

# Maple: a platform for smart contract bonds

V5.0

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## **Abstract**

This paper proposes a decentralised application for raising debt by creating and selling SmartBonds, digital bonds governed by smart contracts. Maple SmartBonds are secured bonds which use yield-generating assets as collateral. The application will provide a two-sided marketplace in which Supply of Maple SmartBonds is provided by Issuers who create them to raise debt or speculate on interest rates. Demand is provided by Investors who purchase the bonds to earn a yield or to hedge interest rate risk. Access to funding through secured bonds provides a way for lenders on decentralised finance apps to become “crypto banks” by borrowing against the value of their loan portfolio.

# 1 Introduction

Decentralised Finance/Open Finance (DeFi) applications enable holders of Ether and stablecoins to earn interest by lending their cryptocurrency. Maple will enable lenders on these platforms to grow by raising debt through Maple SmartBonds and re-lending through DeFi platforms. Maple paves the way for DeFi banks to emerge by giving them the means to fund themselves through a decentralized bond market.

Maple's two core user group are Issuers and Investors. Issuers are lenders supplying funds on Compound, Maker (via Dai Savings Rate) and other platforms. Investors can be anyone with a Web3 browser plugin. This paper uses Compound's cDai and Maker's Dai in examples as collateral and currency, respectively. The MVP is built on Compound as the most ubiquitous lending platform. Long term, Maple will be integrated with other collateral and cryptocurrencies.

Maple SmartBonds have the following use cases:

- **Banking:** Lenders on DeFi platforms can lever their lending to replicate the business model of a bank. The business model is to capitalise your bank with 10% equity and borrow 90% debt then provide loans. Your revenue is the interest on the loans and your expenses are the interest on your bonds. Maple SmartBonds are the way in which new banks can fund themselves.

Existing platforms can't support this because they rely on "currency as collateral" while Maple is "assets as collateral". This is more efficient because the "bank" can now use its loan portfolio as collateral instead of setting aside cash.

- **Speculation:** Maple SmartBonds are fixed interest rate so users can lever long on interest rates by holding cDai and issuing Maple SmartBonds. If the cDai rate increases, the Issuer earns more interest revenue without paying more interest expense.
- **Hedging:** Investors can hedge the risk of interest rates falling by purchasing Maple SmartBonds and locking in the offered rate.

## 2 Maple's Solution

Using Maple protocol, a lender on Compound, Alice, can basket collateral (represented by Compound's interest-bearing cDai tokens) she has funded to secure Maple SmartBonds which will be minted and sold to Investors.

The cDai tokens are held by smart contract until the Maple SmartBonds redeemed with repayments from closing out the Compound cDai position. The SmartBonds are burned when repaid as Maple does not have a native network token.

Investors in Maple SmartBonds benefit from the following risk controls:

- **Diversification:** their exposure is fractionalised so they're not exposed to the risk of any one DeFi loan default;
- **Credit Support:** the SmartBonds issued by Alice rank differently in order of repayment. This increases their collateral level above 100% and add a loss-absorbing buffer;
- **Interest Rate hedge:** the SmartBonds are issued at fixed interest rates, so Investors are protected against the Compound interest rate falling.

Reduced risk for investors means they can accept lower interest rates than the underlying cDai collateral pays. Alice now has a sustainable lending business because Maple lets her borrow for less than the rate she lends at.

Maple thus replicates the way traditional banks fund themselves by basketing loans as collateral for bonds. That global bond issuance exceeds US\$1T annually. Maple is more efficient because it aligns money, payment processing, collateral and contract enforcement on a single infrastructure layer, Ethereum. The old system uses fiat currency, unlinked bank accounts, oracle databases, paper contracts, phone calls and spreadsheet macros to accomplish the same, but each step sits on different infrastructure and incurs third party fees. Maple is a 10x improvement on this, removing fees and manual processes.

### 3 Using Maple: Lenders

Alice has supplied 100,000 Dai on Compound with an interest rate of 8%. She has run out of equity to supply and must raise debt to continue. The process of raising debt using Maple is as follows:

1. Maple deploys i) an SPV smart contract to control the Compound cDai tokens and issue SmartBonds, and ii) an Escrow smart contract to execute settlement;
2. Alice sets the bond terms to offer Investors. It includes Grade 1 and Grade 2 SmartBonds for investors and Equity SmartBonds to be retained by Alice (see key terms below).
3. A) Investors accept the offer and pay 90,000 Dai to purchase the Grade 1 and Grade 2 SmartBonds (see table below), this amount is held by the Escrow contract until settlement;  
B) Alice transfers the cDai collateral to the SPV contract and will receive 90,000 Dai on settlement (= Value of cDai minus the amount of the Equity tokens Alice must retain).
4. The offer period ends and the SmartBonds are Activated by Alice or an Investor. The Escrow contract releases the Grade 1 and 2 SmartBonds to the Investors, while the Equity SmartBonds and the 90,000 Dai which Investors paid both go to Alice.
5. Alice uses the 90,000 Dai to lend more on Compound. She now benefits from a portfolio of 190,000 Dai against liabilities of 90,000 Dai from the SmartBonds. Her equity is unchanged at 100,000 Dai. Importantly Alice earns more Dai revenue and increases her Return on Equity (see second table below).

