

Quantification of Blockchain Benefits for AML / KYC,  
Settlement Costs and Underwriting Spread  
Research Collaboration Between Cambridge  
University and Hashstacs



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This is a collaborative research report between Masters in Finance scholars at Cambridge Judge Business School and Hashstacs. We would like to give a warm thank you to Dr. Pedro Saffi for overseeing this research. This paper is reflective of the authors' opinions and does not necessarily reflect the opinions of the University. All enquiries about this research should be directed to Hashstacs or the respective authors.

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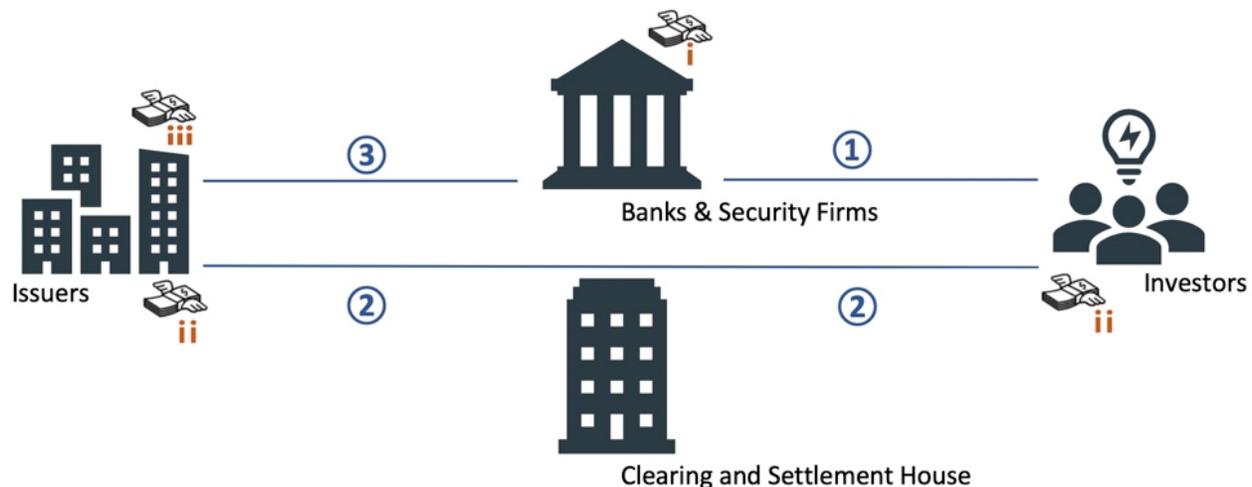
## Introduction – Project Scope

Originating in the early 1990s, blockchain gained worldwide fame in 2008 when Satoshi Nakamoto published a whitepaper outlining the opportunity of placing a distributed ledger on an open source neural network (Nakamoto, 2008). The next step is proving use cases. Examples where blockchain adds value would include fractionalization of artwork, distribution of microinsurance and issuance of tokenized bonds. Tokenization refers to the act of breaking a programming string into separate elements called tokens. In the finance industry, tokenization is symbolic of ownership in an asset.

This report will focus on the cost reduction synergies empowered by blockchain. The figure below illustrates the process and the corresponding cost saving benefits (Exhibit 1). Of particular interest are cost savings in respect to:

- ① anti-money laundering (AML) and know your customer (KYC) administration cost reduction (i),
- ② settlement /clearing cost reductions and (ii),
- ③ issuing cost reduction (iii).

**Exhibit 1 – Overview of Cost Reduction Opportunities Enabled from Blockchain**



Cost reductions linked to AML and KYC can be achieved through an Identification blockchain. As an example, assume an individual has a crypto-wallet accessed through his fingerprint. This wallet would be reviewed once by an administration to verify the owner is a trusted source. Afterwards, the blockchain's advanced security and open source neural network would decrease the probability of fraud. Other costs stemming from human error in administrative paperwork as well as cyber forensics would be reduced. These line items will only grow in cost as we see an increase in expenditure for cyber security and anti-money laundering. As an example, McAfee, a world leader in cyber security software, in collaboration with the World Bank reported that 0.80% of world GDP is lost per annum due to cybercrime such as money

laundering (Lewis, 2018). This report will quantify how much cost may be decreased stemming from more diligent AML/KYC. We will examine the current AML impact on the financial services industry, forecast growth trends in AML settlement costs and offer estimates on how the application of blockchain can reduce costs for a financial firm.

