Risk Parameters of Auctions are:

1. **Maximum Duration**: The maximum duration of an auction, which is set for each collateral type.
2. **Bid Duration**: Amount of time before an individual bid expires and closes the auction.
3. **Increment Step**: The minimum increase when placing the next bid, comparing with the current highest bid.
4. **Auction Size**: The maximum estimated value of collaterals in an auction. If the estimated value of all collaterals in a CDP exceeds the Auction Size, they will be broken into auctions running separately to facilitate the liquidation.

4.3   Emergency Shutdown
Emergency Shutdown is the last-resort mechanism to protect the Platform and the stability of pUSD price. There are two types of Emergency Shutdown as below:

4.3.1   Emergency Shutdown for Single Asset Type
If the risk of a particular collateral type reaches its limit, Emergency Shutdown for this asset can be triggered with the following steps:

1. Remove this asset from the accepted collaterals for future CDPs
2. Increase Liquidation Ratio for associated active CDPs to encourage user to close the CDPs in a certain time limit
3. Forced Liquidation of remaining active CDPs after step 2

4.3.2   Global Emergency Shutdown
In situations where the negative affection of outside factors become increasingly heavier and deemed irreversible, the Global Emergency Shutdown can be triggered with the following steps:

1. Snapshot of latest oracle pricing
2. Stop CDP creation
3. Forced Liquidation of all outstanding debts and profits
4. pUSD holders can redeem collaterals proportionately to their pUSD balance.

5 Governance Mechanisms

5.1 Fi Token holders

Holders of the Fi token—the Governance token of the Platform—can receive a portion of profits earned from the Platform operation as well as vote on proposed changes to the Platform, including but not limited to:

1. Add a new collateral asset type with a its set of Risk Parameters.
2. Remove an existing collateral asset type.
3. Change the Risk Parameters of one or more existing collateral asset types, or add new Risk Parameters to one or more existing collateral asset types.
4. Change the Risk Parameters of Auctions
5. Choose the set of Oracle Feeds
6. Change the weight of Oracle Feeds
7. Choose the set of Emergency Oracles.
8. Trigger Emergency Shutdown.
9. Upgrade the system.

5.2 Key Actors

Oracle Feeds: In order to monitor the liquidity risk of collaterals and trigger the Forced Liquidation, the Platform requires real-time information about the market price of the collateral assets. The prices are calculated from prices given by a broad set of individual nodes called Oracle Feeds. Each Oracle Feed is assigned a pre-determined weight to control their influence on the overall prices. The number of Oracle Feeds and their weight is subject to changes by Fi voters.

Emergency Oracles: Emergency Oracles are able to freeze individual Oracles and trigger an Emergency Shutdown for Single Asset Type.

6 References

Maker Dao: https://makerdao.com/en/

Polkafoundry: https://polkafoundry.com/

Polkadot: https://polkadot.network/