Undercollateralized Loans:

The current state in DeFi, issues, developments and solutions.

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Introduction

As developers started experimenting with blockchain technology and its potential, the financial sector presented the need to build blockchain-based fintech applications. Secure distributed ledger technologies have eliminated the need for third parties in financial transactions creating an open and permissionless form of finance dubbed '*Decentralized Finance*' (*DeFi*). This crypto sector features financial products such as trading platforms, decentralized exchanges, insurance services and money markets.

One of the thriving subcategories within DeFi is money markets. In the current state, money markets give users the ability to deposit collateral and borrow digital assets in a trustless manner. Lenders are able to earn interest, whereas borrowers are able to leverage up or be more capital efficient with their portfolios. The benefits of decentralized money markets include a censorship-free process, transparency, improved loan origination speed, and permissionless. Additionally, as the crypto industry has grown to a size of trillions, the presence of credit markets is important to stimulate economic growth and improve the use of digital assets on blockchains.

While transparency, over-collateralization and automation make DeFi dramatically less exposed to systemic risks, but inevitably make the credit market less capital efficient. This design choice was taken given the inherent lack of trust in anonymous transactions and the high volatility of the assets used as collateral. In order to protect lenders, the borrowers are mandated to post collateral that is automatically liquidated when their *loan-to-value* (*LTV*) ratio falls below a certain threshold.

The absence of *know-your-client* (KYC) and *anti-money laundering* (AML) information makes it hard for existing protocols to offer more effective solutions. Over-collateralization in DeFi limits capital efficiency and hinders future (exponential) growth of crypto-native money markets.

Rudimentary forms of unsecured lending have been developed in recent times but often involve entities established in Traditional Finance (*TradFi*) / Centralized Finance (*CeFi*) accompanied by some form of borrower creditworthiness analysis. This type of lending could improve a lot of the bottlenecks in the current DeFi lending landscape and the overall capital efficiency in the space. Some of the on-chain unsecured lending solutions currently on the market and presented in this paper require the borrowers and/or the lenders to go through identification processes. This compromises the whole crypto ethos of censorship resistance and decentralization. This paper aims to be a framework for the proper implementation of unsecured loans in DeFi. We believe that by analyzing the current

market, we are able to identify key factors that others can use to develop a well-functioning lending service.

Total Accessible Market (*TAM*)

To put this in perspective, let's consider the market of lending in TradFi. The global lending market is expected to grow from $70,070.08 *billion* in 2021 to $70,833.88 *billion* billion in 2022 at a compound annual growth rate (*CAGR*) of 10.8% and expected to reach $110,285.05 *billion*in 2026 at a compound annual growth rate of 9.6%. Currently, major companies in the lending market include *China Construction Bank*, *Agricultural Bank Of Chin*a, *JPMorgan Chase & Co*., *Bank of China*, *Industrial and Commercial Bank of China*, *Citi Group*, *Bank of America Corporation*, *State Bank of India*, *Mitsubishi UFJ Financial Group*, and *Legal & General Group plc*.
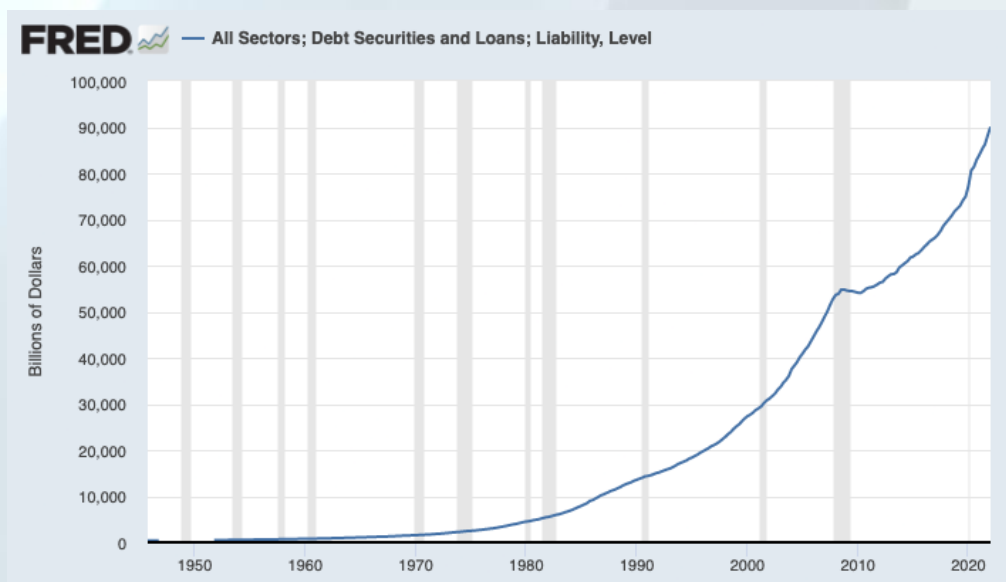
Source: Board of Governors of the Federal Reserve System (US)), August 12, 2022. Past performance is not a reliable indicator of future results. The data provided is for informational use only.

A short history of defaults

In case of mismanagement, unsecured lending brings critical risks to the table. Recently, we have seen this in crypto with the collapse of venture fund Three Arrows Capital (3AC). The fund reported multimillion-dollar losses due to a combination of a down-trending market and the crash of LUNA and UST. It led to the firm defaulting on a \$650 *million* million loan composed of 15,250 BTC and \$350 *million* USDC. These loans were often partially collateralized and brought the firm in trouble as the markets crashed. On the 1st of July, it was reported by Bloomberg that the company had filed for bankruptcy.

The firm was forced to liquidate its holdings and the markets were flooded. It caused crypto asset prices to decline further, causing a downward death spiral on assets that contributed to the destabilization of any crypto lender.

The situation with 3AC has several similar characteristics to what happened during the financial crisis of 2008. A bunch of companies performed little to no risk management on their asset holdings and were overleveraged to the top. Back then, the collapse of Lehman Brothers led to a domino effect and taken others in its fall. The difference with 3AC in crypto is the overcollateralized nature of the DeFi ecosystem. All the on-chain liquidations were carried out as they were programmed and overall crypto functioned as normal. This was important to reduce some of the damage created by poorly managed CeFi parties, like 3AC.

Another example of a poorly managed crypto firm is Celsius Network. A centralized company that facilitated a lending and borrowing market for crypto users. For the majority of 2021, they upheld the image of a reliable and trustworthy place to park assets and earn yield. In 2022, following the downtrend of the crypto markets, it came to light that the company took massive risks and had entered leveraged positions in an effort to offer higher yields than its competitors. One of the largest positions they held was in staked Ethereum and due to the assets being locked, the company had a hard time unwinding the position. The poor risk management led them to become insolvent after crypto assets dropped significantly in value, but it was ultimately the shade obscuring their operations that did not differentiate them from the TradFi companies that fell in 2008.

It is worth noting here that CeFi and DeFi are completely different worlds even though they are operating in the same industry, namely crypto. Different kinds of talent from all over the world have entered the crypto space to build a financial system that is more equitable, transparent, and antifragile. The events of 3AC and Celsius have shown how CeFi parties violated anti-fragility by borrowing on the funds of their depositors, being overleveraged, and subsequently being liquidated as a result of

poor risk management. It strengthens the value proposition of crypto-native financial systems that have been built over the past few years and continue to be built out.

Under these assumptions, we would like to address the current undercollateralized lending markets in DeFi, their problems, current approaches, and potential future solutions.

