

DeFi Protocols For Securitization: A Credit Risk Perspective

Feb. 7, 2023



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Key Takeaways

- As part of a drive to finance real world assets (RWAs) through decentralized finance (DeFi), protocols have emerged that aim to support the issuance of blockchain-based securitizations.
- The concept of DeFi securitizations raises some fundamental risks, in particular legal risks, operational risks, and the potential mismatch between fiat currency assets and digital currency liabilities. Addressing these risks will be critical to establishing robust structures.
- The use of DeFi protocols to facilitate securitizations is nascent, and we do not currently rate any. This report presents our initial views on the risks that such structures create for investors relative to traditional securitizations.

S&P Global Ratings believes the financing of RWAs will be a key focus area for DeFi, including the use of DeFi protocols to create securitizations. These protocols aim to emulate securitization structures seen in traditional finance, to capture potential efficiency gains from the use of blockchain technology, reduce reliance on third parties, and potentially access new sources of on-chain capital (i.e., market participants providing capital directly in crypto currencies). The early development of DeFi focused primarily on applications providing financial services within the crypto ecosystem, such as lending collateralized by crypto assets, investment tools for crypto assets, and crypto trading platforms. These initial use cases were broadly disconnected from the real economy. The financing of RWAs has emerged as a theme in the DeFi space, with lending protocols offering loans originated in the traditional way, based on borrower underwriting rather than backed by crypto assets pledged as collateral.

This report highlights some of the key credit and legal risk considerations that arise in contemplating a securitization structure set up in DeFi. We view the risk analysis of DeFi securitizations through the same analytical lens that we apply to traditional securitizations. DeFi securitizations carry some nuanced traditional risks, as well as some novel risks, such as those associated with the use of a privately issued stablecoin for payment, or a blockchain's temporary or permanent outage. We do not present any individual DeFi protocol, but rather the overall concept and the risks we see based on our current understanding. As with all things DeFi, this is a rapidly moving space and our thinking is evolving continuously. We use the following terms throughout this report:

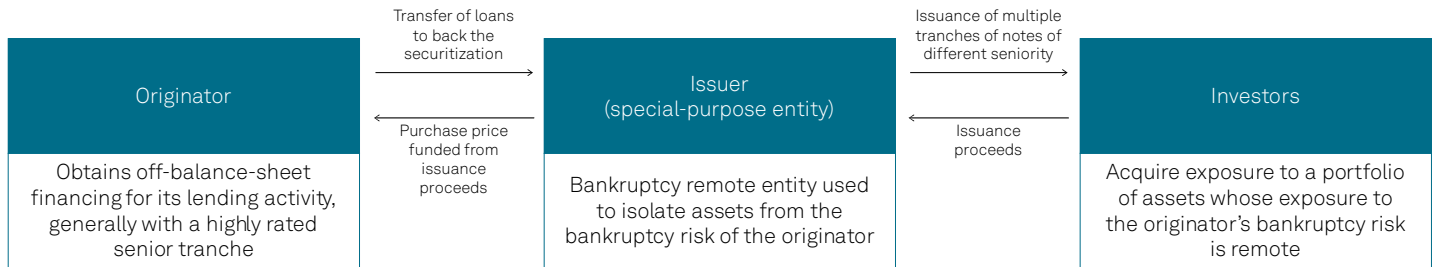
- **DeFi protocol:** An application built on a public, permissionless blockchain, that provides a financial service without reliance on a centralized intermediary, using a coded set of rules or procedures referred to as a 'smart contract' (see "Smart Contracts Could Improve Efficiency And Transparency In Financial Transactions.")
- **DeFi securitization:** A securitization transaction created through a DeFi protocol on a public blockchain. While the public blockchain may be permissionless, the DeFi protocol itself is likely to be permissioned to support anti-money laundering and 'know-your-customer' requirements. This report does not focus on the potential use of private blockchains in securitizations (see "Structured Finance: Distributed Ledger Technology Prepares For Takeoff," for a broader discussion on this topic).
- **On-chain and Off-chain:** Payments and activities that take place on a blockchain, or outside of a blockchain, respectively.

DeFi securitizations may enable a use case for DeFi in the financing of real world assets, but also introduce new risks

- **Tranche tokens:** Tokens created by the DeFi securitization protocol and purchased by investors. In some cases these tokens may represent investors' only claim on the issuer; in other cases investors may hold both tranche tokens and traditional notes.

DeFi Securitization: Why, What, And How?

Traditional And DeFi Securitizations Share Similar Purposes



DeFi securitizations aim to **achieve similar objectives** while enabling efficiency gains, improved transparency, and market access for smaller issuers and issuers located in new jurisdictions - but they also **introduce new risks**

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DeFi May Bring Potential Benefits To Securitization...

