Moody's
INVESTORS SERVICE

New Developments in US ABS

William Black, Managing Director, Structured Finance

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Agenda

1. Marketplace Lending: Creative Disruption
2. Solar ABS: Financing Green Tech
3. Blockchain: A Glimpse of the Future

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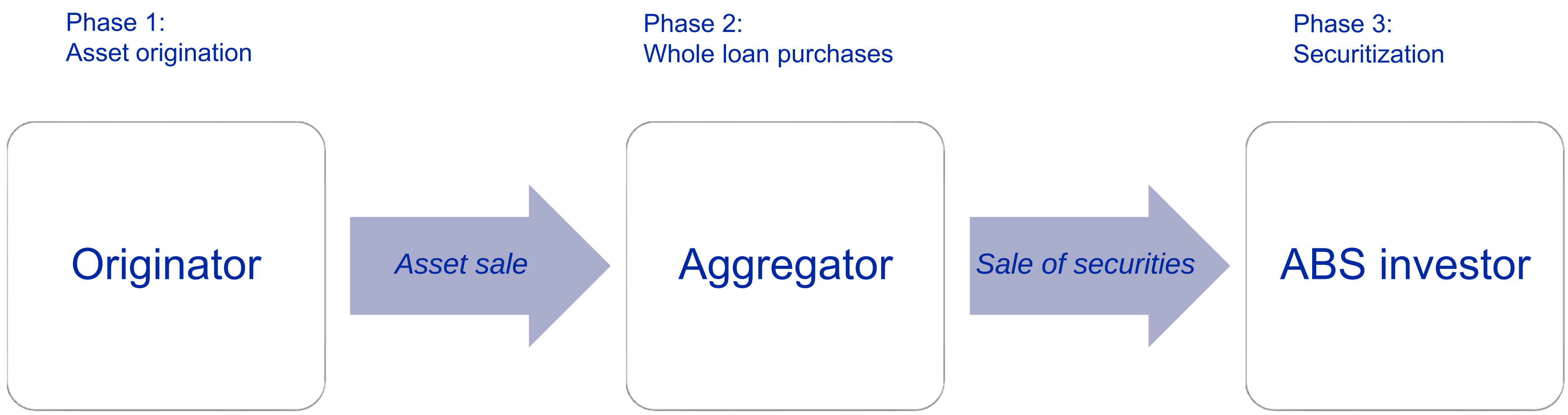
Marketplace Lending: Creative Disruption

Marketplace loan financing chain



Marketplace loan financing chain

	Phase 1: Asset origination		Phase 2: Whole loan purchases		Phase 3: Securitization
Market participant & transaction:	Originator	*Asset sale*	Aggregator	*Sale of securities*	ABS investor
Transaction terms & controls:	• Credit terms/pricing disclosed • Consumer & small business finance, extension of credit		• Asset level review & analysis, due diligence • Representations and warranties • Repurchase / indemnification		• True sale, and bankruptcy-remote status of assets • Eligibility criteria • Representations and warranties • Risk retention
Legal & regulatory framework in place:	• Federal and state banking laws: DIDMCA, Gramm-Leach-Bliley, TILA, Regulation Z, ECOA, UDAAP, FDCPA • CFPB: broad oversight		• No explicit regulation covering whole-loan purchases of assets • Anti-fraud law applies		• Securities Act • Securities Exchange Act • Dodd-Frank Act • Rule 144/144A • Regulation AB II

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Number of US marketplace lenders is growing

- More than 100 companies in the US now fit the description of marketplace lender
- Some of the more established players are expanding into additional loan types