Purpose of this paper

Money markets play a crucial role within a financial system and show strength and traction in both the TradFi and the DeFi space. In the current DeFi environment, the overcollateralized character of present lending markets limits its use cases and capital efficiency. Due to the pseudonymous nature of blockchains and wallets, offering un(der)collateralized loans is hard to nearly impossible at the current state. As of writing, a handful of projects are actively working on solving this matter with likely a lot more projects/teams flying under the radar.

This paper analyzes sixteen protocols that aretackling the issue of un(der)collateralized lending in DeFi. The main goal is to outline the current market situation, but also to create a framework for undercollateralized loans by aggregating the benefits and pitfalls of current solutions developed by existing protocols. We hope that this paper can act as a source of information for those interested in this lending niche or in developing a new solution.

Undercollateralized Lending Basics

Definition and terminology

Outside of DeFi, no one segregates lending by "overcollateralized" and "undercollateralized." There are many types of lending: asset-backed, consumer, small and mid-size enterprises (*SMEs*), security lending, money markets, mortgages, and many more. In all of these, the level of collateralization is just a per-deal detail.

Keeping in mind the key characteristics of DeFi of being automatic and trustless, collateralization becomes standardized in the offerings of a protocol.

Generally,

- Undercollateralized loans have $collateral\ deposited\ >\ borrowed\ amount$;
- Overcollateralized loans have $collateral\ deposited\ <\ borrowed\ amount$.

Lending in traditional finance

In TradFi, collateralized loans are considered **secured loans** and have substantially lower interest rates than **unsecured loans** which are un(der)collateralized. Through collateralization, the lender/bank is able to seize and sell assets to offset losses in case of borrower default.

For households, typical collateralization assets include houses and cars while for business loans, lenders may post equipment, property, stock or bonds. Most secured lenders lend about $70\%\ to\ 90\%$ of the value of the collateral. Interest rates on collateralized loans range from $2\%\ to\ 8\%$ (these numbers display an industry average). A clear observation that comes up by studying the nature of these secured loans is that the collateral provided is most of the time considered to be a "safe" asset even though some struggle to become liquid on short notice.

Non-collateralized loans include credit cards and personal loans and generally have much higher interest rates ranging from 3% all the way up to 36%. These types of loans are generally supported only by the borrower's creditworthiness and lenders can generally decide whether or not to approve an unsecured loan. To access larger unsecured loans, higher credit scores are required.

One can already identify the bottlenecks that DeFi has to deal with in order to offer unsecured loans. In the traditional world, gatekeepers are in place to enforce KYC and handle creditworthiness. Because of the automated, transparent, and non-discriminated nature of DeFi, it is hard to implement such gatekeepers. This space is still in the early stages with a lot of "traditional" functionalities missing. That being said, there are a lot of protocols on the market working on and building out solutions. The next part of this paper is dedicated to analyzing these existing projects and identifying the strengths and weaknesses of their solutions.

Problems in offering undercollateralized loans in DeFi

Undercollateralized lending could make decentralized credit markets accessible for a wider set of use cases. The combination of easy, accessible capital and the open, cross-border nature of DeFi could lead to mainstream adoption as it is a very desirable financial tool. While the advantages of having such a market are pretty straightforward, there also are many challenges in offering these types of loans. The problems in offering different types of loans can be resumed in the following table:

Type of loan	Protocols	Challenges
Flash loans	*Aave, DYDX, Equalizer*	Very limited use cases - cannot be used for traditional loans use cases.
Crypto credit scores	*LedgerScore, Credmark, Arc, Zoracles, Wing, EasyFi*	Insufficient on-chain data for most users and ability for users to create infinite wallets. Lending on reputation is not enough, as it can be subject to manipulation.
Off-chain credit integration	*Teller, Clear chain capital*	Dependence on TradFi infrastructure.
Personal network bootstrap	*Aave, Akropolis, Union*	Hard to scale if not integrated with other metrics, ability for users to create infinite wallets.
Real-world asset loans	*Aave, Centrifuge, OpenDAO*	Illiquidity of physical assets depending on market condition.
NFTs as collateral	*Aave, NftFi, Youhodler, Helio, Stater, Lendroid,*	Asset illiquidity.

Besides these problems tied to specific loan types, we also identified more general problem patterns regarding unsecured loans in DeFi:

- **Credit defaults: not enough incentives to pay the loan back**
  Undercollateralized loans come with a much higher standard of trust that must be met by a borrower. This is a problem that persists even with heavy KYC done in many protocols but in an entirely decentralized lending system paying the loan back is simply not a dominant strategy for lenders. In the real world, this is handled by Government Agencies.

- **Higher interest rates for borrowers in comparison to fully collateralized loans**
  Unsecured loans represent a higher risk for lenders in comparison to collateralized loans; therefore they expect to be rewarded with greater interest. This ultimately reflects on the borrower, who will need to pay higher interests.

- **Decreased speed for loan approval**
  Any kind of additional check on the borrower makes the loan approval timing significantly slower. Current overcollateralized loan services offer extremely fast loan approvals as the only requirement is the posting of collateral. This makes up for a unique selling point for DeFi money markets.

- **Performing a credit check or any kind of *know-your-customer (KYC)* and *anti-money-laundering (AML)* practices**
  Conducting any kind of identification practice goes against the core values of crypto and DeFi, albeit quite necessary to establish a form of trust. We expect that over time a crypto-native solution will be found for this to work in a trustless manner without having to give up sensitive, private details.

- **Potentially lower liquidity and less flexibility**
  While instant withdrawals are becoming a norm for new protocols, uncollateralized lending does not offer the same flexibility. Most borrowers would only be interested in fixed-rate, fixed-term loans for predictable repayment. This means lenders who fund such loans need to be comfortable locking up their assets for the duration of the loan and we expect them to be fewer than in the case of instant withdrawals.

- **Regulatory risk**

  Offering undercollateralized loans could bring strong regulators' attention to the protocol offering them. This is a result of the mess that the financial crisis of 2008 left behind.

Existing protocols

Maple

Website URL	https://maple.finance/
Chain(s):	*Ethereum, Solana*
Token(s):	*$MPL, $xMPL*
Category:	*Third-party risk assessment protocols*
Compliance:	*Very compliant; Strong due diligence conducted on borrowers*

Maple is a credit marketplace built on Ethereum and Solana providing undercollateralized lending for institutional borrowers and fixed-income opportunities for lenders. The protocol aggregates liquidity from any lender willing to deposit assets to the protocol and allows whitelisted institutional entities to borrow. Maple is similar to TradFi equivalents and conducts strong due diligence on their whitelisted borrowers

In order to borrow, institutions need to go through an approval process by creating an account on the platform and establishing contact with the Maple team. After approval, *Pool Delegates,* individuals or entities responsible for managing the lending pool, can request and conduct private diligence directly on the borrower. The inquiry on the borrowers' creditworthiness is done in a private process and consists of a confidential assessment of reputation, management background, business strategy, and financial records. The party responsible for the analysis is Credora who has established infrastructure using zk-proofs to do so. The loan approval time can be lengthy, because of the information requirements and the due diligence approach. Maple is catered towards high-frequency traders, market makers, exchanges and centralized lenders.

The lending functions through a system of *Pool Delegates* and *Liquidity Providers*. Pool Delegates are responsible for the evaluation of borrowers and are able to earn from the *establishment* and *ongoing* fees. To align incentives, *Pool Delegates* are required to deposit *Balancer Pool Tokens* (BPTs) into the pool they are managing. On the other hand, *Liquidity Providers* are also required to stake BPTs into a *Stack Locker* that is used as a 'first loss reserve' against borrower default.

