INSURE

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ABSTRACT

Over time, the insurance industry has developed from a community-based model to an adversarial one in which large institutions dominate. It is also inefficient in many areas, leading to large frictional costs being borne by customers. Insure is a fully collateralized, permissionless, decentralized peer-to-pool insurance protocol. Users interact with the insurance pool to perform underwriting processes with a market supply and demand-driven premium pricing mechanism, allowing users to exchange risks and premiums without any human intervention. The Insure risk pool creates a unique earning opportunity for the entire crypto ecosystem by creating aligned incentives through smart contract code.

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1 INTRODUCTION

Insurance is a way to mitigate risks that individuals face in life. It protects against potential financial losses by requiring the payment of small premiums to insurance providers. In recent years, technologies such as blockchain and smart contracts have emerged as tools with the potential to unlock value across a range of sectors, providing more efficiency and transparency that can level the playing field for all stakeholders. These technologies present opportunities to enhance the mechanisms powering the traditional insurance industry, which has historically suffered from issues such as an overreliance on trust, information asymmetry, cumbersome processes, and opaque practices.

Traditional insurance companies often rely on statistics and personal information to measure risk and determine premiums. Insure offers a decentralized solution, providing a comprehensive insurance platform and underwriting without intermediaries that uses supply and demand data to determine risk and premiums. All user funds are managed by the smart contract, enabling self-custody and making the underlying liquid by minting share tokens to depositors that are freely tradable in the open market. The premium rate for buyers is determined by the amount of funds available in the pool at a given time.

1.1 Basic Concepts

At the core of Insure is the concept of a pool, which is made up of USDC stablecoin, with the total amount defined as the total liquidity, L_t . Users can deposit funds into the pool which will then be used as collateral for the insurance. The maximum cover amount a user can get depends on the funds in the pool. Only stablecoins are considered as collateral for insurance as they are the least volatile tokens.

A new policy can be purchased by paying the premium determined by the premium engine. Policies can be of any duration, with the minimum being 30 days and the maximum being 1 year.

In case of price fluctuations, user deposits might be liquidated if the payout threshold is reached. A liquidation event occurs when the price of the insured asset drops below the threshold, T_p, called the payout threshold. The payout threshold of the pool is 90%.