## Key Token Offering Terms:

Token	Held by	Amount (Dai)	Loan-to-Value	Denomination per bond	Interest Rate (APR)	Term (mths)
<b>Grade 1 SmartBond</b>	Investor	70,000	70%	1 Dai	5%	12
<b>Grade 2 SmartBond</b>	Investor	20,000	20%	1 Dai	6%	12
<b>Equity SmartBond</b>	Issuer	10,000	10%	1 Dai	Residual	12
<b>Total</b>		100,000				

Alice is now funding her business at a weighted average interest rate of 5.2%<sup>1</sup>. The average interest rate she earns on her Compound loans is 8%, so if her other costs are less than 2.8% of her portfolio, then she can profitably grow her business by lending more through Compound and funding this with Maple.

## Return on Equity:

The table below shows that Alice has increased her Return by 4x by using Maple to lever her business.

	Before	After (assumes no reinvestment)
<b>Assets</b>	100,000	100,000
<b>Liabilities</b>	0	90,000
<b>Equity</b>	100,000	10,000
<b>Interest Revenue</b>	8,000	8,000
<b>Interest Expense</b>	0	-4,700
<b>Net Profit</b>	8	3,300
<b>Return on Equity</b>	8%	33.0%

<sup>1</sup>  $[(70,000 / 90,000) * 5\%] + [(20,000 / 90,000) * 6\%] = 5.2\%$

## 4 Using Maple: Investors

Compared with lending directly on a DeFi lending platform, Maple SmartBonds offer Investors the following benefits:

- **Diversification:** they in effect have a slice of hundreds of P2P loans instead of risking exposure to any one;
- **Extra Collateralisation:** the Grade 1 SmartBonds have an effective collateralisation of 143% using the example above. They are repaid first when the cDai is redeemed. Therefore their collateralisation =  $100,000 \text{ Assets} / 70,000 \text{ Grade 1 SmartBonds} = 143\%$ . The Grade 2 SmartBonds are repaid second, but before the Equity SmartBonds. Grade 2 collateralisation is  $110\% = 100,000 \text{ Assets} / (70,000 + 20,000 \text{ Grade 2 SmartBonds})$ .
- **Pricing for risk:** Investors wanting a higher return for taking more risk can buy the Grade 2 SmartBonds;
- **Operational risk:** as Maple integrates other DeFi lending platforms, Investors can be less exposed to the code risk of a single platform.
- **Hedging interest rates:** Maple SmartBonds are fixed rate so Investors are protected from a drop in interest rates on the collateral.
- **Liquidity:** Maple SmartBonds are ERC20 tokens which can be traded by investors on the secondary market instead of holding them to maturity.

### Use Case 1: Retail Investor

Bill is a retail investor who has not used Compound protocol before. He has a small amount of Dai available to lend but wants to ensure that he minimises his risk of default as much as possible. He is willing to accept a lower return in exchange for this but would still prefer a medium yield. By investing in Alice's Grade 2 SmartBond, Brendan benefits from the 10% of additional collateralisation from the Equity SmartBonds to absorb defaults.

### Use Case 2: Institutional Investor

Carrie is an experienced institutional investor looking for a new asset class. In the crypto-space at the time of writing there are no equivalents of investment grade debt. Carrie learns of Alice's SmartBonds and sees the similarity to traditional secured bonds. Carrie investigates, seeing that the structural credit support means a large proportion of loans would need to default (30%) and the value of the underlying ETH collateral fall significantly for her to suffer any loss.

Based on this she considers the Grade 1 SmartBond to be investment grade and purchases them.

## 5 The smart contracts

Maple recreates a secured bond using smart contracts. To execute this Maple has the following features:

- **ERC20** compliant, and tradeable;
- **Collateral-backing:** The smart contracts transfer cDai tokens to a smart contract to act as collateral;
- **Yield-generating:** The SmartBonds accrue interest which is paid at their maturity;
- **Trustless settlement:** Investor funds are escrowed until settlement, and returned if the SmartBonds aren't issued;
- **Risk transfer:** Each SmartBond Grade can have different collateralisation levels;
- **Fungibility:** Tokens within a Grade are fungible with each other, but not from one Grade to another;
- **Compliance:** Investors can be whitelisted to ensure trading is compliant with securities laws.

## 6 The Participants

The parties required for a Maple SmartBond issuance are:

- **Issuer (aka lender):** the party raising debt. They use Maple to create and sell SmartBonds to Investors and retain any leftover collateral interest at maturity.
- **Investors:** participants with different risk appetites seeking liquid, yield-generating assets.
- **SPV:** the smart contract created to mint SmartBonds for the investors. It receives the cDai from the Issuer and then transfers the SmartBond price paid by Investors to the Issuer. At maturity, the SPV closes out the collateral position and then repays Investors.
- **Escrow:** a smart contract created to ensure trustless settlement. It releases funds to Issuer and SmartBonds to Investors simultaneously.

Additional participants which may be required for efficient protocol function:

- **Oracles:** may be required later to monitor off-chain collateral eg non-blockchain personal loans where the underlying borrowers must make regular repayments.
- **Underwriters:** may be included to support Investors by performing due diligence on Lenders who provide undercollateralised loans. Underwriters would be paid a fee on settlement.

## 7 Interest and Final Redemption

Maple SmartBonds accrue interest over their life and this is paid to Investors on maturity of the SmartBonds. The Grade 1 SmartBond investors receive their interest first, then the Grade 2 and finally the Issuer who holds the Equity SmartBond.

Any shortfall between the interest payable and interest received is deducted in reverse order; starting with the Equity SmartBonds and ending at the Grade 1 SmartBond. The SmartBonds are burnt at maturity, completing the deal. At this point the Investor should have had their principal repaid and received all interest payable accrued, less any losses.