Whenever a loan default occurs, *Pool Delegates* incur a loss before *Liquidity Providers*. Loan payments are required regularly and before considering a borrower defaulted they are conceded a grace period. The development of V2 introduced the possibility to offer refinancing deals to borrowers.

$MPL and $xMPL holders share fee revenues but also provide cover to the lending pools. This way, losses are ultimately covered by both stakers and native token holders.

Maple's company structure is partly centralized as administrators need to validate *Pool Delegates* and can stop the creation of loans and of new pools. They are also in the position to stop the protocol entirely.

Pros	Cons
Presence of mechanisms to address defaults	Identification and heavy due diligence conducted on borrowers
Choice-making lenders (Pool Delegates) have incentives aligned with the protocol's	Centralized control - admins can stop the protocol and need to validate pool delegates
Ideal for market-makers and CEXs	Slow loan approval time

Goldfinch

Website URL:	https://goldfinch.finance/
Chain:	*Ethereum*
Token:	*$GFI*
Category:	*Third-party risk assessment protocols*

Goldfinch is a credit protocol lending to institutions and businesses that provide collateral both on-chain and off-chain. Their core principle is "*Trust through consensus"* which means they require borrowers to show creditworthiness from the collective assessment of other market participants rather than base it on their asset holdings.

Borrowers are currently off-chain organizations who seek financing and they can propose *Borrower Pools* to the network containing all the details and terms of the loan such as interest rate and repayments. Before proceeding, these proposals need to be approved by auditors.

Investors decide on a case-to-case basis to either invest in a borrower pool receiving more benefits but being first-loss-capital or to be *Liquidity Providers*, supplying second-loss-capital to a common pool that automatically allocates funds across all borrower pools.

Pros	Cons
Model is viable if Cons are resolved	Difficulties bootstrapping a network of capable credit assessors
Distributed counterparty risk	Borrowers often do not provide enough data to make an accurate decision
Aligned incentives from anyone involved	Slow-going loan approval time

Gearbox
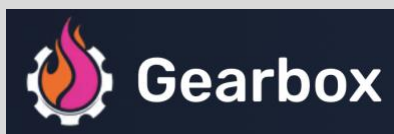
Website URL:	https://gearbox.fi/
Chain:	*Ethereum*
Token:	*$GEAR*
Category:	*Leverage protocol*
Audits:	*Peckshield, MixBytes, ChainSecurity, Consensys*

Gearbox is a generalized leverage protocol that allows users to get leverage to use in certain parts of the DeFi ecosystem. There are two key stakeholders: passive liquidity providers who earn yield by depositing assets on the protocol and receive *dTokens* (Diesel Tokens) in return. These are interest-bearing tokens that represent their shares of the pool; The second group of stakeholders are active traders who can borrow the assets deposited by LPs and trade/farm with leverage of up to four times their capital.

The protocol runs on *Credit Accounts*. These are isolated smart contracts that hold users' deposited funds and borrowed funds integrated with liquidation thresholds and a list of allowed tokens and protocols. The allowlist policy was implemented in order to avoid attack vectors from malicious actors or sending operations to malicious smart contracts

While the borrowing rate depends on pool utilization, the liquidation fees stand at 5% and a 1% fee on TVL is charged upon withdrawal to liquidity providers. The protocol fees for different operations partly go to the *Reserve Fund* in the form of LP tokens which are used to cover losses of the pools in case a *Credit Account* is closed with a loss for the pool. In such cases, Gearbox Protocol automatically burns their part of the Treasury's LP tokens - restoring the rate of Diesel Tokens. This makes the DAO Treasury act as a fund that automatically compensates liquidity providers' losses up to the level it is practically able to.

Pros	Cons
Allows the use of leverage on DeFi blue-chips	Leverage positions can only be used in a list of allowed tokens and protocols
Extended use cases: trading, farming, delta-neutral strategies	Can only be used in allowed protocols and with allowed tokens
Presence of a reserve fund to cover losses	
No identification is required	

Credora (formerly X-Margin)

Website URL:	https://credora.io/
Chain(s):	*14 EVM compatible chains and Solana*
Token:	*None*
Category:	*Credit evaluation*

Credora offers a privacy-preserving credit evaluation solution for institutions. They have built an infrastructure on top of *Zero-Knowledge Proofs* that allow institutions to give insight into their portfolio balance sheets, and other privacy-sensitive data without having to give up exact details.

The score institutions receive is a number from 0 *to* 1000 and is based on three categories: *Operations and Due Diligence* [200] - which measures corporate and operational risk*, Financial Analysis* [200] - representing an evaluation of borrower's reported financial data*, and Risk Monitoring* [400] - being a real-time evaluation of a borrowers' asset and liability visibility.

The real-time credit valuation and calculated credit score allow Credora to calculate a maximum Borrow Capacity. This metric provides clear guidance for other protocols and institutions and targets the maximum amount of borrowing that is feasible.

Their solutions are currently being used by Atlendis, Clearpool, Maple, Cega, and Zest.
Important to note that the protocol does not have a token and is heavily funded by venture capital.

Pros	Cons
Privacy-preserving	Third-party dependence for protocols
Piece of infrastructure for other protocols	Charges a fee upon using - can result in less competitive rates for borrowers

Atlendis

Website URL:	https://atlendis.io/
Chain:	*Polygon*
Category:	*Money market*

Atlendis is a money market protocol that aggregates liquidity from any lender and allows whitelisted institutions to borrow without having them to post upfront collateral. The protocol is very similar to Maple and also uses Credora for the credit rating. Borrowers on the platform issue zero-coupon bonds in the form of liquidity pools and any debts are paid back at the end of the maturity period that is set when the pool is created. The platform is very strict in terms of parameters: the maturity period and the credit limit are both set by the borrower upon pool creation and cannot be altered after.

As lenders deposit assets in the pool, the borrower is able to use those up to their chosen credit limit. Any unused assets are deposited to Aave to earn a safe yield, whereas borrowed assets enjoy higher rewards in the form of interest paid by the borrower plus any rewards. Positions in the pools are represented as NFTs with the following characteristics: the borrower pool, chosen lending rate, number of bonds, and amount of unused capital (in Aave).

As of writing, there are three whitelisted parties with active pools on Atlendis: Rhino Finance, ZigZag Protocol, and Wintermute.

Pros	Cons
Uses Credora for credit rating - working procedure	Only allows whitelisted institutions to borrow
Unused assets in the lending pool are deposited into Aave to earn a safe yield	Strict parameters that limit the flexibility of borrowers.

TrueFi

Website URL:	https://truefi.io/
Chains:	*Ethereum, Polygon*
Token:	*$TRU*
Category:	*Third-party risk Assessment*

TrueFi is an undercollateralized credit protocol powered by on-chain credit scores. They enable undercollateralized lending through the interaction of three stakeholders: (1) lenders, which can earn returns by lending stablecoins in TrueFi lending pools; (2) stakers, that act as part of the protocol's risk management system in return for native token rewards and fees generated by the protocol. Additionally, stakers are also able to vote on loan requests to signal creditworthiness on TrueFi's credit prediction market; and (3) borrowers who are vetted by the protocol request loans from lending pools using loan tokens, denominated in TUSD, USDC, USDT, or BUSD. Both lenders and borrowers need to be whitelisted.

The *Capital Markets* part of TrueFi enables third parties to launch their own lending pools that are customized and configured to their needs. The *DAO Pools* are managed by $TRU holders and they collectively assess the creditworthiness of borrowers and individual loans by staking the native token.