Furthermore, with blockchain, investors can purchase assets directly without the intermediation of fund managers, global/local brokers, custodians, central counterparty clearing Houses (CCPs) and central securities depositories (CSDs). Taking out the “middle man” greatly reduces (and in some cases potentially eliminates) settlement and document fees in both the primary market and the secondary market (Oxera, 2016). For example, Deloitte (2018) states that using blockchain on fund distribution could save the Luxembourg Exchange \$1.2B (Luxembourg Exchange is the largest fund administration industry in Europe). Similarly, when considering the global clearinghouse contract values, cost savings in clearing / settlement fees could easily amount to billions USD. This report estimates this saving amount by calculate how much banks and security firms pay to clearing / settlement intermediaries.

In the future, assets such as fixed income products could see substantial reductions in underwriting spread. Tokenization enables firms to issue securities on the blockchain platform which can be connected to a plethora of investors globally. Intermediaries (e.g. underwriters) as well as clearing and settlement houses may no longer be needed. Even if an issuer still needs a digital underwriter, underwriting cost might be deducted through enhanced liquidity on the platform compared to traditional financial assets. Therefore, this report also explores the possibility for reductions in underwriter spread after the blockchain technology is fully adopted into the financial market.

## Benefit Analysis of Issuing Tokenized Assets

Before moving to the quantification of cost reductions, Exhibit 2 below outlines some critical financial services industry pain points. The table is meant for general discussion purposes as a first look if blockchain could be a tool to solve some of these challenges.

**Exhibit 2 – Summary of Benefits for Issuing Assets via Blockchain**

Pain Point	Solved by blockchain?	Rationale
Faster & Cheaper Settlements	✓	With blockchain, assets such as bonds could be paid out within milliseconds of triggers being activated. Transaction costs are lower as they are done virtually. There will be a significant reduction in administrative functions. In the future the function of intermediaries will be minimized.
Wider Customer Base	✓	Assets issued on the blockchain can be offered to a wider audience because these products could be listed on multiple exchanges and available to customers of numerous nationalities. Further to this point, tokenization would allow for fractionalization of assets.
AML / KYC Costs	✓	Approximately \$3T+ is laundered per annum leading to higher regulatory penalties. Because the blockchain technology allows for a Digital Identification and is conducted on an open source neural network, transactions will become transparent. In respect to asset issuance, red flags can be programmed into the blockchain and accounts may be frozen if suspicious activity is reported.
Political Risk & Stability	✓	Because assets can be linked to cryptocurrencies, this could be a huge advantage, especially in developing / unstable countries where issuing assets in the local currency carries additional political risk. In the future, blockchain could also support one, global currency which would in theory eliminate pitfalls such as currency risk (Mourdoukoutas, 2018).
Inflation / Deflation Risk	✓	Piggybacking the political risk point above, connecting an asset to a stable cryptocurrency could mitigate risks pertaining to inflation or deflation of a local currency.
Reduction in transaction cost	✓	The increase in liquidity offered by blockchain is another benefit. For example, it is estimated that bonds hold an additional liquidity premium of c.30% (Hibbert et al., 2014) on pricing. In applying blockchain technology, there is a clear synergy created through blockchain's enhanced liquidity system due to an increased customer base. This results in saving the transaction cost.

## Quantification of Cost Reduction Coming from AML/KYC Benefits

Blockchain is dramatically transforming the process of AML and KYC. AML and KYC processes refer to the steps taken by financial institutions to (Oracle, 2016):

- Establish the identity of investors,
- Perform an analysis of said investors' history in order to authenticate the source of funds, and
- Conduct risk assessments on money laundering / illegal financing.