Reduce transaction costs...	...by automating certain steps in the transaction through a smart contract, such as the allocation of cash flows through the structure's priority of payments. This can remove or consolidate certain roles performed by third parties (for example, the cash manager).
Improved transparency on asset pool...	...if assets are tokenized (that is, represented digitally on a blockchain), since this may enable near real-time availability of portfolio information on-chain, compared to traditional securitizations where the servicer compiles and publishes asset performance information with a certain time-lag.
Reducing counterparty risk...	...for example, by reducing the accumulation of fiat currency on the issuer's bank account. Further risks may need to be considered, such as the custody of the issuer's digital wallet.
Less operational dependency...	...relative to a traditional securitization, through the reduced involvement of third parties described above, but also relative to a securitization that would use a private blockchain operated by a central entity. DeFi securitizations operate on decentralized blockchains.
New sources of on-chain capital for originators...	...as investors with on-chain assets to invest can deploy these in DeFi securitizations.
Faster payment settlement for investors...	...facilitated by disintermediation through on-chain payments.

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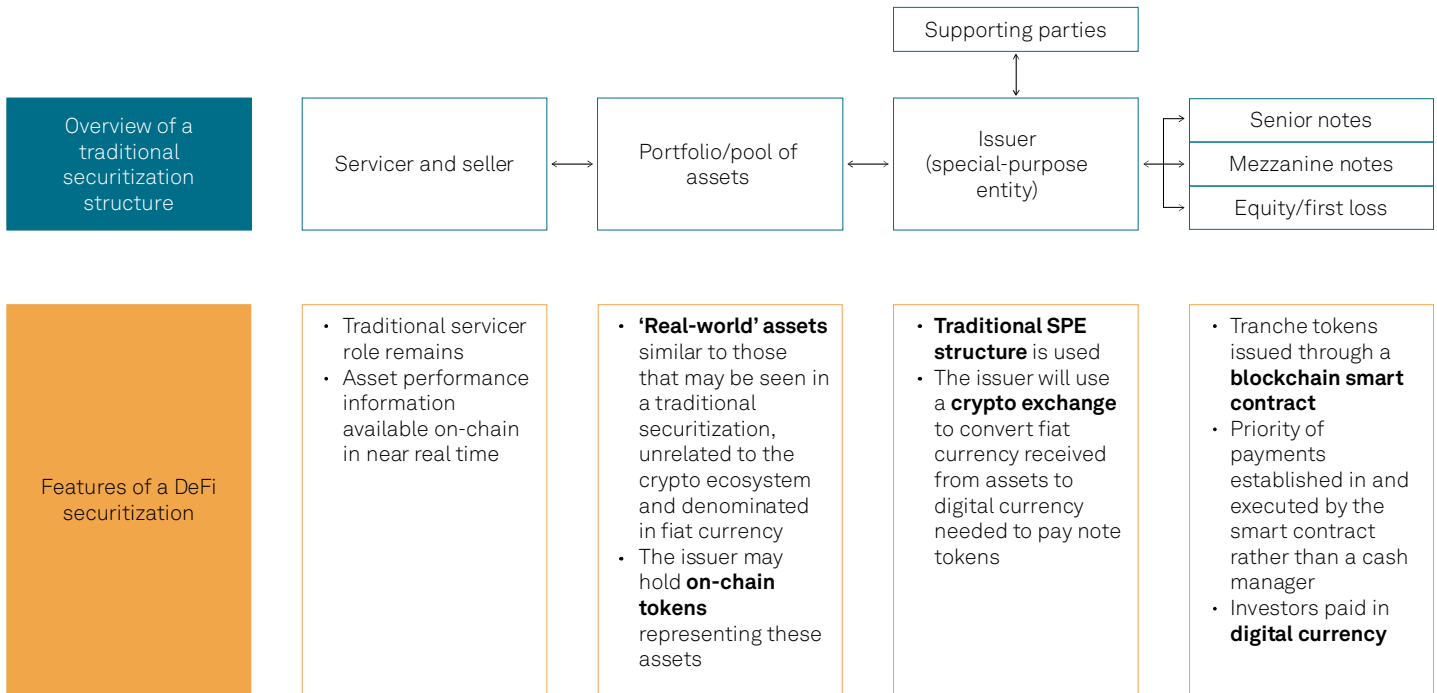
...Whereas Traditional Securitization Features May Mitigate Certain Risks In DeFi Lending

The DeFi lending protocols we have seen create certain risks. In these protocols, investors deposit funds into a lending pool, which are then disbursed to borrowers. Investors may also place funds in a reserve to cover credit risks in the lending pool, for a higher return. Investors may withdraw funds from both the lending pool and the credit risk coverage reserve, at the end of certain pre-defined lock-up periods, and subject to sufficient liquidity. Traditional securitization features can mitigate some of the resulting risks to investors (see chart.)