Currently, TrueFi only offers stablecoin loans with a minimum size of $1 *million* and a maximum size of $10 *million* with the average interest rate ranging between 8% *to* 12%. The loans are only conceded in the protocol's native stablecoin TUSD with the TRU governance token deciding who to lend to. This model makes sure that the incentives for users are aligned with voting rationally with a burning feature.

Pros	Cons
Lending decisions are made through the TRU governance token and its model makes sures that	Average interest rates are pretty high ~ 8/12%

there's alignment on incentives and rational voting	
Offers DAO Pools managed by TRU holders	Only focusses on large stablecoins loans having as a minimum $1 *million*
	Loans are conceded only in the protocol's stablecoin TUSD

Aave flash loans

Website URL:	https://aave.com/
Chain(s):	*Ethereum, Arbitrum, Optimism, Polygon, Fantom, Avalanche, Harmony*
Token:	*$AAVE, $stAAVE*
Category:	*Money market*

Aave is the most popular lending market for retail and institutions in crypto. They have a proven track record and have put out a great, reliable lending and borrowing product. One of the more interesting features of the platform is *flashloans*. This service is designed for developers as it is only accessible by building a smart contract that requests the loan. *Flashloans* are extremely interesting as they allow borrowers to get any amount of assets without collateral. The only requirement is that the loan is paid back in the same transaction with a fixed fee of 0.09%, hence the name *flash*-loan. In case the loan cannot be paid back the transaction reverts and nullifies every input and command..

The *flashloans* feature on Aave is a highly experimental, financial tool and requires deep technical understanding of the Ethereum code base. Even though the vanilla use of *flashloans* requires coding knowledge, there are tools like DeFiSaver and CollateralSwap that allow non-developer users to benefit from this feature by making it accessible and simple to use.

Pros	Cons
Flashloans allow borrowers to get any amount of assets without collateral	As the loan must be paid in the same block, the use cases are limited to arbitrage
There are protocols built on top of this feature that allow users without coding knowledge to use them	Solution that currently only works on Ethereum
The mechanism by which Ethereum transactions	

can revert addresses the issue of the user not repaying the loan back

Clearpool

Website URL:	https://clearpool.finance/
Chain(s):	*Ethereum, Polygon*
Token:	*$CPOOL*
Category:	*Money market*

Clearpool is a decentralized marketplace for unsecured capital that allows institutions to borrow funds from a decentralized network of lenders without the need for collateral. To be able to interact in the Clearpool ecosystem, institutions need to be whitelisted by contacting the team and having them go through KYC and AML practices, to sign a legal agreement and to go through a credit risk assessment.

Interest rates are dynamic and all pools are denominated in USDC. In their offering, we also find *permissionless pools*, which have a fixed duration, fixed interest, and fixed reward structure but require lenders to go through KYC. As a lender, when you provide liquidity to a pool, you will receive the platform's native interest-bearing tokens cpTokens in exchange. Insurance is offered to provide more protection to lenders and it is financed by a percentage of the interest applied. In the event of a loan default, insurance can be claimed by the pool's token holders (lenders), following an auction process, which is designed to maximize the total claimable amount for lenders.

When a pool reaches 95% utilization the *High-Utilization* mode is turned on and borrowers cannot remove liquidity, and once utilization reaches 99% withdrawals are suspended. Only then, borrowers have 120 hours until they get liquidated and the loan is considered defaulted. When a pool is in default, an auction will be triggered, which allows participants to bid for the pool's cpTokens (the total debt of the pool). Bidders can be individuals or institutions and must be whitelisted.

For credit risk-scoring, the protocol has partnered with Credora, which uses Zero-Knowledge technology to calculate risk computation on borrowers while preserving the borrower's privacy. $CPOOL is the utility and governance token for the protocol. In the protocol roadmap, we can find

the introduction of a native oracle system where a number of contributors will be tasked with providing parameters that will shape the interest rate.

Pros	Cons
They offer an insurance to protect lenders that is financed by a percentage of the interest applied	Very slow loan approval process as institutions need to a) contact the team b) go through KYC and AML practices c) be whitelisted
They outsourced credit scoring to Credora	Borrowers must go through KYC and AML
Results in being compliant thanks to their identification practices	

Mars Protocol C2C loans

Website URL:	https://marsprotocol.io/
Chain:	*Cosmos*
Token(s):	*$MARS, $xMARS*
Category:	*Money market*

Mars is a credit protocol that has three primary components: *the Red Bank* - where users can lend and borrow assets (collateralized borrowing); *the Fields of Mars* - where users can interact with applications built on top of the Red Bank such as leveraged yield farming (through C2C borrowing); and *the Martian Council* - where users with staked MARS (*xMARS*) can propose and vote on changes to the protocol.

The protocol consists of two types of borrowers: collateralized borrowers and contract-based borrowers (CBB). The latter are smart contracts that borrow assets from Mars' liquidity pools without having to post any collateral. These so-called smart contract credit lines have to be approved beforehand by governance and include a limit to mitigate the protocol's risk exposure. After the collapse of Terra, Mars has put their platform on hold and has been working on its transition to an application blockchain on Cosmos. Back when their platform was still functioning, examples of whitelisted smart contracts for C2C borrowing were yield farms on Astroport, a DEX on the Terra chain, to facilitate leveraged yield farming.

Mars implements a dynamic interest rate model that is based on control theory. This allows for greater responsiveness and capital efficiency. This is applied in the following ways: (1) on an outstanding loan the interest can be used as a tool to push borrowers and have them pay back their loan faster, and (2) higher interest rates will reduce borrowing demand which ultimately reduces the protocol exposure.

Pros	Cons
Smart contract credit lines are approved beforehand by governance limiting the risk of malicious contract interaction	Took a huge hit with Terra collapse and the following liquidation cascade

C2C loans can both be considered undercollateralized and collateralized as the collateral underlying a loan is present but not on the protocol.

DebtDAO

Website URL:	https://debtdao.finance/
Chain:	*Chain agnostic. Borrowing is done on request and approval*
Token:	*$DEBT*
Category:	*Money market*

DebtDAO is an open marketplace for DAOs and DeFi protocols that focuses on revenue-based financing. The target borrowers are protocols with on-chain revenue. They summarize bad debt held by major lending and borrowing protocols and allow users to acquire assets, extend credit lines, and allow for undercollateralized loans.

Revenue-based borrowing in their product dubbed *Spigot* means that protocols are able to borrow against their future revenue without KYC and automated repayment options. A major feature of this product is that other users are able to buy, sell, underwrite, and manage debt for the DeFi economy. The marketplace on DebtDAO allows for the creation of derivative products of the original debt to be sold on the open market. Examples are fixed-rate bonds or structured notes- which allow lenders to earn immediate profits and free up their capital.

Pros	Cons
They target protocols with existing on-chain revenue	They are able to offer loans without any KYC
They allow to create derivative products on the top of their offering	

Teller finance

Website URL:	https://teller.org/
Chain(s):	*Ethereum, Polygon*
Token(s):	*Fortune teller NFTs*
Category:	*Money market*

Teller protocol is a lending and borrowing market that operates through an open order-book model. Borrowers are able to bridge off-chain data onto an on-chain loan request and lenders that agree to the terms of the loan can directly transact with the borrowers.

The information appended to a loan request is at the borrower's discretion and may include financial stature, social status, identity and other relevant data. Depending on the users' jurisdiction or market owner, lenders may also be required to KYC using the third-party service *Hypernet*.