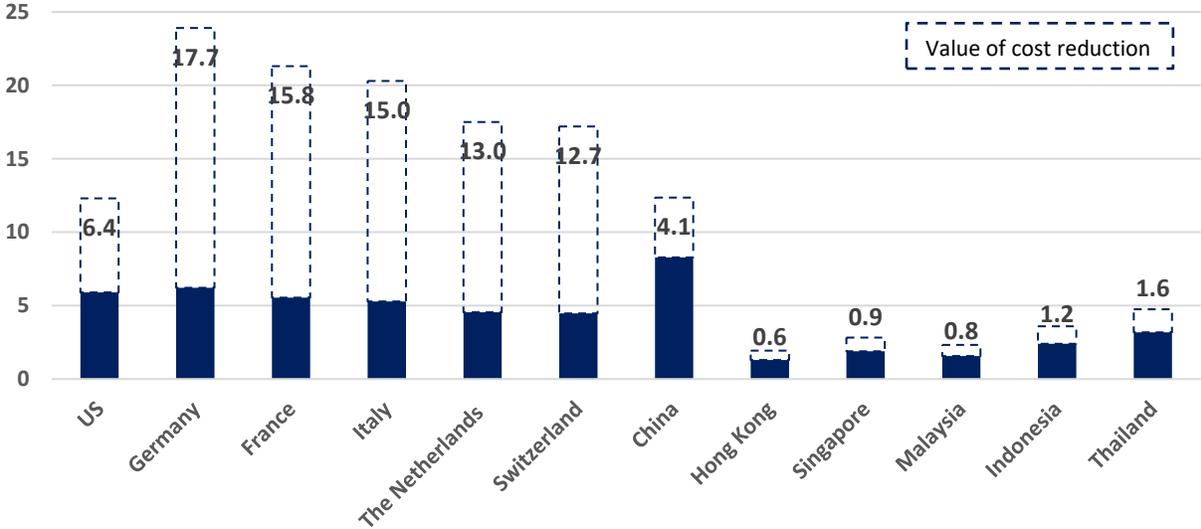
Compliance practitioners continue to regard managing regulatory change as their biggest challenge (English and Hammond, 2018). Most financial institutions are conducting these processes independently and have their own isolated database of identities. Much of the cost comes from manual processing expenses. Going through the KYC process is tedious and the average time to complete due diligence on business accounts ranges from 3 to 17+ hours depending on industries (LexisNexis, 2018). These time delays result in a loss of 2%-4% of new customer acquisitions. The Thomson Reuters KYC Surveys (2016) revealed the costs and complexity of KYC are rising. Some financial firms spent up to \$500M annually on KYC globally, inserting a negative impact on their businesses. 61% of firms are expecting an increase in their total compliance budget in 2018 (compared to 53% in 2017). The surveys conducted by LexisNexis illustrate the average annual cost of AML compliance operations in US market (2018), 5 European countries (2017) and 6 Asian countries (2016) (Exhibit 3).

According to LexisNexis (2018), the average total spending of compliance cost in US financial firms are \$12.3M in 2018 while on average 52% are attributed to labor costs. The data also shows the US financial institutions are expecting a trend of increasing compliance cost in the coming years (17% on average). Meanwhile, with EU AML regulations continuing to evolve, the European financial institutions are suffering from great and higher burden on compliance cost. The estimated true cost of compliance across Switzerland, the Netherlands, Italy, France and Germany were \$83.5B in 2017 (LexisNexis, 2017). Labor resources represent a significant proportion of this compliance spending - on average 74%. While in Asia, AML and KYC have become leading concerns among financial institutions as well. The estimated AML compliance costs in Thailand, Malaysia, Indonesia, Singapore, Hong Kong and China for 2017 were \$1.5B. This \$1.5B figure includes direct costs for compliance operations and technology as well as indirect costs arising from the impact of AML compliance on productivity, customer acquisition and business growth. Taken as a whole, watchlist activities (KYC processes, periodic screening and sanctions operations) account for 33% of AML compliance costs (Exhibit 3).

The benefits of using blockchain for AML/KYC are that it increases transparency, enhances compliance and enables data sharing (Deloitte, 2018). With the application of blockchain, AML and KYC checks and verifications can be done efficiently through a shared repository of identities to automate behavior analysis and entity screening and to support analysis workflow and decision making. Therefore, it is assumed that the cost reduction effect of blockchain come from the labour/resources-related and watchlist-related part,

52% in US market, 74% in European market and 33% in Asian market respectively (applied in each country). The corresponding figures of cost reduction in each country are shown in Exhibit 3. In overall, utilizing blockchain could save the financial institutions a cost of estimated \$6.4M individually per annum in US market, \$14.8M in European market and \$1.5M in Asian market. These cost saving figures are expected to increase as AML costs are forecasted in increase in the coming years as the total compliance cost raises.

**Exhibit 3 – Average Annual Cost of AML Compliance Operations by Countries (\$M)**



Note: Overall European and Asian cost reduction ratios are applied to each European and Asian country.