Leading marketplace lenders and loan types they offer

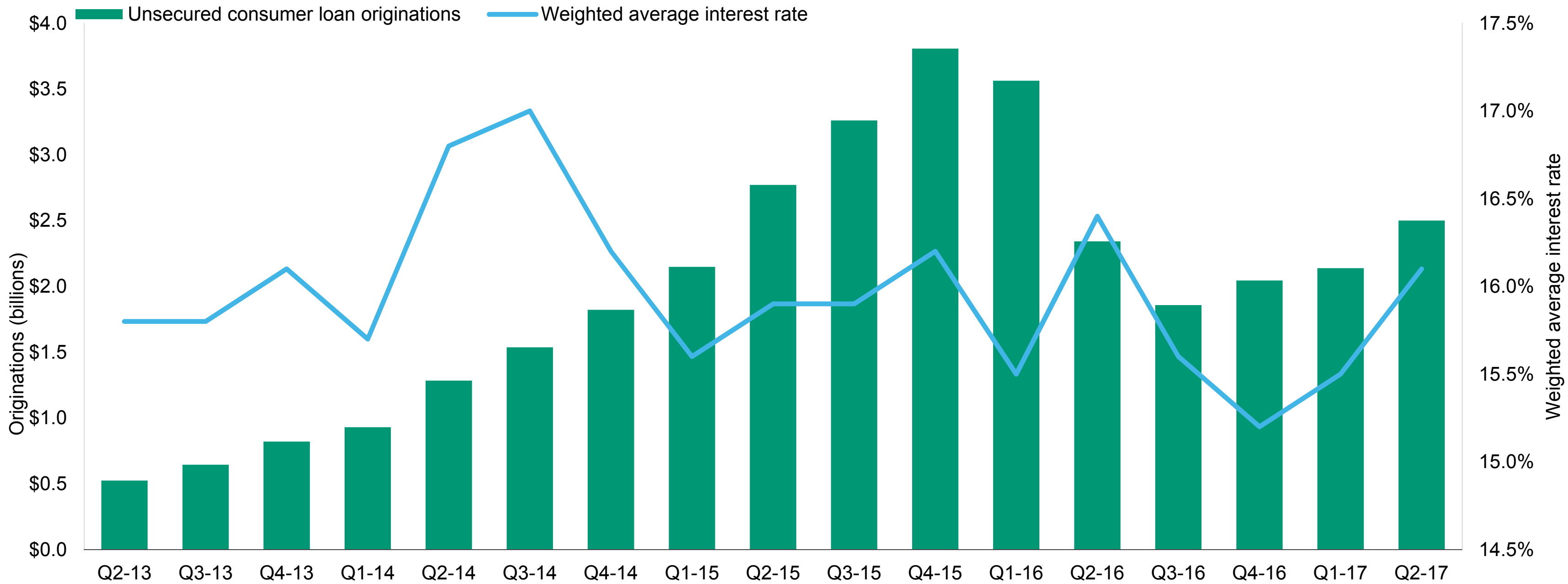
Originator	Student loans*	Personal consumer loans*	Residential mortgage	Medical procedure loans	Education loans**	Small business loans*	Subprime consumer loans
Lending Club		X		X	X	X	
Prosper		X					
SoFi	X	X	X				
CommonBond	X						
Avant		X					X
OnDeck						X	

* Assets included in rated securitizations
** Includes loans for private secondary and elementary tuition or tutoring; these loans are distinct from college student loans
Source: Platform websites, Moody's Investors Service

MPL origination growth, hampered by negative headlines, resumes at moderate rate

» Investors in MPL loans showed wariness in 2016 as a result of negative developments
  - Lending Club's CEO resigning amid questions about data manipulation and conflicts of interest
  - The weaker than expected performance of some marketplace lending platforms, including performance trigger breaches in some transactions

» Investor interest in direct loan purchase or ABS is renewed after a period of scrutiny on platform efforts to strengthen governance and internal processes



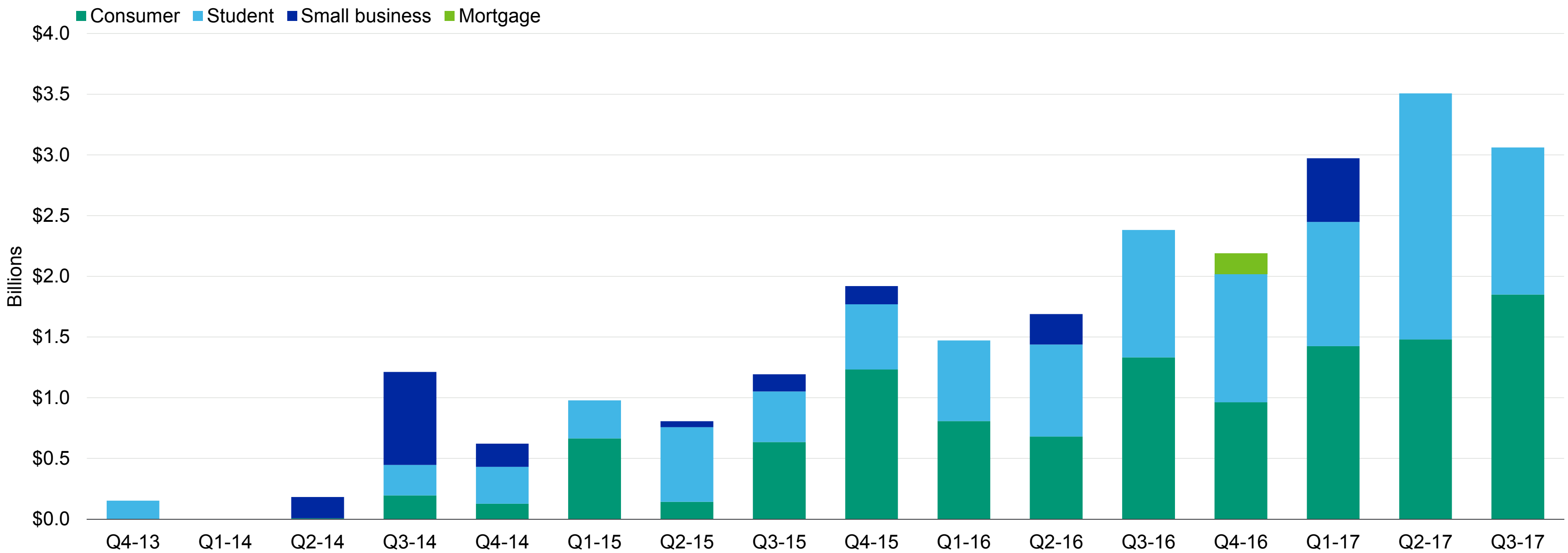
Source: Orchard Platform, Moody's Investors Service