The protocol allows builders to become marketplace owners and launch their own lending book on top of the Teller platform. There are several use cases including mortgages, unsecured loans, payday and student loans, revenue-based financing, crypto investment loans, and bridge loans.

Pros	Cons
Able to safely offer unsecured loans for borrowers	Relies on traditional forms of credit rating - does not bring any innovation
Regulatory compliant thanks to the heavy KYC practices required	Requires both parties to go through KYC - unaligned with crypto values
	In order to get a loan, users need to connect a bank account but data remains private

	Resulted in not getting too much traction
	Relying on the Amazon Web Service infrastructure

Zeta

Website URL:	https://devnet.zeta.markets/
Chain:	*Solana*
Token(s):	*$DEX, $FLEX*
Category:	*Liquid derivative platform*

Zeta is an under-collateralized DeFi derivatives platform, targeting both individuals and institutions. They have two core products: *DEX* and *FLEX*.

DEX is a decentralized derivatives exchange with undercollateralized options and futures trading. It functions through a margin system which takes advantage of Solana's $400ms$ block time to update prices and monitor positions multiple times per second allowing for undercollateralized trading experiences. Key elements in their margin system are the *mark pricing*, the *collateral framework*, and the *liquidation mechanism*.

FLEX is a permissionless options creation and auction protocol that allows anybody to create tokenizable options with flexible parameters. The aim of this feature is to facilitate the matching process between options sellers and market makers with an auctioning and bidding system.

Zeta only accepts USDC as collateral and the requirements are different for each type of product.

Pros	Cons
Offering undercollateralized options and futures trading	Building only on Solana can limit their growth considerably
Taking advantage of Solana's high throughput	Hasn't got much traction yet with a TVL of $10 *million*

Paxo

Website URL:	https://paxo.finance/
Chain:	*Not live yet*
Token:	*$PAXO*
Category:	*Money market*

Paxo is a permissionless undercollateralized lending protocol with perpetual contracts. The protocol takes a Walled Garden approach, meaning that the borrower can only take out the loan amount once the principal and the interest have been paid. This kind of approach is often used in TradFi, where Walled Gardens play a huge role in taking the form of a fixed menu of products or services delivered by the Garden Keeper. Because your bank makes money off of your assets through spread lending and other fees, it's in their best interest to keep you in the Garden — even if it's not in your best interest.

On Paxo, the interest on borrowings is floating but very competitive. No KYC, credit checks or social enforcement conducted on borrowers are required. The protocol provides loans up to five times the collateral provided and the loaned amount is perpetual, which means that there's no expiration date for the loans as long as the collateral does not fall below the margin amount.

From a lender's POV, users can deposit their assets into a pool earning interest and *PAXO* rewards.

Pros	Cons
Following the Walled Garden approach where the borrower can only take out the loan amount once the principal and the interest have been paid	Not live yet - not clear what are the incentives for borrowers to return their loans
No KYC, credit checks or social enforcement is	Strongly relying on VC funding

conducted on borrowers	
Loans are perpetual as long as the collateral does not fall under the margin amount	

Sentiment

Website URL:	https://sentiment.xyz/
Chains:	*Not live yet*
Token(s):	*No token yet*
Category:	*Money market*

Sentiment aims to enable permissionless on-chain credit. The team recognized the widespread counterparty risk due to the lack of trust and absence of KYC practices in the space. Sentiment aims to change that by introducing on-chain hypothecation through the use of a proxy smart contract (wallet).

This proxy wallet is called the Sentiment *account* and is able to access leverage without overcollateralizatione. It is best to understand this account as a composite cross-margin debt position. In order to unlock loans, the borrower has to collateralize some assets, which can be multiple tokens. Based on the collateral amount, the borrower is able to unlock leverage under the constraint that the collateral and the borrowed funds cannot be moved freely and are bound to certain venues.

In this model, the borrower is not in direct custody of the funds, but rather in control of the proxy wallet. The protocol has first right of ownership to the wallet and this allows it to keep position risk in check which is important to keep the protocol protected from insolvency issues.

The Sentiment *controller* is overarching the proxy wallets analyzing all the calldata determining whether the action and the impact of the action on the holdings in the account are within certain boundaries. To a degree the controller is able to restrict the borrower from specific actions in order to maintain risk. On top of this authority there is the *risk engine* that controls the solvency on account and protocol layer.

This solution is very similar to Gearbox in the way they use proxy accounts for the creation of exceptional leverage on collateral. This project has only published a whitepaper and its product is not live as of yet, making it harder to analyze it.

Pros	Cons
Allowing on-chain hypothecation using proxy smart contracts	Borrowed funds cannot be moved freely - they are not in custody of the borrower but in control of the proxy wallet
Developed a risk engine that controls the solvency on account and protocol layer	

dAMM Finance

Website URL:	https://damm.finance/
Chain:	*Ethereum*

One of the newest protocols in the undercollaterlized lending field is dAMM Finance. The protocol is very similiar to Maple, but with some slight differences. Like Maple and Clearpool, dAMM is meant for institutional borrowers, more specifically market makers. Those institutions are able to borrow a wide variety of crypto tokens in an undercollateralized manner. In order to do so, they are required to pass a credit check by Credora and agree on the *Master Loan Agreement* with the dAMM Foundation for legal enforceability.

There are a few characteristics that set dAMM out of other institutional lending platforms. For one, whitelisted entities are able to borrow volatile crypto assets. Maple and others only support USDC and one or two other tokens. This gives market makers more control and flexibility in their market maker operations as it gives them access to altcoin liquidity without much or any collateral. The interest rates on these loans are determined algorithmically based on the utilization rate of the pool multiplied by the fixed borrowing rate set by governance.

Another interesting concept pushed forward by the dAMM team is *Liquidity Bonding*. They rightfully claim that liquidity mining often is unsustainable and not suited to create longterm alignment between users and the protocol. In order to achieve the latter, they have come up with *Liquidity Bonding*. A fairly simple, but powerful mechanism. Users are rewarded for pooling assets in the lending pools in **bdAMM** (bonded dAMM). This token is redeemable at parity for dAMM, but at a discount to the market price of dAMM. The discount decreases linearly over time from the moment the token is issued to the user until the end of the first year of the dAMM pools being available.

Pros	Cons

|	
Undercollateralized loans for volatile crypto assets	Only available for whitelisted institutions
Novel take on liquidity mining in the form of liquidity bonding to ensure long-term alignment between users and protocol	Thorough process to get whitelisted

Solv Protocol

Website URL:	https://solv.finance/
Chain(s):	*Ethereum, Polygon, Fantom, BSC, Arbitrum*

Solv is a decentralized marketplace for creating, trading and managing vouchers in the form of ERC-721 tokens that represent financial rights. Their product suite is mainly aimed at blockchain startups and DAOs (*B2B*). Solv creates new financial products in the form of NFTs among others are uncollateralized loans for DAOs.