Risks in DeFi lending protocols		Traditional securitization features can mitigate these risks	
Liquidity risk...	...resulting from timing mismatches between underlying borrower repayments, investor withdrawals, new investor deposits, and new loan disbursements	Clear flow of funds from underlying borrower to tranche token holder	Clear priority of payments governing timing and conditions for investor withdrawals, providing visibility on available subordination levels over a transaction's life
Decrease in available coverage for credit risk...	...due to investors' ability to withdraw at the end of their lock-up period		
Some investors may withdraw quicker than others...	...leaving the laggards with a smaller pool comprising mainly the worst performing assets from the original pool		

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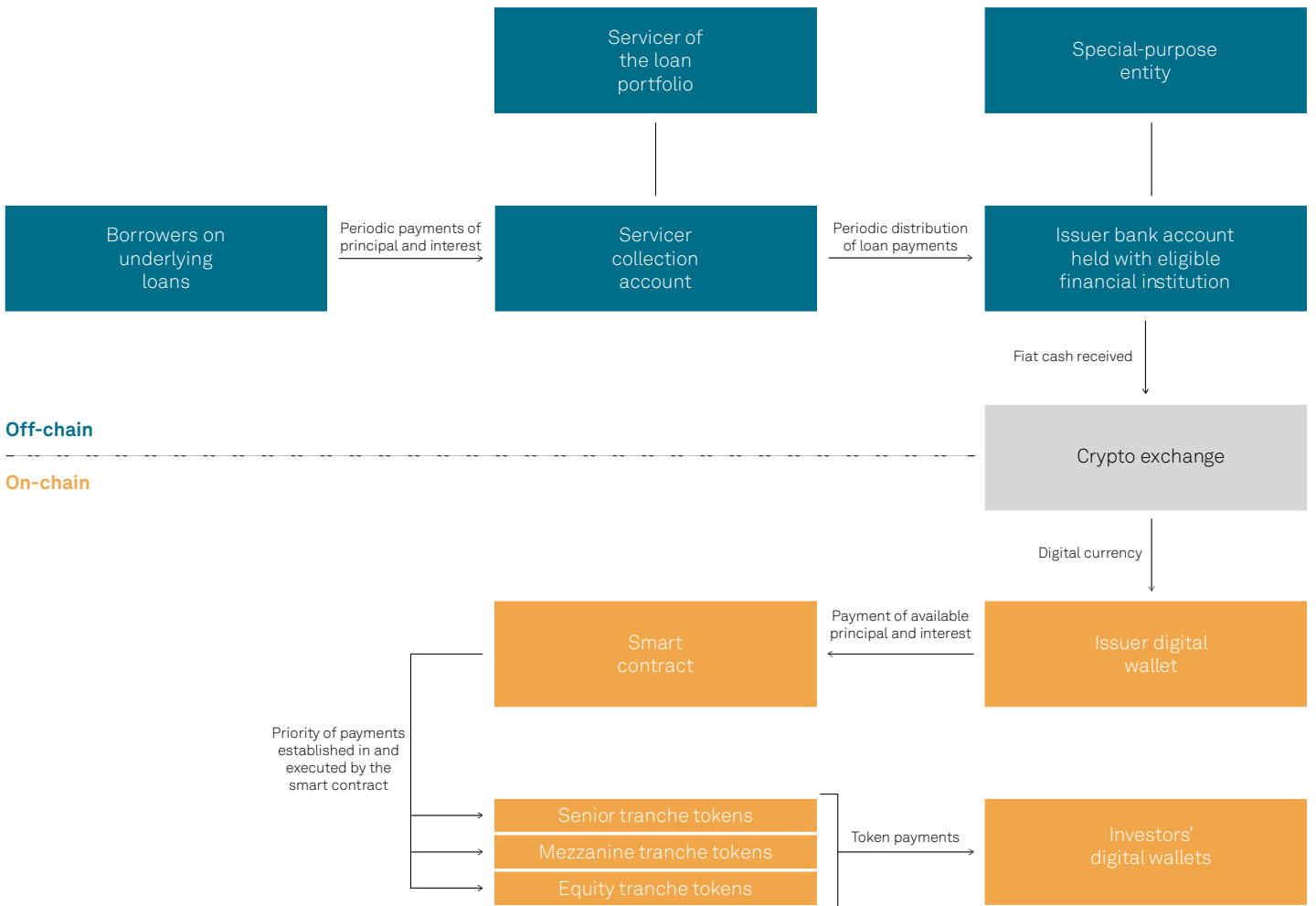
Features Of Traditional Versus DeFi Securitizations



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The flow of funds in a DeFi securitization starts in a traditional way as the underlying assets are RWAs. The key difference from a traditional securitization is that investors hold digital tokens (either in addition to, or instead of, traditional securities), and the transaction's priority of payments is executed on-chain through a smart contract to make payments to token holders (see chart). An on-chain flow of funds requires the use of a digital currency rather than fiat currency, which is one of the key risk factors we consider in this report. The issuer will convert the fiat currency received from borrowers to the digital currency needed for token payments through a crypto exchange, and will then transact with the smart contract through its on-chain digital wallet.