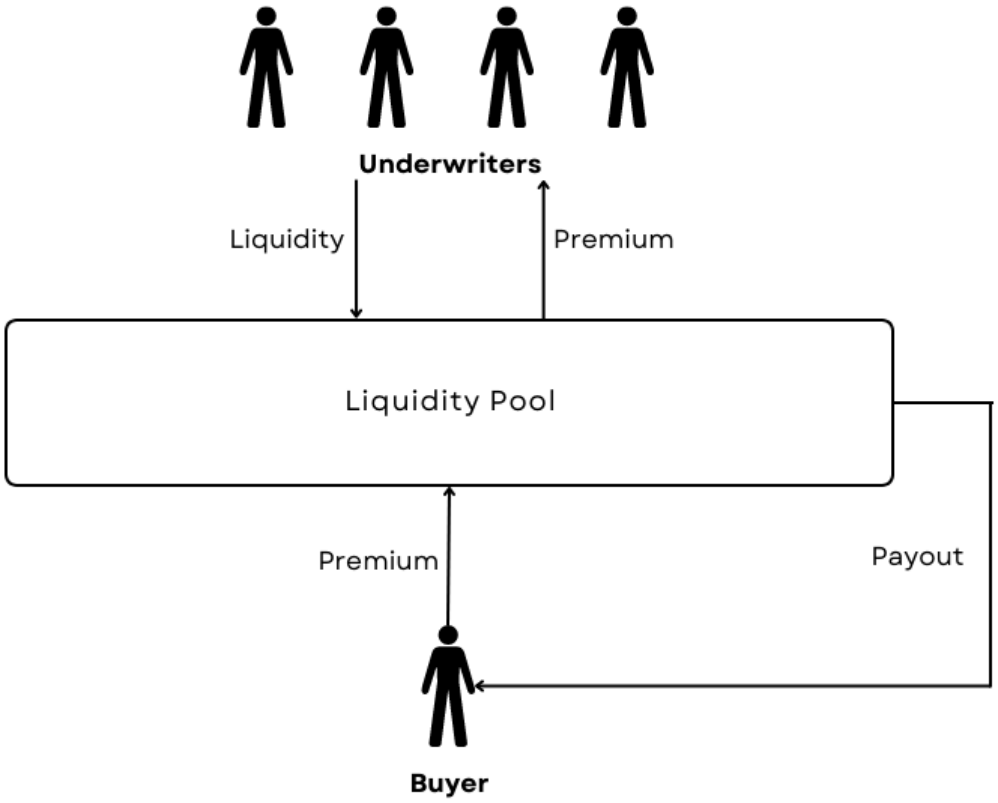

Figure 1: Insure Pool Basics

1.2 Formal Definitions

Variable	Description
L_t, **total liquidity**	Total amount of liquidity available in the pool. The decimals of this value is 6.
LO_t, **total locked liquidity**	Total amount of liquidity locked. The decimals of this value is 6.
U, **utilization rate**	Representing the utilization of the deposited funds.
U_{before}, **utilization rate before**	Representing the utilization of the deposited funds before locking the payout amount.
U_{after}, **utilization rate after**	Representing the utilization of the deposited funds after locking the payout amount.
$U_{optimal}$, **optimal utilization rate**	The utilization rate targeted by the model, beyond the variable premium rate rises sharply.
P_0, **base premium rate**	Constant for $LO_t = 0$.
P_{slope1}, **premium rate slope below** $U_{optimal}$	Constant representing the scaling of the premium rate versus the utilization, when $U \leqslant U_{optimal}$.
P_{slope2}, **premium rate slope above** $U_{optimal}$	Constant representing the scaling of the premium rate versus the utilization, when $U > U_{optimal}$.
P, **premium rate**	The premium rate
T_p, **payout threshold**	The threshold at which payout is to be made to the insured

2 PROTOCOL ARCHITECTURE

The current implementation of the protocol is as follows:

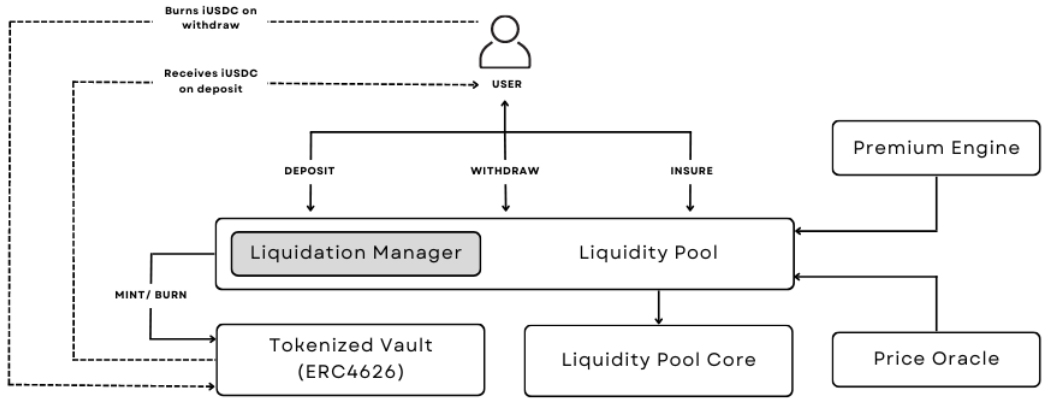

Figure 2: Protocol Architecture

Insure is a decentralized, peer-to-pool insurance protocol that allows users to participate as insurance buyers or underwriters. Insurance buyers pay premiums to the pool to protect against potential events of drastic devaluation of a crypto asset. At the same time, underwriters earn premium paid by buyers by providing liquidity to the protocol in the form of USDC stablecoin. Insure provides an easy way to hedge against drastic devaluation of crypto assets, and it enables underwriters to earn a safe return on their stablecoin holdings. The protocol implements the concept of a unified risk pool, where all crypto assets supported by the protocol are insured by a single liquidity pool minimizing risk for underwriters and also providing more liquidity for insurance buyers.