MPL ABS issuance picks up despite market challenges

» Although lending volumes in 2016 decreased for some major lenders, MPL ABS issuance increased to $7.8 billion from $4.9 billion in 2015

» Growth continues in 2017, with Q2 and Q3 2017 issuing the largest amount of issuance yet

» Short term growth will depend on market and economic conditions, however large funding agreements signed in the last months should support 2017 origination volumes



Source: PeerIQ, Moody's Investors Service

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Solar ABS: Financing Green Tech

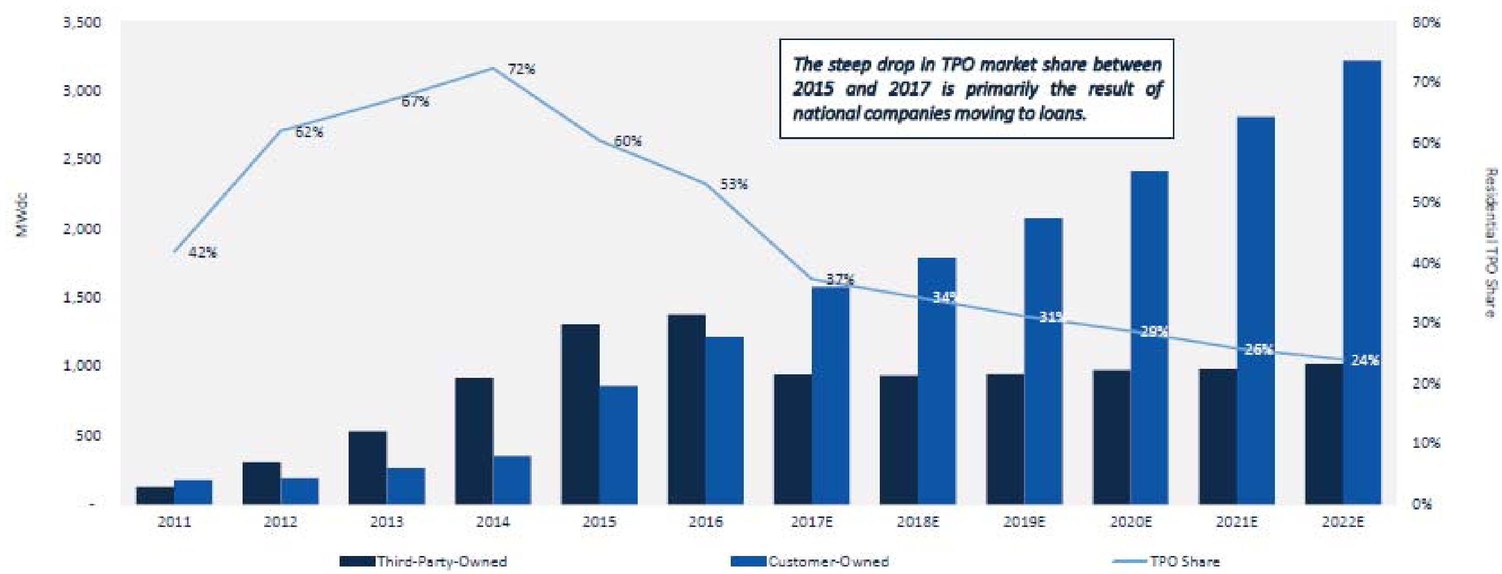
Solar loans have become a larger share

» Growing originations of solar loans to homeowners are likely to result in more residential solar ABS backed by loans than backed by leases and power purchase agreements (PPA)
  – Some loans might offer more savings than leases and PPAs, and the fixed monthly payments of solar loans are likely to be more appealing to consumers as compared with solar leases and PPAs with annual escalators
  – Three solar loan ABS were issued in 2017 to date

» Solar leases and PPAs will still play an important role in financing solar installations
  – Leases and PPAs provide solar companies with the federal ITC as well as a tax benefit from depreciation of the solar PV systems. Therefore the solar developer's cost of funding for loans may be less favorable than for leases

» Tesla Energy, among others, issued securitizations backed by leases and PPAs

Customer-owned systems will exceed third-party owned for new residential originations in 2017

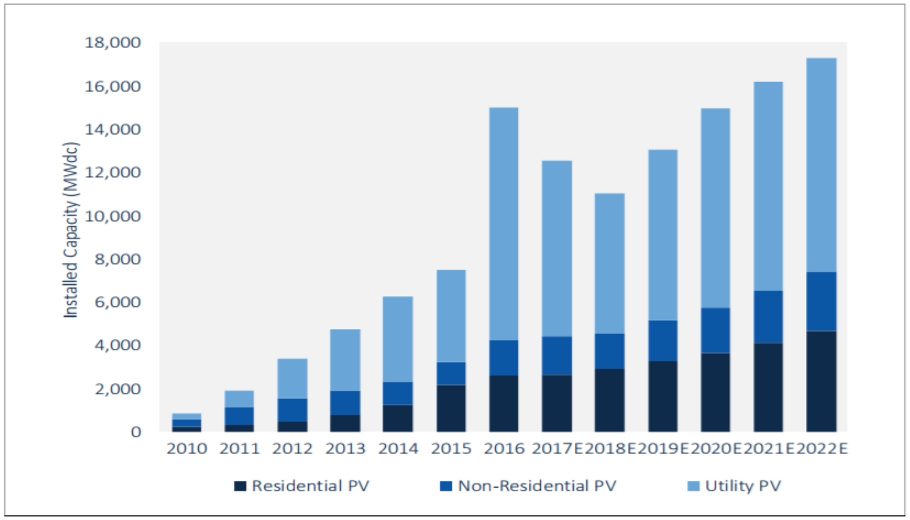


Source: GTM Research U.S. Residential Solar Finance Update: H2 2017

Pace of growth in residential solar installations may slow further