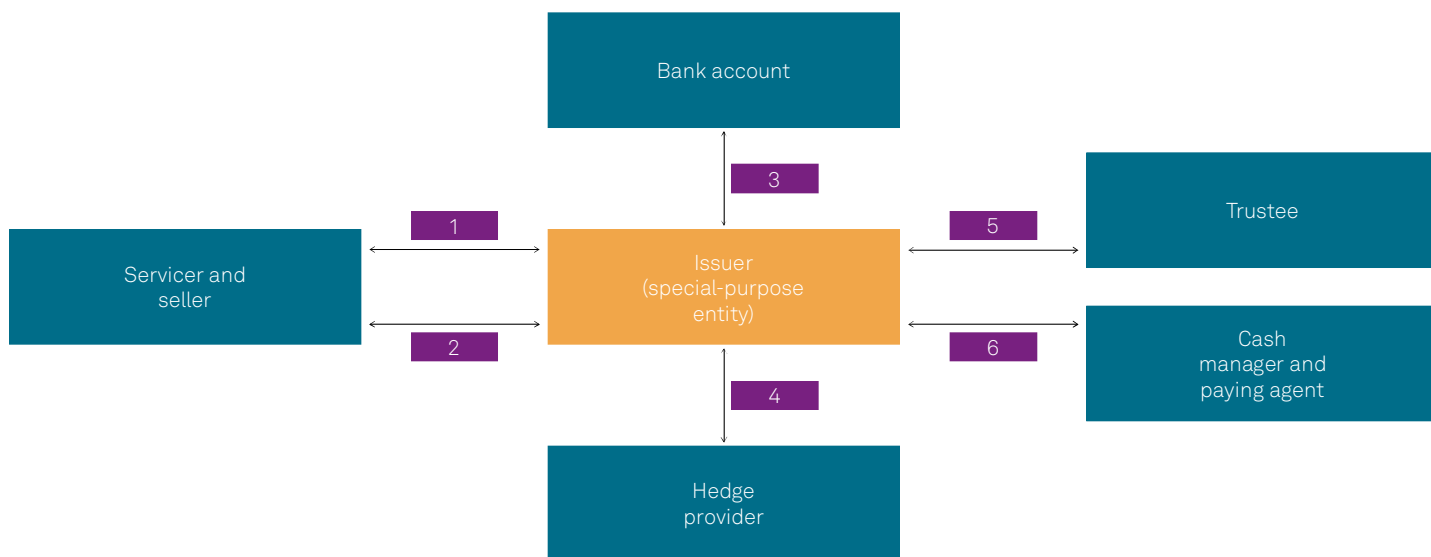
Flow Of Funds In An Illustrative DeFi Securitization



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Considering the off-chain component, some of the core traditional roles and documentation aspects remain relevant in DeFi securitizations, with some specific considerations (see chart).

How DeFi Affects The Role Of Key Transaction Documents



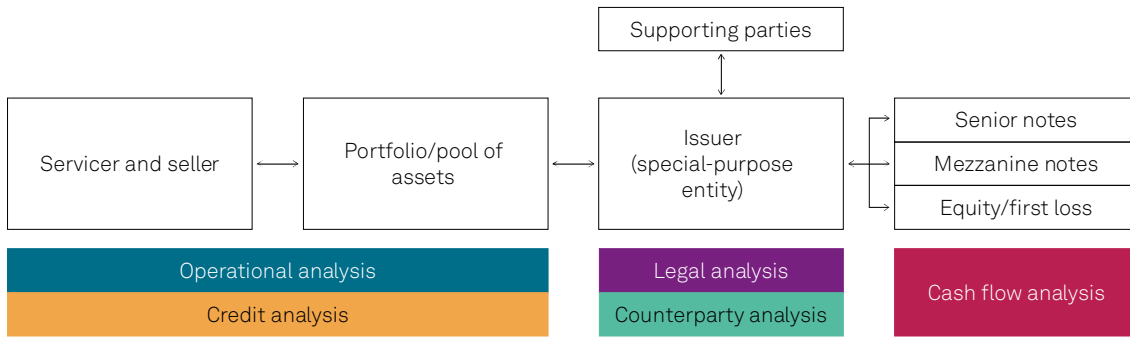
Document	Traditional securitization	DeFi securitization aspects
1 Receivables sale agreement	Defines the asset eligibility criteria, concentration limits, and seller's representations and warranties.	Similar considerations as assets are traditional 'real world' assets.
2 Servicing agreement	Outlines the servicing standards and fees, frequency of transfers from the servicer's collection account to the issuer's account, servicer termination events, and ongoing reporting requirements.	Similar servicing due to similar assets, with potential transparency improvements through on-chain availability of asset performance data.
3 Account bank agreement	Outlines the minimum required ratings for the account provider and remedies if it fails to maintain the minimum rating.	Remains relevant in relation to any accumulation of fiat currency prior to conversion. There may be additional dependencies relating to the custody of the issuer's digital currency.
4 Swap documentation (if applicable)	Defines the economics of the swap, events of default/additional termination events, and minimum required ratings for the swap counterparty.	Traditional currency or interest rate mismatches may exist and hedging may be relevant. The more novel mismatch is between fiat and digital currency--it is critical to understand this risk, for which traditional hedging tools may not be available.
5 Issuer security documentation	All of the issuer's assets are pledged to the security trustee, acting on behalf of investors, to secure the issuer's obligations.	Important to consider the trustee's role as well as legal aspects relating to tokenized assets (such as the creation and perfection of security interest in tokenized assets), if applicable.
6 Cash management agreement	Defines how collections will be applied according to the priority of payments (that is, transaction waterfall).	Replaced by the smart contract.