2.1 Registry

The `Registry` contract provides initialization and access control functions for `Core` and `Pool`:

- Asset initialization
- Pool manager address
- Fee collector address

The `Registry` contract is also the proxy admin for `Core`, `Pool`, `PremiumEngine`, `PriceOracle`, and `Parameters`.

2.2 Core

The `Core` contract is the hub of the protocol and it:

- Holds the state of all policies created
- Handles basic logic (calculation of policy expiry and policy creation)

2.3 Pool

The `Pool` contract is the contract users interact with. It uses the `Core` and `Parameters` contract to perform actions:

- Deposit
- Withdraw
- Buy insurance
- Claim
- Unlock expired funds

2.4 PremiumEngine

The `PremiumEngine` contract algorithmically calculates the premium rate based on total liquidity and the current locked amount. The following parameters are defined in the PremiumEngine contract:

- Base premium rate
- Optimal utilization
- Premium rate slope below optimal utilization i.e. P_{slope1}
- Premium rate slope beyond optimal utilization i.e. P_{slope2}

The current premium rate is calculated as:

$$P = \begin{cases} P_0 + \frac{P_{slope1} \cdot U}{U_{optimal}}, \text{ if } U \leqslant U_{optimal} \\ P_0 + P_{slope1} + \frac{P_{slope2} \cdot (U - U_{optimal})}{100 - U_{optimal}}, \text{ if } U > U_{optimal} \end{cases}$$

This premium rate model allows for the calibration of key premium rates:

- At $U = 0$, $P = P_0$
- At $U = U_{optimal}$, $P = P_0 + \frac{P_{slope1} \cdot U}{U_{optimal}}$
- Above $U_{optimal}$, the premium rate rises sharply to take into account the cost of capital

3 POOL CONTRACT

The actions implemented within `Pool` allow users to interact with the pool.

3.1 Deposit

The process of making a deposit is straightforward and does not involve any special checks or requirements. The steps to follow for this action are:

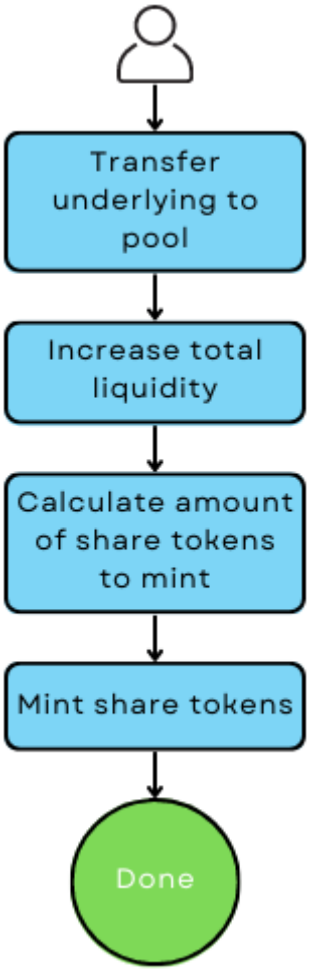

Figure 3: Deposit Funds

3.2 Withdraw

The withdraw action allows users to exchange an amount of iUSDC for USDC. The actual amount to withdraw is calculated using the iUSDC/USDC exchange rate. The action is defined as follows:

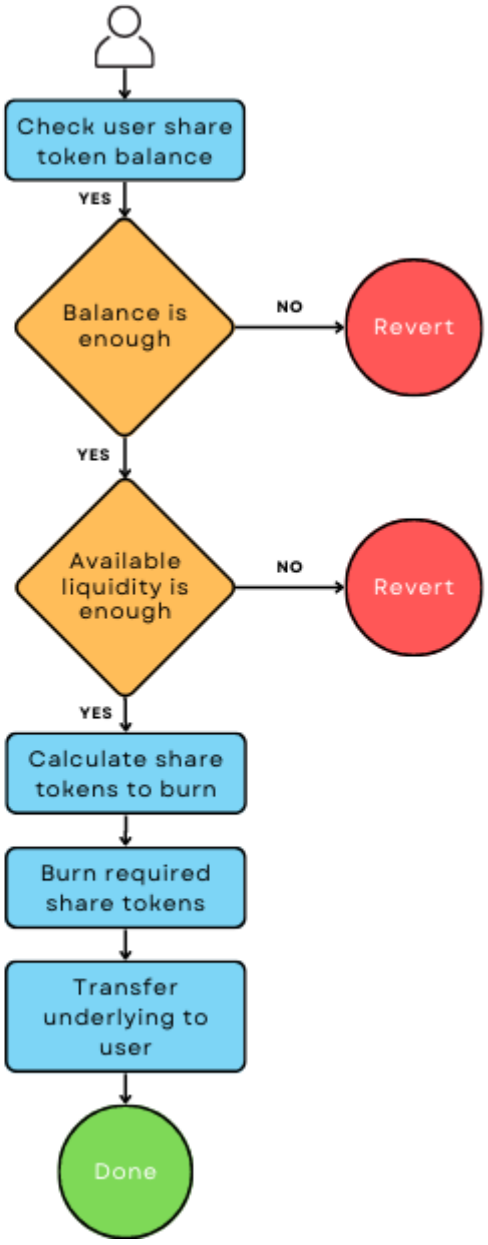

Figure 4: Withdraw Funds

3.3 Insure

The insure action issues a new policy to the user for a specific amount of premium. The flow of action can be described as follows:

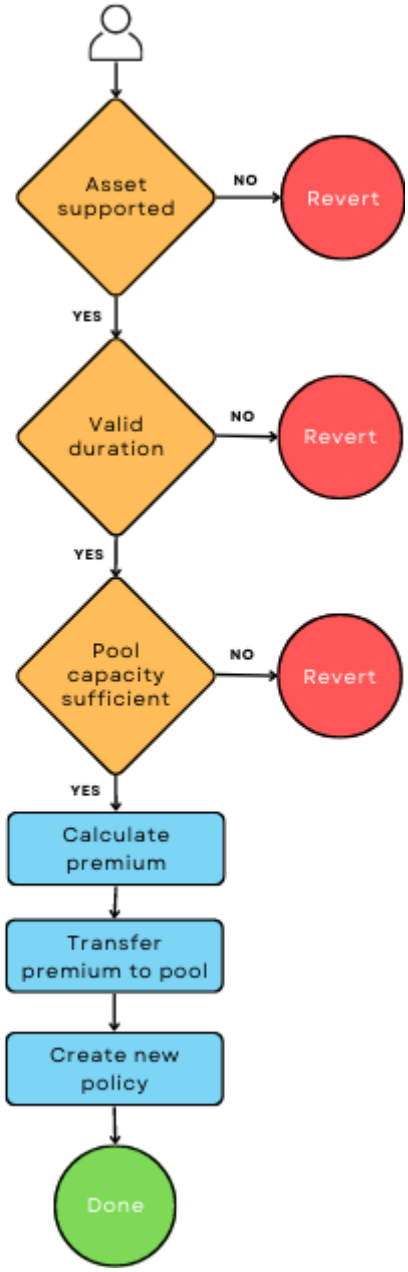

Figure 5: Buy Insurance

3.4 Claim

The claim action allows users to claim payout for their policy. The flow of action can be described as follows:

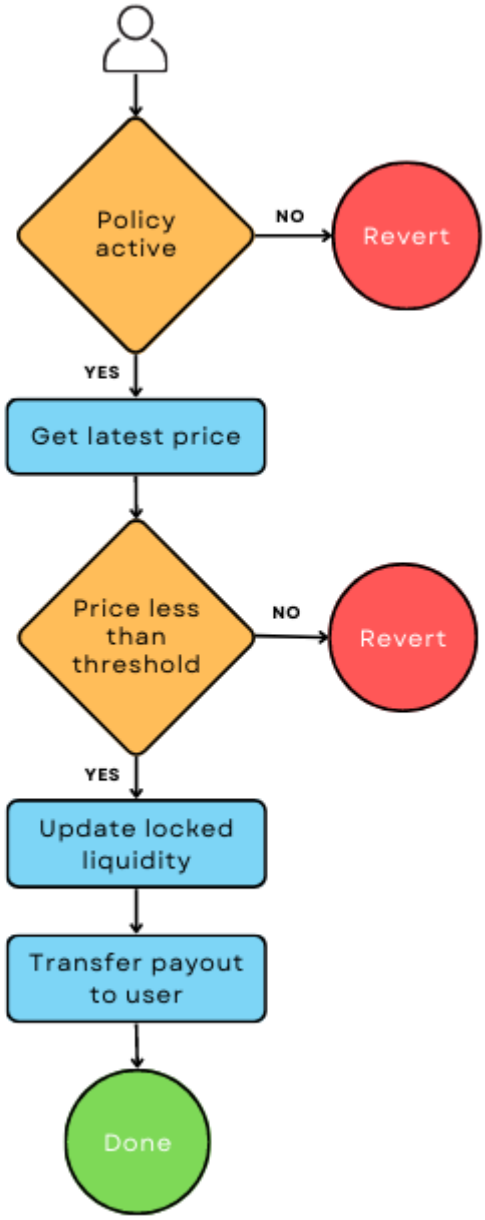

Figure 6: Claim Policy

3.5 Tokenization

The Insure protocol implements the ERC4626 tokenized vault strategy. When you deposit funds, you will receive a corresponding amount of share tokens called "Insure Interest Bearing USDC" (iUSDC).

iUSDC share tokens are natively interest-bearing, meaning that the value of the tokens will appreciate over time as a result of the premiums paid by insurance buyers. This increase in value will be reflected in the exchange rate of iUSDC to USDC.

4 BUYING & UNDERWRITING INSURANCE

Underwriting insurance on the Insure protocol is done directly between individuals and the pool. Risk premiums are determined by market supply and demand, with supply being the total liquidity in the pool and demand being the total amount insured by the protocol. This market-based approach allows for transparent and efficient underwriting of insurance.

4.1 Supplying insurance liquidity

To become an underwriter in the Insure protocol, you must provide USDC stablecoins to the liquidity pool. In return, you will receive an ERC20 token called "iUSDC" representing your share of the pool. As an iUSDC holder, you will receive proportional premiums from insurance buyers based on your share of iUSDC compared to the total supply of iUSDC. In return for receiving these premiums, you are required to pay out your pooled USDC in the event of an insurable loss. You can redeem your pooled USDC at any time, as long as it is not locked up as an insurance deposit. The iUSDC token is freely tradable on the open market, providing flexibility and liquidity for underwriters.

4.2 Getting protected

With Insure, anyone can purchase insurance to protect against losses from crypto asset devaluation, up to the amount of the liquidity pool. Insurance can be purchased at any time by paying the premium, which is determined by current market conditions. Insure calculates premiums based on supply and demand. As demand increases, the premium increases, and as demand decreases, the premium decreases.