- After rapid growth, US residential installations have fallen in the last year
  - Tax incentives created an anomaly in 2016
  - National residential solar companies continue to slow operations and pursue profitable sales channels at the expense of growth
  - Presence of top national installers in unprofitable geographies reduced
  - Customer acquisition challenges are constraining growth in major states, including California
- Headwinds:
  - In September, the US International Trade Commission ruled that imported solar panels caused "injury" to the domestic panel manufacturers. PV system costs may increase considerably.
  - Adverse changes in net metering rules for new solar customers in several states will slow installations because the economic savings that new solar customers receive from PV systems will decline

U.S. PV Installation Forecast, 2010-2022E



Source: GTM Research / SEIA U.S. Solar Market Insight

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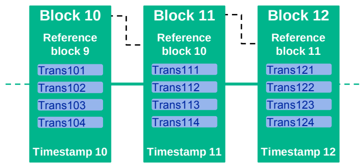
Blockchain: A Glimpse of the Future

Overview of blockchain technology

1. What Is a blockchain?



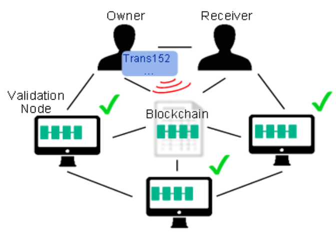
- A blockchain is a continuously growing list of data records that is organized into a series of blocks, each containing a batch of records or transactions
- Each block also has a timestamp and a reference to the previous block, allowing all blocks to be linked together to form a 'chain' that includes a history of all transactions executed in the network, thereby increasing the transparency and auditability of transactions → **immutable ledger**
- A blockchain can transfer any digital assets, such as financial instruments, contracts, ownership rights

