Blockchain Insurance

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Contents

1 Introduction

Blockchain lending protocols are smart contracts that handle the lending of assets. These protocols use overcollateralization to decrease risk. A similar idea can be used to implement insurance on the blockchain.

Traditional (centralized) insurers use past experience to determine the amount of premium to charge for a given benefit. Benefit payout is handled by people. This entire process can be automated by a smart contract. However, in the case of a smart contract, the premium paid is equal to or more than the benefit to be paid out to ensure the insurer stays solvent.

A smart contract does not have a person examining past data. Rather, a token representing past experience can be issued to the insured. The smart contract can then decrease the premium of the insured based on the amount of experience token the insured pays into the contract.

Insured users who can pay large amounts of experience tokens are good risks which have been with the insurance company for a long time, and which the insurance company wants to keep as customers.

2 Terminology

The **insurer** is the smart contract that provides the insurance by taking in premiums. The insured is the user, or counterparty, wanting to recieve a benefit in exchange for paying a premium to the insurer smart contract.

The **benefit** is the amount the insured receives when the insured makes a claim. The **premium** is the amount the insured pays into the insurer.

Successful centralized insurers keep more premiums than they pay out in benefits to stay **solvent**. If the amount of benefit paid out is more than the amount of premiums taken in at any point in time, the insurer becomes insolvent.

Term is the period of time after premium payment during which a claim can be made. On the blockchain, term can be measured in how many blocks were added since the premium has been paid.

The **insurance contract** is the protocol that determines how much benefit is paid out, and how much premium is paid in, within a specified term.

The insurance contract is different from the smart contract, which is the code on the blockchain that implements the insurance contract. The insurance contract is active during the term, whereas the smart contract is always on the blockchain.

3 Benefit

The benefit is the amount the insurer will pay to the insured. This amount can be fixed by the protocol to one or more levels, e.g. 1000 USDC, 10,000 USDC etc.

4 Premium

The premium is the amount the insured will pay into the insurer smart contract. Centralized insurers allow low premiums to be paid for low risks. Premium calculation is based on past data.

A smart contract can simulate this risk adjusted premium by lower the premium required based on the amount of a special token, called the “experience token”, the insured pays into the contract. The premium and the experience token are paid together.

5 Experience Token

Experience tokens are tokens issued by the insurer to reward the insured for being a good risk. Experience tokens can also be used for the insurance company DAO. Large experience token holders have been customers with the insurance company for a long time, and are good risks.

6 A Distributed Insurance Protocol

This section proposes how a smart contract can automate the function of an insurer. Note the similarities of this insurance protocol with other overcollateralized lending protocols.

Insurance contracts have a term. On the blockchain, this term can be measured in the number of blocks since the premium was paid into the insurer. For example, after 5 blocks are confirmed, the insurance term can end. After that, premium must be paid to the insurer again to stay insured.

A longer term has higher risk, so the premium charged should also be higher. Let the term of the insurance contract be denoted by T.

Suppose at time t_0 an insured wants to receive 1000 USDC in benefit. The insured deposits funds into the insurer smart contract. In order to ensure there is enough money in the insurer, the insured must "overpay", similar to overcollateralized lending protocols. Let p denote the premium paid at the beginning of the insurance contract term, and B denote the one benefit paid during the term of the contract. The following relation must hold:

$$p \geq B \ .$$

In the following discussion, suppose the premium is $p = 1100$ USDC and the benefit is $B = 1000$ USDC.

Let t_1 be a future point in time during the term of the insurance contract, $T \geq t_1 > t_0$. If the insured wants to make a claim, the benefit amount of 1000 USDC is paid out, leaving the premium amount of 100 USDC with the insurer. The insurer is solvent.

Suppose the insured does not make a claim, and the insurance contract expires at $t_2 \geq T$. The entire premium amount of 1100 USDC is kept by the insurer. In order to entice the insured to not make a claim, the insurer issues experience tokens to the insured.

Topics of further research include when should the experience tokens be minted, whether the experience token can be bought and traded in other markets, whether there should be a fixed supply of experience tokens.

Since the insurance contract has expired at time T, after this time, the insured needs to make a payment again to stay insured. This time, the insured has a choice in how they pay the premium.

- Pay the premium in any accepted cryptocurrency.
- If the insured is a good risk and made very little claim, they will have a large balance of experience tokens with which they can now use to pay the premium. Up to 90% of the premium can be paid in experience tokens, so the insured is effectively paying just 10% of the premium out-of-pocket.

As long as the insured does not make a claim, they will always get back more experience tokens than paid in premiums. Thus, an insured that does not make a claim for a long period of time will have an increasing balance of experience tokens.

7 Conclusion

This document proposed a distributed insurance protocol which can be implemented on a blockchain. The protocol is inspired by overcollateralized lending.