The protocol offers what is called *bond vouchers* which are zero-coupon bonds with an embedded call option. Projects can use this voucher as a convertible bond or remove the European-style call option and use it as a pure form of debt. Solv's bond voucher leverages credit to borrow funds and offers investors a steady form of income with free upside on top (the embedded call option). The process works as follows:

1. The project/DAO locks an amount of token collateral in the NFT;
2. At maturity the issuer is charged a repayment for principal and accrued interest.
3. The payment is sent to the investors' wallet and additional native tokens are sent if the call option is exercised.
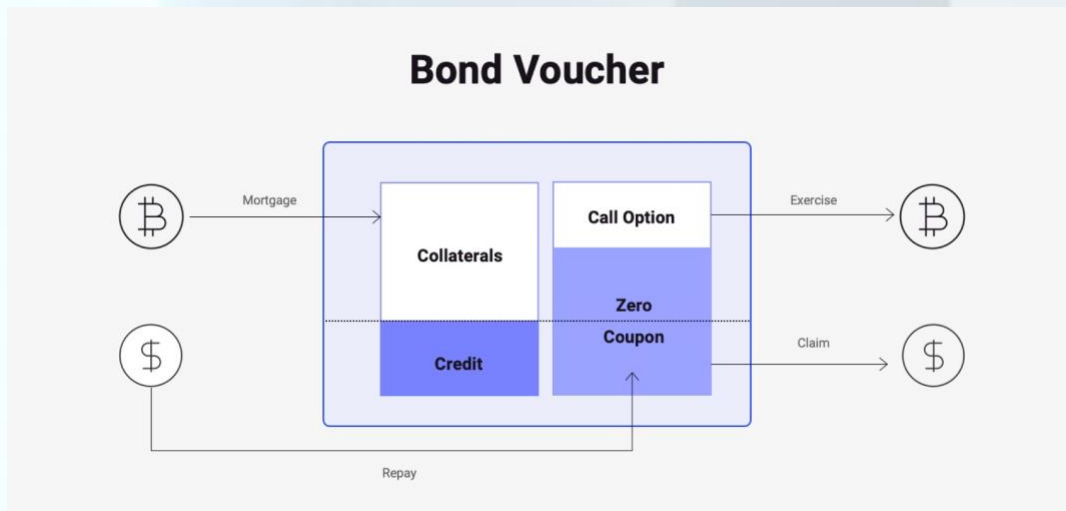
Bond voucher, the concept, Solv docs

DAOs can use the bond voucher as an undercollateralized loan as they are able to obtain liquid, stable assets without having to provide any upfront capital as collateral.

However, this does require a form of credit rating and Solv has created a credit rating system for DAOs. Normally, a DAO would raise funds by selling tokens or through emissions. This is not the case with a bond voucher, as debt repayments are enforced through the over-collateralization of assets for the call options, a neutral third-party funds manager, or an on-chain *IOU* (*I owe you*). The credit rating is handled by a neutral third-party protocol that will provide ratings and risk analysis based on the issuing DAO's balance sheet, financial reports, on-chain governance, and endorsements.

In the case of Solv, it is not clear who the third-party fund manager will be nor the party that is performing the credit rating. If a DAO is creditworthy, the voucher could have full intrinsic value and the holder of the bond could use it as collateral elsewhere. As a convertible bond, the voucher allows DAOs to obtain sustainable liquid assets by leveraging a mix of credit and collateral. By providing a fixed income to investors with a call option as the incentive, it empowers DAOs to get external funding in a cheap and sustainable manner.

Pros	Cons
Solv issues the Bonds as NFTs which makes them composable elsewhere	Unclear how Credit Rating will be done
The embedded call option makes it more appealing to investors as they are able to increase their profitability	Strongly relying on VC funding

In short

	Permissionless	Flexibility of loans	Assets	KYC	Credit rating
Maple	*Only for institutions*	*Freely movable*	*USD*	*Yes*	*By Credora*
Goldfinch	*Only for institutions*	*Freely movable*	*USD*	*Yes*	*On borrower discretion*
Gearbox	*Yes*	*Restricted*	*Blue chips*	*No*	*No*
Atlendis	*Only for institutions*	*Freely movable*	*USD*	*Yes*	*By Credora*
TrueFi	*Only for institutions*	*Freely movable*	*USD*	*Yes*	*Yes*
Aave	*Yes*	*Restricted*	*Multi*	*No*	*No*
Clearpool	*Only for institutions*	*Freely movable*	*USD*	*Yes*	*By Credora*
Mars	*Yes*	*Restricted*	*Blue chips*	*No*	*No*
DebtDAO	*Only for protocols/DAOs*	*Freely movable*	*Multi*	*No*	*Yes*
Teller	*Yes*	*Freely movable*	*Blue chips*	*Yes*	*Yes*
Zeta	*Yes*	*Restricted*	*Multi*	*?*	*?*
Paxo	*Yes*	*Freely movable*	*Multi*	*No*	*No*
Sentiment	*Yes*	*Restricted*	*Multi*	*No*	*No*

Solv	*Suited for protocols/DAOs*	*Restricted*	*Multi*	*?*	*By Credora*
dAMM	*Only for institutions*	*Freely movable*	*Multi*	*Yes*	*By Credora*

Potential solutions

zkKYC

By far the most interesting solution to us, and one partly adopted by *Credora*, is the use of zero-knowledge proofs in know-your-customer practices. The only caveat to Credora's business model is the focus on institutional markets and the presence of TradFi characteristics (centralized). An iteration of Credora's solution is the concept of zkKYC, which is a solution concept for KYC without knowing the customer while leveraging self-sovereign identity and privacy. It is a form of KYC that does not rely on upfront sharing of personal information with the counterparty/business, but still enables the identification of the customer if required.

In current KYC practices, when onboarding on a business a user must present their ID, the business then verifies the ID with a third-party identity verification service and if the identity is successfully verified, the user becomes a customer.

The ZK solution takes into account the creation of a ***Token*** that has to be generated by a potential customer and contains an identifier with verifiable information. The *Verifier*, i.e. the business, cannot read the information inside the token but is able to verify that the token contains the correct information. This is a highly desirable solution for both the customer and the verifier as the process takes place in a completely trustless and seamless manner. It has the potential to reduce process time and costs significantly by handling it on-chain.

A Verifier under zkKYC can request the *Holder* (customer) to present three types of information:
- **Eligibility proof**: proof that the Holder meets the (business) criteria set out to be able to provide access to their service;
- **zkKYC token**: encrypted data object that contains information to enable the Holder's identity to be revealed to specific parties only;
- **Validity proof**: proofs that the presented zkKYC token contains the correct information, without disclosing what that information is.

The objective definitely is improving security and privacy by taking away the need for businesses/merchants to have to process and store sensitive customer information.

This whole concept is based on the pillars of:

- Self-Sovereign Identity (*SSI*): digital identity documents can be held in a personal digital wallet. The user becomes a holder and he can present his documents to verifiers when requested;
- Decentralized Identifiers (*DID*): they can identify any subject (did: didmethod: did method specific identifier). The string allows a specific resolver to resolve a specific DID document from a Verifiable Data Registry;
- Verifiable Credentials (*VC*): issuers issue a VC to a Holder and digitally sign it with the secret key associated with their DID.

Cryptographic signatures enable the Holder to generate zero-knowledge proofs (ZKP) towards a verifier. Users have the ability to reveal only a selected set of attributes while hiding the rest and prove that something is true/false/greater/equal without giving specific information; revoke credentials.

Tokenization of debt

Next to developing and introducing new crypto native primitives regarding credit and lending, it is also a possibility to create derivative products that can be sold on derivatives markets. In order to create this, debt has to be tokenized, so it is fungible and able to be traded. Lenders are able to earn immediate profits and free up their capital.

This could be the creation of loan tokens represented by an *ERC-20* contract with the lender's share of an uncollateralized loan as underlying. These tokenized loans open up new opportunities on the secondary market. Examples include fixed-rate bonds and structured notes but in the end, the derivative should trade at a discount compared to the nominal value of the debt.