2. How is a blockchain transaction originated?

Transaction ID: Trans152
Receiver's public key: 00f1d5…
Value of asset: property deed
Sender's private key: 004rl9…

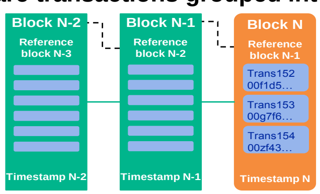
- The transaction 'sender' transmits a message to the network indicating a transaction ID; the address, or 'public key', of the receiver; the transaction value; a timestamp; and the sender's digital signature, or 'private key'
- E.g., two network members have agreed to an exchange of a property deed. The owner of the property sets up a transaction including the network address of the receiver to clarify to whom the property deed should be sent. The sender approves the transaction by signing it off with his private key

3. What ensures a transaction's authenticity?



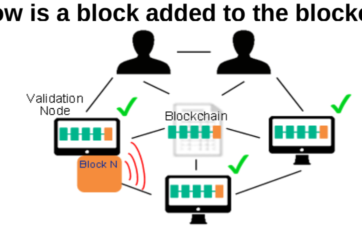
- Once the property owner has sent the transaction to the network, all network nodes receive the transaction message. They then verify the authenticity of the transaction with the network rules by decrypting the transaction using the sender's public key. Once the transaction is verified it is added to a queue of pending transactions
- The blockchain is spread across all participants, or 'nodes', of the peer-to-peer network. Nodes can create and/or validate new data. Each node's copy of the ledger is synchronized with all others to ensure that each member has real-time access to the most current data → **shared ledger**
  - One ledger shared among a network is robust against a failure of a node, increasing resilience to outages or attacks. Transaction completion time is shorter as no reconciliation is required

4. How are transactions grouped into blocks?



- All validation nodes group recent verified transactions of property deeds into a new block that they try to add to the blockchain. Blocks with corrupt transactions will not be accepted by the network
- A new block also includes a header with the name of the new block, a timestamp to indicate when the new block was created and a reference to the previous block of property deed transactions to ensure that the blocks are linked to each other and form a chain with the entire history of property deed transactions

5. How is a block added to the blockchain?



- Before the new block with the property deed transfer can be added to the chain, it is validated through an iterative process that requires consensus from a majority of the members or validation nodes (e.g. real estate agents, financing banks and the land registry authority) → **distributed consensus**
- Validation nodes will verify the work of the node that added the new block to ensure that the network rules were followed and checking the accuracy of the ownership history of the property deed
- Once the block is validated it is added to the blockchain and the updated state of the blockchain is broadcasted to the network. Fraudulent blocks are declined

Source: Bitcoin.org, Deloitte University, Evry, Moody's Investors Service

How does a smart contract work?

» A powerful concept that blockchain technology could leverage is '**smart contract**' computer protocols; i.e., contracts among several parties that are self-executing and/or self-enforcing by automatically verifying, executing, and/or enforcing contractual clauses once predetermined conditions are triggered. These protocols could considerably reduce admin costs as they can be executed bilaterally, while also eliminating uncertainty around the exact terms or the execution process

- Securities that automatically execute some corporate actions, such as principal repayments to bondholders at maturity, coupon payments to bondholders on contractually agreed coupon payment dates, and dividend payments to stockholders on the dividend payment date
- Derivatives that automatically post margin on the occurrence of a margin call or automatically pay out when a counterparty defaults, syndicated loans with automated cashflows among lenders, and loans with collateral being locked when borrower misses payment

1 Set-up contract

All counterparties within the contract agree on common contract terms. The contractual clauses are stored as programming script on the blockchain.

2 Event triggers contract

A particular event occurs and triggers a transaction on the blockchain to the address that stores the contractual clauses.

3 Execution contract

The programming script is automatically executed based on the inputs that the contractual clauses receive.

4 Value transfer

Value of the underlying assets are transferred to the new owner, as described by the contract

5a Settlement digital assets

Digital assets on the blockchain would get automatically settled.