Source: LexisNexis (2016, 2017, 2018)

Furthermore, blockchain platforms can be coded to freeze transactions if red flags are raised. This is done by coding triggers which detect false positives and verify the digital identity of a user. As an example, let’s assume there is an investor in America named Jane Smith. Jane wants to buy a bond through her digital wallet. Most digital wallets would require Jane to show biometric proof and answer security questions before clearing the transaction (e.g. Jane would need to provide a fingerprint, answer three personalized security questions and provide a password to proceed). All transactions would be public information as the blockchain is programmed on open source languages. If Jane’s information is not entered correctly or the system detects false positives, red flag triggers are activated and the blockchain could be coded to automatically freeze the transaction until further investigation.

## Quantification of Cost Reduction in Clearing & Settlement

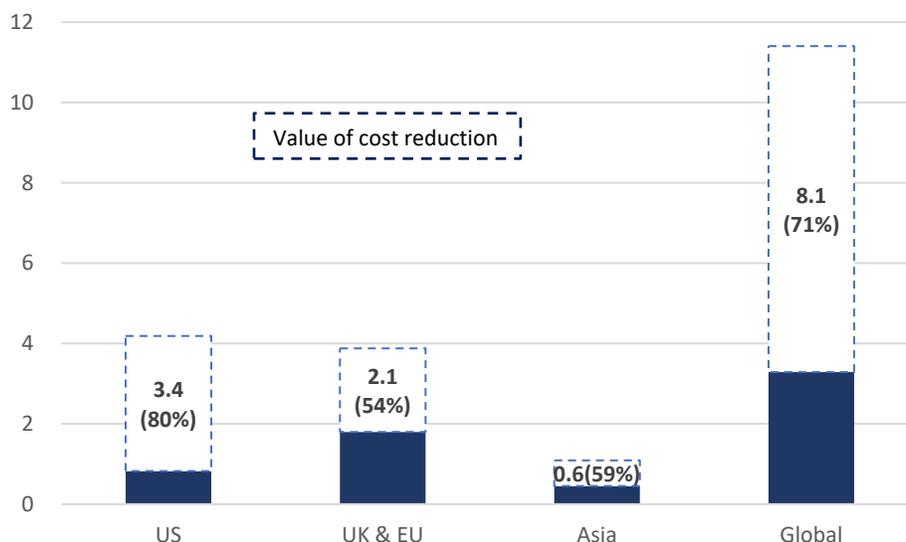
Reduction in settlement costs is another benefit for banks and security firms enabled with blockchain. Banks and security companies usually use central counterparty clearing Houses (CCPs) and central securities depositories (CSDs) for post-trade processing such as clearing and settlement. The distributed ledger technology (DLT) behind blockchain allows banks and security firms to complete clearing and settlement on the blockchain with little to no intermediation. This means that blockchain transactions can be done in near real time resulting in less risk of settlement. More importantly, the automatization enabled by blockchain reduces clearing and settlement fees.

To put the cost saving potential into perspective, consider the United States Fixed Income Clearing Corporation (FICC). The FICC cleared \$1,092T worth of contracts and trades in 2017. Meanwhile, the National Securities Clearing Corporation (NSCC) cleared \$240.5T in 2017. Across the pond, British clearing house, LCH.Clearnet, saw £791.6T worth of trades and contracts transacted in 2017 (Bank for International Settlements, 2019). To simplify, the clearing and settlement cost in this essay focuses on the cost of securities and derivatives for only CCPs and CSDs.

It is difficult to assume an instantaneous removal of intermediation for the following reasons: First, CSDs still could be required in the blockchain technology. Slaughter and May (2016) argues that regulatory requirements demand the maintenance of CSD's book-entry system. For example, the Uncertified Securities Regulations (USR) requires that the title of securities is registered with CREST. CREST is a security depository (Hogan Lovelles, 2017). Second, there are some minority illiquid assets which will continue to require manual processing. McLagan Investment Services (2017) predicts these minority assets represent approximately 10% of revenue in custody banks.

With these assumptions and the clearing / settlement fee income in the large CCPs and CSDs in each region, Exhibit 4 shows the effect on clearing service fee cost reductions enabled with blockchain technology for banks and security companies. Since the estimated reduction rate of fees paid to intermediaries is around c.70%, the calculation indicates that banks and security firms may save upwards to \$8.1B globally. If blockchain can replace CSDs completely such that the book-entry can be admitted on the blockchain, the reduction amount may be larger. It is important to keep in mind, however, that since the figure ignores dividend profits from holding CCP and CDS, replacing these intermediary steps might have an offset effect on the revenue of banks and security firms. Furthermore, with the application of blockchain, there would naturally need to be a phasing out period where the technology is introduced then adopted in the market.