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Old And New Risks In DeFi Securitizations

Firstly, it is important to note that DeFi securitization protocols generally aim to facilitate the financing of RWAs (that is, related to the real economy rather than the crypto ecosystem) through a structure that is conceptually aligned with that of traditional securitizations. Therefore, the underlying assets and the fundamental credit risks of traditional securitization-- captured in the five 'rating pillars' of our securitization analysis (see chart and "Principles of Credit Ratings")-- remain relevant, with some important nuances and additional risks (which we initially discussed in "Exploring Crypto And DeFi Risks In Credit Ratings").

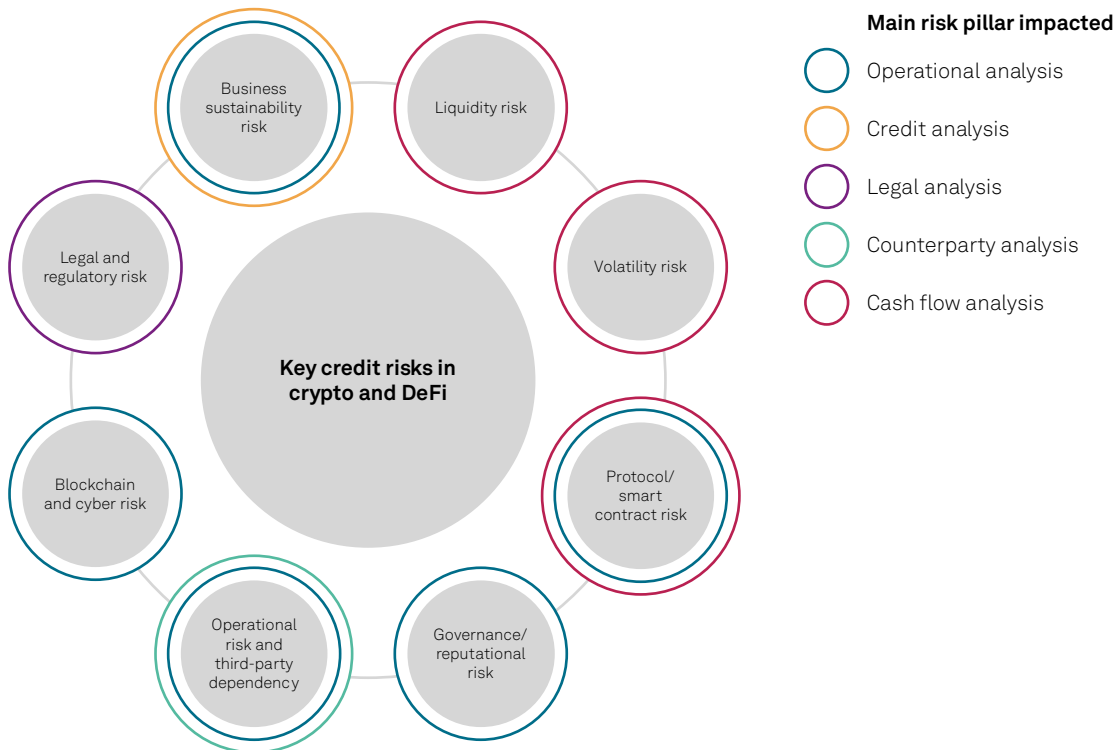
Five Rating Pillars For Securitizations



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We explain below how each one of the DeFi risks affects the five pillars of our credit analysis.

Impact Of Crypto And DeFi Risks On A Securitization Rating Analysis



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Legal and regulatory risk

For most traditional securitizations backed by standard asset types in established markets, the fundamental legal analysis is supported by a clear legal framework, decades of case law and established legal opinion practices. As a result, the demonstration of asset isolation, bankruptcy remoteness of the special-purpose entity (SPE) issuer, and investors’ claim to the underlying assets is generally well understood and backed by legal opinions that have stood the test of time. In contrast, DeFi securitizations are nascent and aspects of their legal setup are untested. They

may use some traditional aspects: the underlying asset types may be similar; a SPE may be used to isolate assets from the originator's bankruptcy risk; investors may hold traditional bonds off-chain in addition to the tokens issued through the protocol. Indeed, an effective legal setup may necessitate that transaction parties' rights and obligations be governed by traditional contractual arrangements. Legal clarity will vary by jurisdiction, as some countries have made more headway than others addressing legal aspects of digital tokens and smart contracts (see "Regulating Crypto: The Bid To Frame, Tame, Or Game The Ecosystem.") In addition, novel elements of these securitizations will be a key focus of our legal analysis. We will consider in particular the following questions:

- How are the assets isolated from originator insolvency risk? Is there a true sale of the assets to a traditional SPE issuer?
- Is the issuer structured as a bankruptcy remote entity?
- Does the issuer hold off-chain RWAs (for example, mortgage loans) directly, on-chain tokens representing these RWAs, or both? If the issuer holds tokens representing RWAs, does ownership of the token equate to a unique and legally enforceable claim on the tokenized RWAs?
- How is the investor's security interest over the issuer's assets created and perfected?
- What legal rights and obligations do the tranche tokens represent? Are they legally enforceable in court? Do tranche token holders have property rights in the tokens, or merely contract rights?
- How would a dispute regarding the smart contract be addressed? Which would be the applicable jurisdiction? Would there be an independent third party (e.g., a trustee) operating for the tranche token holders' benefit, and acting as the secured party for the token holders?
- Could tax considerations affect the transaction's flow of funds?

In addition, as one of the potential benefits of DeFi is to open securitization to new markets, further specific legal risks may arise in relation to new jurisdictions, or new asset or borrower types.

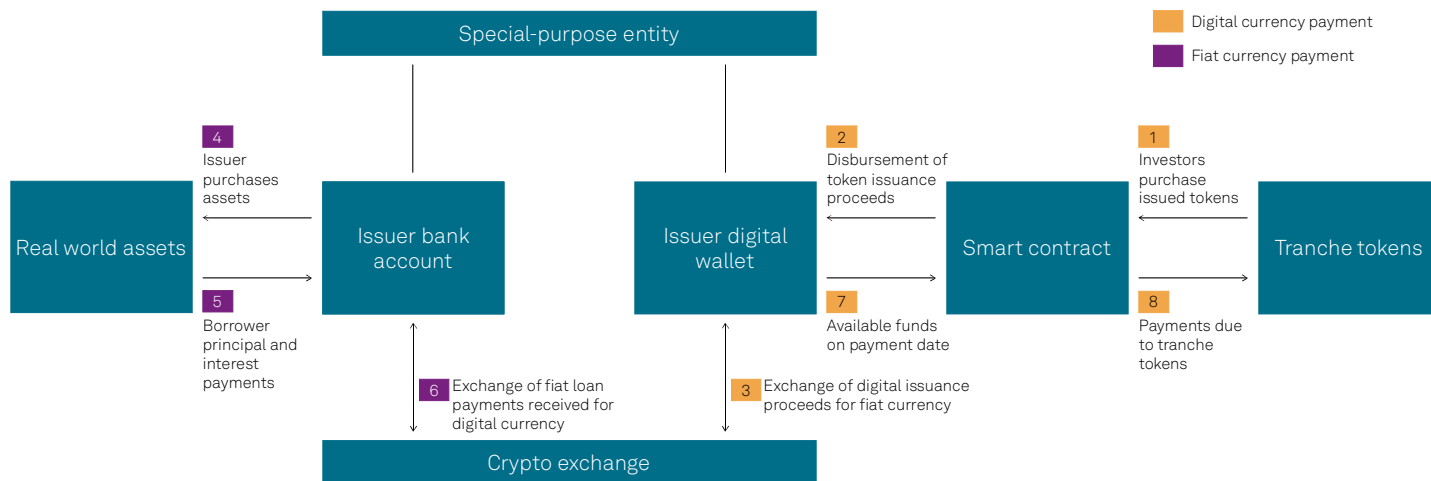
Moreover, similarly to the legal framework, the regulatory framework for traditional securitizations is well-established. It creates requirements around transparency, obligations of the key transaction parties, and the offering of issued notes to investors. In contrast, the regulatory framework for the DeFi ecosystem is also nascent and regulatory changes or interventions may affect investors in a DeFi securitization. A regulator may ban a specific digital asset (for example, a stablecoin used in the on-chain flow of funds for a given securitization) or place additional requirements on transaction participants. Although not affecting the creditworthiness of tranche tokens per se, investors and originators also face the risk that a DeFi securitization may be treated differently than a traditional securitization, for example for regulatory capital purposes. Because the DeFi ecosystem is so new, it is challenging to form a view on the likelihood, timing, and impact of some of these regulatory interventions. This needs to be considered when evaluating the tranche tokens' creditworthiness.

Volatility risk

A DeFi securitization has a mismatch between the payments the issuer receives from fiat-denominated RWAs and the payments it owes on the tranche tokens, denominated in a digital currency. The use of a digital currency is necessary to execute on-chain payments. In the examples we have seen to date, investors purchase tokens denominated in a privately issued stablecoin, such as U.S. dollar coin (USDC) or DAI, which aims to maintain its value pegged to the

U.S. dollar (see "Stablecoins: Common Promises, Diverging Outcomes" and "A Deep Dive Into Crypto Valuation.") A critical consideration is whether the issuer's actual obligation to investors is denominated in this stablecoin, or whether the obligation is denominated in a fiat currency, with the stablecoin used only as a settlement tool-- meaning the issuer could pay its obligation to investors in fiat currency if there was an issue with the relevant stablecoin.