Notable protocols that are built on top of this concept are *DebtDAO, BarnBridge, Index Coop, Notional, and Element Finance*. This method removes the need for credit rating, but comes with other advantages/disadvantages.

Native tokens incentives to pay back the loan

Another possibility is to have protocol-native tokens play a major role in increasing the solvency and diminishing the payoffs for not paying the loan back.

Think of the following scenario where the user takes a loan amounting to x in assets with y as collateral and so that $x > y$. The protocol sets aside $y + z$, z being native tokens. Until the user pays off his x debt, he does not get access to his y collateral and the z incentives.

For one there must be some time constraints for accessing z to limit arbitrage strategies. Whenever the user pays back his debt, he will gain access to his collateral and the incentives offered by the protocol *minus* protocol fees *minus* borrow APR. This method could result in being vulnerable to gaming and other exploitative strategies.

The biggest drawback to this solution is very similar to current incentives offered on liquidity pools by DEXs and other DeFi protocols, i.e. token dilution. Offering these incentives attracts yield farmers who use the opportunity to farm the native tokens and sell them on the open market. This creates a negative feedback loop as new users are less likely to hold the tokens, because of deteriorating price performance.

Creation of (social) recovery funds for defaults

Another possible solution is the creation of recovery funds for defaults. Ideally, this is a smart contract that is responsible for all the bad debt accrued by the protocol. The contract can be funded with a token sale. Protocol bonds, or part of the interest rates, and its sole purpose is to help cover defaults. In case of a loan default, the lending pools would transfer all the bad debt assets to the *secure assets fund* (SAFU) in exchange for the full expected value of those assets.

A Social Recovery Fund would shift the financial burden from the borrower to a better-suited entity and someone else would guarantee repayments in case of borrower default. Much like smart wallets have 'social key recovery', where enough unrelated friends can help one recover access to their wallet, 'Social Fund Recovery' relies on trusted parties buying an option to cover and split the collateral cost.

C2C loans

A somewhat new DeFi primitive could be *Contract-2-Contract* lending. A system that is engineered to facilitate lending and borrowing between smart contracts; Algorithmically, automatically, and without any trust involved which is completely in line with the ethos of crypto.

In order to minimize risks, there should be a whitelist/allowlist in place that only allows certain contracts to use this service and gate it from malicious contracts. Think of smart contracts that have yield strategies based on Curve, which is trusted and relatively low risk as opposed to contracts that farm yield on riskier platforms. The whitelisting process could involve the developer team or a governance voting process.

From a user's perspective, there are quite a few use cases. For one, as stated earlier, smart contracts are able to efficiently leverage idle capital. Users are able to increase their yield through leverage with a small liquidation risk depending on the strategy and token composition. Other use cases include on-chain leveraged trading, insurance-related products, and metaverse lending tools that use in-game assets as collateral, arbitrage, and flash loans.

C2C lending is still largely unexplored. Aave offers flash loans that are also usable by smart contracts, the pitfall there is that the loan has to be repaid in one transaction. Mars Protocol is another project that comes to mind regarding C2C lending. Their product, dubbed *Field of Mars,* allows users to leverage whitelisted yield farms. The product was live on the Terra chain before it collapsed. Since then, the team has been working on a separate Mars application blockchain within the Cosmos ecosystem.

Proxy accounts

Finally, the solution adopted by Gearbox and Sentiment seems to be the most suited one for offering unsecured loans to retail. This method stays true to the permissionless character of crypto and does not require actual KYC. The borrower has to collateralize some funds in order to unlock leverage, but overcollateralization is not mandated.

Through the use of proxy smart contracts, the funds are in control of the borrower, but never in his custody. This is interesting as the borrower is never able to run with the money. A concern is whether the borrower is able to siphon the money out of the wallet through other activities. In the case of

Gearbox, users are only able to use the funds for certain ends and are restricted by the protocol to prevent such siphoning from happening. It is unclear whether Sentiment will launch with the same rigorous restrictions.

Regardless, these restrictions basically are the replacement of KYC. A level of trust needs to be enforced between the lender and the borrower. Traditionally, this is done through KYC. The lender can attest that the borrower is trustworthy and able to pay back the loan. The use of proxy accounts enforces trust on code level by restricting the capabilities of the borrower.

Special mention - Dopex Atlantics

As the last protocol analyzed and mentioned, we wanted to include a peculiar form of undercollateralized lending, Atlantics Options. While this can seem off-topic at first glance, there are neat borrowing mechanics underlying to these options. Dopex is a decentralized options exchange currently having six products that users can interact with: liquidity mining pools, single Staking Options Vaults (*SSOVs*), Atlantic Straddles, an OTC platform for options, interest rate options vaults and bonding. However, in the future, they will also implement Option Pools and Atlantic Options.

Atlantic Options are a true DeFi primitive and can best be understood as a hybrid between European and American options. The goal of Atlantics is to increase the capital efficiency of selling options contracts. As with normal option contracts, the users who wants to sell them has to provide the underlying asset upfront as collateral. The contract depositor has to deposit an asset to an SSOV contract which is then used to sell call or put options to buyers. This process is called providing collateral and leads to capital inefficiency since the deposited collateral is only recieving the liquidity mining emissions from Dopex and the staking returns of the underlying (eg. USDC deposited in Curve's 2pool).

Atlantic options work as normal options but the collateral underlying the options can be moved to be put to work until the expiry date of the contract. Put writers deposit collateral. That collateral can be used within the Dopex managed contracts as long as the premium and the borrowing fee are paid. The option writer clips a fee for allowing his collateral to be used, on top of the premium he got paid for writing the option.

The main feature of Atlantics, and what makes them a hybrid, is while their exercise is European, they allow migrating the collateral of the option elsewhere in DeFi during an epoch. Despite the collateral being locked in the option contract, it is able to be used elsewhere by other Dopex managed contracts.

Atlantic Option writers are token holders looking to buy tokens at below-market prices or to provide insurance while earning a premium and funding on their locked stablecoins within a defined period of time. Writers can deposit assets any time during an epoch.

As an option seller, your SSOV deposit is doing work for you before expiration, because others are able to utilize the seller's deposit for farming, non-liquidation perps and spot margin longs (eg. GMX and RageTrade). This allows sellers to earn funding rate fees on top of the premiums and potential token/staking rewards.

One potential use case for Atlantic put buyers is to borrow the tokens and decrease their liquidation price by a huge factor. This is true as long as the user has an active put option with a strike price greater than his liquidation price and current token price. An important remark to be made here is that users are not able to remove the liquidation price altoghether, because GMX only allows for a minimum of 1.1x leverage:

$$Updated\ liquidation\ price\ =\ protection\ price\ \times \frac{1}{11}$$

Consider this example of liquidation-free perpetuals mitigated with atlantic puts (AP) and atlantic calls (AC):

Hp: A user wants to go Y × long on ETH at a liquidation price of X$.

User buys Y atlantic puts at strike price slightly major of X$, let's say Z$.

- *If the price stays minor of Z$, the stables move from the atlantic puts to the perp to prevent liquidation;*
- *If the price gets greater of Z$, the stables move back to the atlantic puts.*

Users can still lose money but there is no risk of liquidation as long as the option, which can be seen as insurance, hasn't reach expiry.

Now if users do not have Y ETH for collateral, they can buy Y ETH atlantic call options paying a fee and a premium to use the atlantic call collateral and use that to unlock the atlantic put collateral. In this case users can long ETH on any DEX that offers leverage getting access to Y ETH with a lower collateral on the platform. By buying Y out-of-the-money atlantic calls, user can get access to Y ETH with just the initial collateral thus paying the option premium and the platform fee.