#### Exhibit 4 - Cost Reduction in Clearing and Settlement Service Fees by Region (\$B)



*Note: The total fee is the sum of the last five-year average of the clearing and settlement service fees in CCPs and CSDs which are clearing securities and derivatives. The cost reduction percentage is estimated with the assumptions below by region: 1. The fee for CSD is excluded. This reduction estimate is derived from the yearly clearing and settlement fee income in CSD divided by the total CSD plus CCP. 2. 10% of fee income is excluded since these are unaffected as McLagan Investment Services (2017) estimates due to their illiquid nature.*

*Source: Capital IQ and each firm's annual report. US: DTCC, Fedwire Securities, OCC, OME and ICE Clear Credit. UK&EU: LCH, ICE Clearing Europe, EuroCCP, Xetra, Eurex, Clearstream and Euroclear. Asia: JSCC, JASDEC, SGX and HKEX. Global is total of all firms regardless of location.*

### Quantification of Underwriting Spread and Liquidity Savings in the Primary Market

In addition to benefits above for banks and security firms, blockchain and tokenization can also reduce costs for bond issuers in two ways in the future: eliminating administration fees and reducing the underwriting spread.

#### Cutting the Underwriting Spread

Bond issuing costs can be separated into three broad categories: underwriting costs, financial advisory costs and legal costs. An issuer would need to continue paying financial advisory and legal fees as these are considered in the “cost of doing business” and would need to be accounted for regardless of the technological platform in which the bond is issued. However, underwriting costs may be significantly reduced because issuers could promote their bond issuance on the blockchain platform. This is because the underwriter fee is essentially a sales commission. Albeit the underwriting fee may also include a management fee and other expenses, the key takeaway is that with the application of tokenization to fixed

income products, a wider customer base would be achieved and the need for sales intermediaries will be diminished.

Joffe (2015) estimates the underwriting spread within the US municipal bond market by examining the Municipal Securities Rulemaking Board's EMMA dataset. The California Debt and Investment Advisory Commission (CDIAC) dataset collected by Chen (2012) provides a useful foundation in examining the underwriting cost as this dataset sub-divides bond issuance costs into sub-categories. Furthermore, the Mergent FISD database was used in calculating the cost reductions. The bonds examined were in the US market (Exhibit 5).

#### Exhibit 5 – Breakdown of Underwriter Spread and Other Costs within the Primary Bond Market

Source	Underwriter Spread	Financial and Legal Fee etc.	Issuer	Date	Samples
EMMA	0.43%	0.59%	State	2012-2015	478
CDIAC	0.63%	0.34%	State and local government	2009-2011	812*
Mergent FISD	0.40%	-	Government and Corporate	2010-2018	40,770**

Note: % of offering amount. All figures are weighted average on offering amount. All bonds were issued in the US market. \* Out of 812, 293 samples show the underwriter spread. \*\* This report picks up only bonds which has data about underwriter spread since Jan 2010.

Source: Joffe (2015), Chen (2012) and Mergent FISD

The data indicates that the underwriter fee is c.0.4 - 0.6% of the offering amount on a weighted average basis. Therefore, utilizing blockchain would cut the underwriting fee and save investors an estimated \$35-55B within the global corporate bond market based on the 2018 issuing amount, assuming that the underwriter spread can be cut equally (Exhibit 6).

#### Exhibit 6 – Expected Cost Reduction for US, Europe, Asian and Global Corporate Bond Markets when Tokenizing Corporate Fixed Income Cut the Underwriter Spread

	Global	US	Europe	Asia
Size of Issuing Corporate Bonds (\$B)	8,739	1,713	2,767	2,710
Cost Reduction (\$B)	35.0 ~ 55.1	6.9 ~ 10.8	11.1~17.4	10.8 ~ 17.1

Note: The issuing amounts include private placements. Cost reduction is calculated with the size of issuing multiplied by the underwriting spread in Exhibit 5. Europe: Germany, Switzerland, France, Britain, Netherland, Luxemburg, Italy, Austria and Sweden. Asia: China, India, South Korea, Japan and UAE.