Fiat/Digital Currency Mismatch In An Illustrative DeFi Securitization



Underlying assets are denominated in a fiat currency; tranche tokens issued to investors are denominated in a digital currency - generally, a **privately issued stablecoin** that aims to peg its value to a fiat currency.

What happens if this stablecoin deviates from its peg or is no longer available?

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The following example illustrates the risk of a stablecoin deviating from its peg:

- At the time of issuance of a DeFi securitization, the stablecoin's value is equal to the U.S. dollar (USD). Investors purchase 100 million of tranche tokens in stablecoin, backed by collateral in fiat USD. The key question is whether the principal obligation to investors is \$100 million in fiat currency, with the stablecoin simply used as a settlement tool, or the 100 million in stablecoin that they invested.
- If the investors are owed 100 million in stablecoin, there is mismatch or de-pegging risk to be considered. At some later date, the stablecoin's value may drop against the fiat U.S. dollar, such that one unit of stablecoin = 0.90 fiat USD. The drop in the stablecoin's value supports the issuer's ability to repay principal, but investors lose out relative to the initial fiat dollar equivalent amount of their investment.
- In an alternative scenario, the stablecoin increases to \$1.10. In this case, if investors are owed 100 million in stablecoin, the increased value of the stablecoin hinders the issuer's ability to repay principal. This risk needs to be mitigated.

- If instead investors are owed \$100 million in fiat, the risk associated with fiat/stablecoin exchange rate fluctuations is less fundamental, as the issuer can settle its obligation to investors off-chain in fiat USD if necessary. However, even if a transaction structure contemplates an off-chain alternative payment mechanism, this is likely to be triggered only in an extreme stablecoin depegging scenario, and otherwise the primary settlement method would be to use the stablecoin. Therefore, the off-chain payment contingency would not mitigate the risk of costs to the issuer resulting from smaller fluctuations that affect the ongoing exchange of fiat USD to stablecoin.

Beyond the risk of exchange rate fluctuations, a privately issued stablecoin may not be available for settlement over the transaction's life. For example, it is uncertain whether a privately issued stablecoin could continue to operate if its issuer became insolvent. Moreover, the protocol governing a decentralized stablecoin may explicitly contemplate that it could shut down in the event of material stress. How would a DeFi securitization operate if the stablecoin intended to be used in the smart contract was no longer available?

In addition, it is important to understand the stability of the subordination levels in a transaction. In a traditional securitization, investors in each tranche are repaid principal according to the transaction's priority of payments. In DeFi protocols, investors may be able to redeem their tokens at certain times and under certain conditions. Another key consideration is whether these conditions enable the amounts that can be redeemed for a given tranche to be comparable to the available principal proceeds to the tranche in a traditional securitization. This mitigates the risk that some investors withdraw leaving others facing losses due to reduced subordination levels.

Finally, digital currency payments incur transaction costs (commonly referred to as 'gas fees' and denominated in the selected blockchain's native token), which may affect transaction cash flows. One way in which DeFi protocols limit these costs is by accruing interest on the tranche tokens, rather than paying out interest each period, to reduce the number of digital currency transactions and the gas fees incurred.

Protocol/smart contract risk

In a traditional securitization, noteholders receive principal and interest payments in amounts and on dates established in the transaction documents. The contractual priority of payments (cash flow waterfall) sets out, based on available funds on any given payment date, the amounts of principal and interest owed to investors in each tranche in the structure. It also sets out any events that may lead to a change in this cash flow waterfall (for example, certain credit-related events may lead to a distribution of principal on a sequential rather than pro rata basis). A cash manager is responsible for the allocation of payments throughout the transaction's life and is bound by a contractual relationship with the issuer.

In a DeFi securitization, the transaction's priority of payments is established in and executed by a blockchain smart contract--essentially, a piece of code. Whilst this automation presents an efficiency gain and cost saving by removing the reliance on a third-party cash manager, it introduces a risk that an error in the code could lead to an allocation of payments that differs from the original intent. Once an error is identified, somebody needs to rectify it. In a traditional securitization, this would be the responsibility of parties who would follow predefined procedures and voting rights (where applicable) to make a change. In a DeFi securitization, a smart contract will continue to run in the same way until it is updated. It is important to consider which parties may update a smart contract, and how they would do this, to address issues identified during the transaction's life. This may introduce a third-party dependency, for example if only the entity that originally set up the protocol is able to make changes and may not be replaceable.

Furthermore, a smart contract code vulnerability would allow a malicious actor to exploit the protocol in such a way that may affect a transaction, for example by creating new tokens or disrupting the priority of payments. A smart contract audit may provide some comfort around the code's accuracy and protocol's security, although audits do not eliminate the risk of an exploit, or of an error.

'Oracle' risk is another novel factor that can affect DeFi securitizations. An oracle is an automated data source, external to the smart contract, that provides data inputs needed for the operation of the smart contract. For example, on a given payment date, the smart contract's allocation of available funds to tranche tokens may require inputs relating to the assets' performance. An oracle will feed this information to the smart contract. Any inaccuracy, interruption, or manipulation of this data feed could affect payments to token holders.