Pricing

Atlantic Options are priced at a premium compared to regular options since they offer a wider capital efficiency. The Premiums are based on the *Black Scholes pricing model* based on a function of the remaining supply of options in the pool and time to expiry. To use the collateral, users pay an option premium, collateral borrowing APR and protocol fees. Dopex and the protocols with Atlantics integrations receive fees from capital-in-use.

Anytime capital is unlocked from the option, a funding fee is paid inversely proportional to the percentage of capital remaining in the Atlantic Option Pool up to a max funding percentage set by governance.

Fees

Dopex-managed contracts would collect fees from all integrations: no liquidation perps/lending, leveraged no liquidation bonds, insurance, capital raises and any other application in the future. So the writer will be receiving three layers of "fees": premium, funding fee and staking yield. Protocol Fees: 10 bps of notational for buying Atlantic Puts or Calls, 50 bps flat for using the Atlantic Protocol

In summary:

Collateral	Collateral is mobile and movable through Dopex-managed contracts by depositing the underlying token. They allow the collateral to be released and used elsewhere in Defi in a productive manner. The underlying token can be withdrawn at any time as long as the collateral is returned to the option. Anytime the collateral is borrowed a funding fee is paid to the option writer.
Expiration	Atlantics are option contracts with a fixed expiration date. On expiry collateral being used is closed. The option writer gets part of the underlying tokens in exchange for collateral in-use. The remaining underlying collateral is withdrawable by both the writer and the purchaser.
Liquidation	In case of liquidation, the underlying token is moved to the option writer.

Use cases:

|	
No liquidation perpetuals	Buy Atlantic Put, move the collateral to position when x% away from liquidation via bots.
Leveraged non-liquidatable bonds	Deposit collateral to the bond, the managed contract borrows more funds to bond using the collateral and purchases Atlantic Puts for the bond time period. If the price gets x% away from liquidation, Atlantic collateral is unlocked.
Nested puts	Buy Atlantic Put, use the collateral from the Atlantic Put to sell a Put at a strike price x% lower. Example: Buy 2k Atlantic Puts and sell 1.5k Puts. This sets up a buy-the-dip strategy and can be chained in countless variations with options, perps and more for extended capital efficiency.
No liquidation borrowing	Buy Atlantic Put, move the collateral to another protocol when x% away from liquidation via bots.
Capital Raising	Accept APs instead of USD as a protocol for bonding, token sales or liquidity provision. This allows for more USD to be raised at a fraction of the cost for depositors.
Single-sided LP Staking	Buy WETH-denominated AP, a managed contract that adds liquidity for tokens and WETH in LP for incentives. The WETH ratio is rebalanced at the time of removal from LP in case of Impermanent loss to reimburse the writer with full WETH. The

	buyer of the AP receives farming rewards plus partial upside from the token going up.
Protocols who want to defend their native token price	The protocols sitting on rich treasuries usually defend their tokens' price by performing buybacks on spot. With Atlantics, protocols can write Atlantic puts and only move the collateral to the contract once x% away from the strike price, allowing protocols to use the capital in the meantime and earn a premium.
Options strategies	Buy Atlantic put, take the writer's collateral from the put and use it to write (sell) your own put at x% lower. This way you are earning a premium from the put you've sold and leveraged your own put using the Atlantic Option writer's collateral.

Conclusion

Since the notorious '*DeFi Summer*' of 2020, dozens of protocols have entered the space and created a wide variety of financial services and products on top of the blockchain. One of the most successful services offered is lending, which is an interesting tool for both small and large players, since it allows them to be more flexible in their portfolio management, short certain assets, or leverage up on a position.
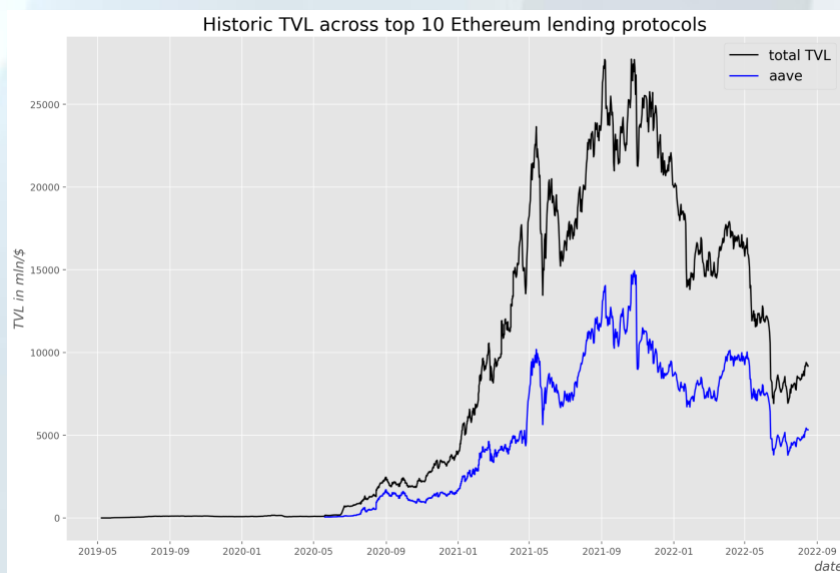
In the graph above the *Total Value Locked (TVL)* of the top 10 lending protocols on Ethereum is charted over time. The lending market really peaked last year during the huge bull run at over $25 *billion* in TVL. Right now, lending is just shy of $10 *billion* TVL. There are quite a lot of arguments to be made against TVL and that it is an irrelevant metric. We include it here because it does show the significant growth in popularity of the market and the size it had at the peak. This size was mainly due to the sharp increase in asset prices, therefore the data is in essence somewhat conflicting. The numbers in DeFi, even at peak bull run, are dull compared with traditional lending markets.

A major leap forward can be made with the introduction of unsecured loans in the crypto space. The DeFi lending space is mainly characterized by over-collateralization: borrowers have to put up collateral that exceeds their loan. This is done to ensure that loans can occur in a trustless manner. In case of default, the collateral is sold off and used to pay back the loan. Overcollateralization hinders capital efficiency and access to excess capital. Unsecured loans do not require collateral but require trust, guardrails, and/or backstops. It is a hard solution to find due to the nature of DeFi, and of the risks involved.

History is filled with examples of how unsecured loans ended up in financial ruination for households, banks, and other institutions. Examples are the financial crisis in 2008 and more recently the collapse of 3AC and Celsius. Successful implementation of unsecured loans in DeFi would mean a big step forward. In this paper, we went over a lot of the teams working on a solution with each taking its own approach.

By far the most successful protocols are the ones that share similarities with TradFi entities. Protocols, like Maple, Goldfinch, Clearpool, and Atlendis, follow the same model of aggregating collective liquidity and making it borrowable for institutions that went through a strict KYC and credit-rating procedure. The borrowers are able to do as they please with the loans but are bound to the maturity date and other preset parameters, like asset choice. This model is currently the best working as it only accepts trustworthy institutions that have also proved their creditworthiness. Interestingly enough, the majority of these protocols utilize the credit rating solution offered by Credora that is based on zero-knowledge proofs.

Ideally, we would like to see new protocols challenge this existing market and offer permissionless unsecured loans. The biggest bottleneck by far is KYC. Without implementing a form of KYC, it is hard to gauge whether the borrower is (1) able to pay back the loan, and (2) likely to pay back the loan.

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