5b Settlement off-chain assets

Off-chain assets (e.g., securities) will be settled through settlement instructions to the respective ledgers

Source: R3, Moody's Investors Service

Blockchain's benefits vs. outstanding hurdles

» Given the limited track record of large-scale blockchain applications, many hurdles are ahead. Those hurdles should be overcome for broader blockchain adoption

Key potential benefits	Key outstanding hurdles
• Increased transaction **speed**	• Select optimal blockchain **configuration** per application
• Increased **accuracy** & reduced **human error**	• **Scalability** of the blockchain and its ability to compete with current solutions remains uncertain
• Reduced opportunity for **fraud** and data manipulation	• Need for development of **industry standards** and **technical skills** for blockchain
• Improved **efficiency** and reduced infrastructure costs by eliminating the need for manual reconciliation	• **Compatibility** of new blockchain infrastructure with existing non-blockchain solutions as well as different blockchain solutions with each other
• Increased **transparency** over and **auditability** of transactions	• **Regulatory** backing needed in some industries before firms will fully explore the technology
• Increased **resilience** to outages/attacks as the ledger is shared among participants	• **Legal** uncertainty around data ownership, settlement finality, cross-border transaction legislation and smart contracts
• Increased **security** though cryptography	• **Security** to hackers and network domination & **privacy** of confidential information
• **Broad application** of the blockchain is possible	• **Cost-efficiency** of the benefits of an effective blockchain versus required investments and implementation risks

Fully implemented blockchain is still some time away

» Although market participants are mapping a large and growing landscape for blockchain applications, the tangible territory for fully implemented blockchain solutions beyond bitcoin is limited and is likely to remain so for up to a decade or longer

» Only when blockchain applications **solve significant real-world problems** – providing user-friendly applications with a high level of stability and governance – will substantial ground be gained, paving the way for further investment and progress

» Blockchain development will need to allow for **deliberate, in-depth analysis and testing**, as well as the incorporation of the new technology with existing technology. Many 'proofs of concept' of blockchain use cases have been put forward, but the next step will focus on how to operationalize and integrate the technology into current processes and systems

» **Collaboration across companies and industries** would benefit blockchain's development since its highest value will likely be derived from interconnected networks among institutions, rather than from closed networks within an institution

» Blockchain will only embed itself in a given industry once solutions have been found for its hurdles and its benefits are proven to outweigh the additional investment cost required to develop and employ it as a replacement technology. A **deep cost-benefit analysis of each blockchain use case** will reveal if blockchain technology makes sense or if alternatives provide similar benefits in a more cost-efficient manner

Moody’s related research

Marketplace Loan ABS - Court Ruling in Lending Club Case Is Positive for Marketplace Lending ABS, 6 February 2017

Marketplace Lending ABS - An Overview of Marketplace Lending Securitizations, 13 February 2017

Marketplace Lending ABS - Prosper’s Funding Agreement Is Credit Positive for Its Marketplace Lending ABS, 6 March 2017

Marketplace Lending ABS – China and US: Different Lending Models Present Unique Credit Challenges and Strengths, 16 March 2017

Fintech: An Overview of the Fintech Regulatory Environment, 28 February 2017

New Issue Report: Marketplace Originated Consumer Assets 2017-1 PLC, 8 November 2017

Moody's related research

Marketplace Loan ABS Would Benefit from a Bank Charter for US Financial Technology Companies, 13 December 2016

Marketplace Lending ABS - US 2017 Outlook - Credit Quality Will Be Generally Steady as Lenders Look to Reestablish Confidence, 5 August 2016

Marketplace Lending ABS - US: FDIC Proposal Would Improve Credit Quality of Marketplace Loans Originated Through Partner Banks, 28 October 2016

Fintech - US Online Lenders: Competitive Advantages in Underserved Niche Market Rest on Unsteady Foundation, 19 October 2016

Marketplace Originated Consumer Assets 2016-1: New Issue - The 1st Marketplace Originated Consumer Loan Transaction in the U.K., 5 October 2016

Marketplace Lending ABS - US: Key Risks in US Small Business Marketplace Lending Securitizations, 12 September 2016

Marketplace Lending ABS - US: CFPB Win in Lending Lawsuit Is Credit Negative for Sector, 9 September 2016

Marketplace Lending ABS – US Efforts to Strengthen Lender Protections Will Not Remove Legal Risks for Sector, 30 August 2016

Marketplace Lending ABS – US Uncertainty Lingers as Supreme Court Declines to Hear Madden Case, 29 June 2016

New Issue Report: Small Business Origination Loan Trust 2016-1 DAC, 23 May 2016

Marketplace Lending ABS - US Proposed Class Action Lawsuit Against Lending Club is Credit Negative for Sector, 5 May 2016

Marketplace Lending ABS - US Lending Club's Updated Model Likely Reduces But Doesn't Eliminate Legal Risks, 28 February 2016

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William Black
william.black@moodys.com
Tel: 212-553-4563

moodys.com