Finally, it is important to understand the potential for any smart contract execution dispute, and how this could be resolved.

Liquidity risk

The use of a DeFi protocol does not modify the concept of liquidity risks that can arise in traditional securitizations based on mismatches in the amounts and timings of cash flows received from the assets and owed on the notes. In the context of a DeFi securitization, the smart contract's payment timings may create or mitigate specific liquidity risks, in particular by establishing investors' rights to redeem tokens from the issuer.

Although not affecting the creditworthiness of tranche tokens per se, investors should also consider if a secondary market exists for these tokens. We understand these tokens are either not transferable or can only be transferred between permissioned investors registered with the relevant protocol. It is so far unclear as to whether any entity would be able and willing to act as a market maker in these tokens. Future regulatory developments may also impose additional restrictions on the transferability of tokens.

Blockchain and cyber risk

The blockchain on which the DeFi protocol is built, and smart contract payments are settled, may affect the continuity of payments in the securitization. The risk of a temporary or permanent outage of the blockchain could lead to delayed payments owed to investors or a loss of transaction information. Potential mitigating factors include the chosen blockchain's track record in operating without outage, as well as any contingencies and information back-ups contemplated in the transaction, for example to settle payments off-chain if on-chain payments were not possible. Another consideration is whether a specific transaction includes the use of multiple chains, requiring funds to be transferred ("bridged") from one chain to another as part of the transaction's flow of funds. The cross-chain bridges enabling transfers have been targets in some of the most significant cyber exploits to date, emphasizing the importance of mitigating such risks.

Operational risk and third-party dependencies

DeFi securitizations introduce novel forms of operational risks and third-party dependencies. We consider the impact on a transaction if these third parties were no longer able to perform their roles, and whether the issuer would be able to find another entity to perform that role. In particular:

- Reliance on the entity that originally developed the protocol (and the smart contract – see above), to maintain or upgrade the protocol as needed. The issuer may find it difficult to replace this entity, due to limited suitable replacements and potential interoperability issues.
- A dependency on the crypto exchange that the issuer uses to convert fiat currency to digital. Beyond simply enabling this conversion, a financial dependency could arise if the issuer holds funds on the exchange.
- The security of the private keys to the issuer's digital wallet is critical to the transaction's integrity because a loss of the keys could lead to an irrevocable loss of issuer funds. The storage of private keys for a SPE issuer is likely to involve a third party in some manner, whether simply to secure the issuer's offline storage device ('cold wallet') or to provide the issuer with an online solution ('hot wallet'). This raises questions around that party's security procedures and how the issuer's private keys would be kept secure if the party no longer performed its role.

Governance risk

A trustee or similar party's role will be important to establish and protect investors' rights in a similar way to a traditional securitization. As the transaction terms are set out and automated in a smart contract, it could prove more difficult than in a traditional securitization to make necessary amendments following a major unforeseen development. Further, the protocol may change over time. It is important to consider whether it is possible for protocol changes to affect specific transaction mechanics defined in the smart contract, and if so, how any such changes would be approved and introduced.

Business sustainability risk

Business sustainability risk (i.e., the risk associated with business volatility and competitive pressures) is generally not a key consideration in the analysis of a static asset pool backing a securitization. The assets backing a DeFi securitization are RWAs and therefore potentially resemble the types of assets backing traditional securitizations, and subject to the same credit risk factors driving borrower defaults and recoveries. It is likely though that initial originators using these protocols, and the pools they create, will differ in some respects from typical originators and pools in traditional finance. As a potential benefit of DeFi securitization is to provide a funding tool for smaller originators, pools may be smaller and present greater concentration risks. Originators may also be more recently established entities with a limited track record of operating at scale through a stressed environment.

It is also worth noting that securitization represents a use case for DeFi technology that is connected to the real economy, whereas earlier DeFi activity has focused primarily on financing within the crypto ecosystem. That said, it also relies to some degree on the performance of recently established entities with a limited track record in supporting party roles, creating potential operational risks in a transaction.

Is DeFi The Future Of Securitization?

DeFi securitization is at a very early stage and has a long way to go to be established as an alternative to traditional securitization. The technology has the potential to unlock efficiency and transparency gains as well as cost savings, and to open a new funding option in particular for originators whose size or jurisdiction has thus far hindered their access to traditional securitization markets. However, the use of DeFi protocols to create securitizations raises

fundamental risk considerations, in particular around the legal set-up and the potential mismatch between fiat currency RWAs and tokens issued by a DeFi protocol denominated in digital currency. In our view, addressing these risks will be critical to achieve meaningful interest among institutional investors.

Related Research

- [A Deep Dive Into Crypto Valuation](#), Nov. 10, 2022
- [Smart Contracts Could Improve Efficiency And Transparency In Financial Transactions](#), Oct. 5, 2022
- [Regulating Crypto: The Bid To Frame, Tame, Or Game The Ecosystem](#), July 14, 2022
- [Exploring Crypto And DeFi Risks In Credit Ratings](#), June 30, 2022
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