5 PREMIUM RATE MODEL

Insure's premium rate algorithm is calibrated to manage liquidity risk and optimize utilization. The premium rates are derived from the Utilisation Rate U.

$$U = \text{Total amount insured} \quad / \quad \text{Total liquidity}$$

U is an indicator of the availability of capital within the pool. The premium rate model manages liquidity risk in the protocol through user incentives to support liquidity.

Liquidity risk materializes when utilization is high, and this becomes more problematic as U gets closer to 100%. To tailor the model to this constraint, the premium rate slope is split into two parts around an optimal utilization rate $U_{optimal}$. Before $U_{optimal}$ the slope is small after it begins rising sharply.

The premium rate P follows the model:

$$\text{if } U \leqslant U_{optimal} \ : \quad P_0 + \frac{P_{slope1} \cdot U}{U_{optimal}}$$

$$\text{if } U > U_{optimal} \ : \quad P_0 + P_{slope1} + \frac{P_{slope2} \cdot (U - U_{optimal})}{100 - U_{optimal}}$$

- When $U \leqslant U_{optimal}$ the premium rates increase slowly with utilisation
- When $U > U_{optimal}$ the premium rates increase sharply with utilization

The relationship between the utilization rate and premium rate is as follows:

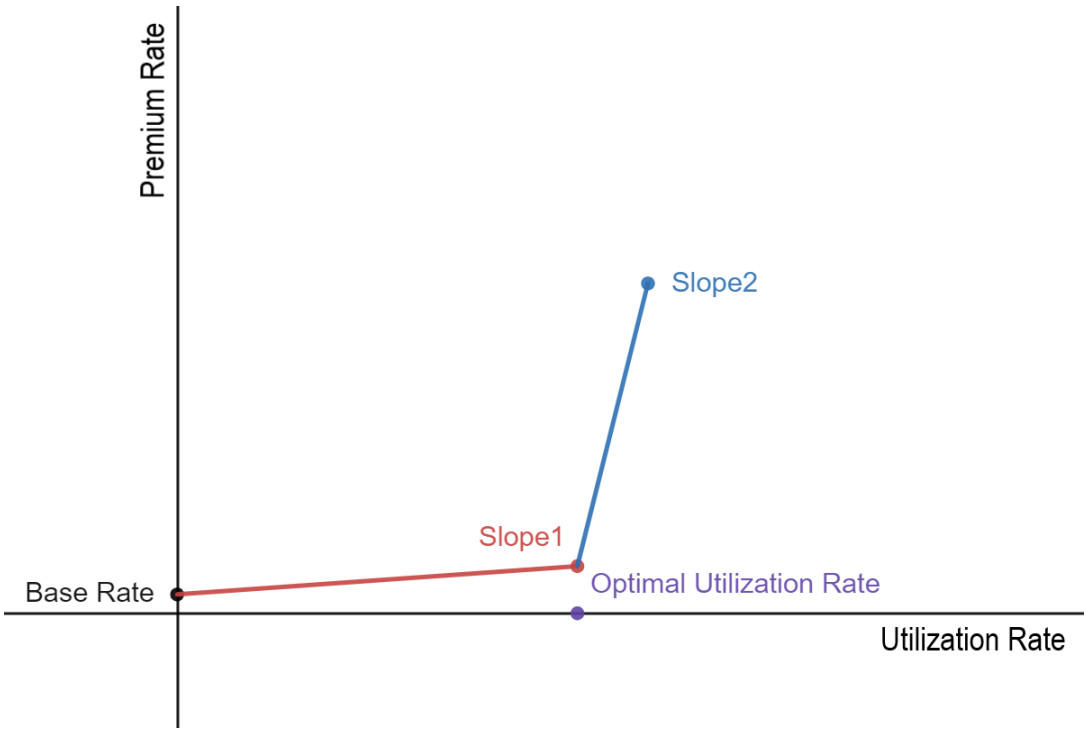

Figure 7: Premium Rate Model