Source: Bloomberg

#### Reduction of Liquidity Premium in Issuing Bonds

Issuers may still need to pay an underwriting fee on the blockchain. The fee would be smaller; however, because of the greater liquidity of a Smart Bond compared to a traditional bond (note that a “Smart Bond” is a bond issued on the blockchain). Petrsek (2010) argues that the global bond would enjoy a lower trading cost. Furthermore, Davis et al (2018) states that more liquidity in the secondary market would improve the cost of the debt by decreasing the extra cost on existing debt (liquidity premium). These reports

may imply that more liquidity from tokenization may lower the cost of issuing bonds since a Smart Bond is tradable on the global blockchain platform with multiple currencies.

To see this benefit, the Mergent FISD bond issuance database showcases the spread deltas according to a bond’s liquidity. The database flags bonds which are issued globally (i.e. issued in multiple markets) and issued in a foreign currency in the US market. Exhibit 7 illustrates how much spread can be reduced if the bond which has more than five-year maturity is issued in another currency and on multiple markets, indicating more liquidity to underwriters and investors. The research indicates that trade liquidity attributed to a larger market and foreign currency options, which are enabled with tokenization, reduces 0.29% of the underwriter spread on a weighted average basis compared to illiquid bonds.

**Exhibit 7 – The Effect of More Liquidity on Reduction of Underwriter Spread in Primary Market**

		Issued in Foreign Currency	
		No	Yes
Issued Globally	No	0.57%	0.42%
	Yes	0.51%	<b>0.28%</b>



*Note: The figures are estimated using more than five-year maturity bonds from Jan 2010 to May 2018 on the weighted average of offering amount as Petrasek (2010) does in the same way. Since liquidity premium becomes significant as maturity becomes longer, long-term bond may benefit more from less illiquidity of tokenization.*  
 Source: Mergent FISD

**Conclusion**

Applying blockchain to financial assets must be evaluated in respect to potential benefits and costs. Cost savings from AML/KYC, settlements and underwriting spread were quantified in this report. Further benefits from tokenizing assets include:

- Faster settlements
- Wider customer base
- Stability from political risks
- Decrease in inflation / deflation risk

There are challenges; however, in applying blockchain to the financial services industry. The greatest downside risks to our valuation are showed in Exhibit 8.

### Exhibit 8 – Downside Risks for Tokenized Assets

Risk	Description
Low Market Penetration	In the USA, approximately 5% of Americans own Bitcoin, less than 2% own Ethereum and less than 1% own Ripple. In the UK, 93% of Brits have heard of Bitcoin and yet only 4% own any Bitcoin currencies (Nova, 2018). In general, cryptocurrencies still maintain a low market penetration and require expenditure to be spent on consumer education.
Platform Development	To distribute and monitor assets on the blockchain, a platform would need to be developed for financial institutions. The platform could be built internally for each institution or a partnership could be created to share costs. Additional costs which fall under this R&D line item would include the labor costs, technology costs, maintenance costs, etc. needed to build and grow a blockchain platform.
Regulatory Risks	Since blockchain is a relatively new technology, there is little legislature in place to manage the risks. For instance, let's consider data privacy risks. In May 2018, the European Union enacted the General Data Protection Regulation (GDPR) which imposes fines of up to 2% or 4% of a company's annual global turnover, depending on the type of data privacy breach (European Commission, 2019). Since the blockchain is an open sourced system, do Smart Contracts count as a privacy breach? The answer is still undetermined. In other parts of the world like Egypt and Vietnam, there is a ban on cryptocurrencies (Law Library of Congress, 2018).
Adverse effect of enhanced liquidity	Although increased liquidity with tokenization may reduce issuing costs it should be noted that higher tradability may bring price fluctuation in the secondary market. Given that bonds are usually intended to be held to the maturity, buying and selling is not necessarily preferred by an issuer. Therefore, tokenization should be carefully developed to balance this risk for an issuer.

## Glossary

Key Term	Definition
AML	Anti-Money Laundering.
Bitcoin	Bitcoin (₿) is one of the most famous cryptocurrencies. At the time of this research publication, it is arguable that Bitcoin is the cryptocurrency with the greatest market penetration.
CCP	Counterparty Clearing House
CSD	Central Securities Depositories
DLT	Distributed Ledger Technology.
Hashtag	A hashtag is a metadata tag which can be used in programming to connect ideas.
KYC	Know Your Customer.
Smart Bond	A Smart Bond is a bon offered on the blockchain.
Tokenization	Tokenization refers to the act of breaking a programming string into separate elements called tokens. In the finance industry, tokenization is symbolic of ownership in an asset.

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