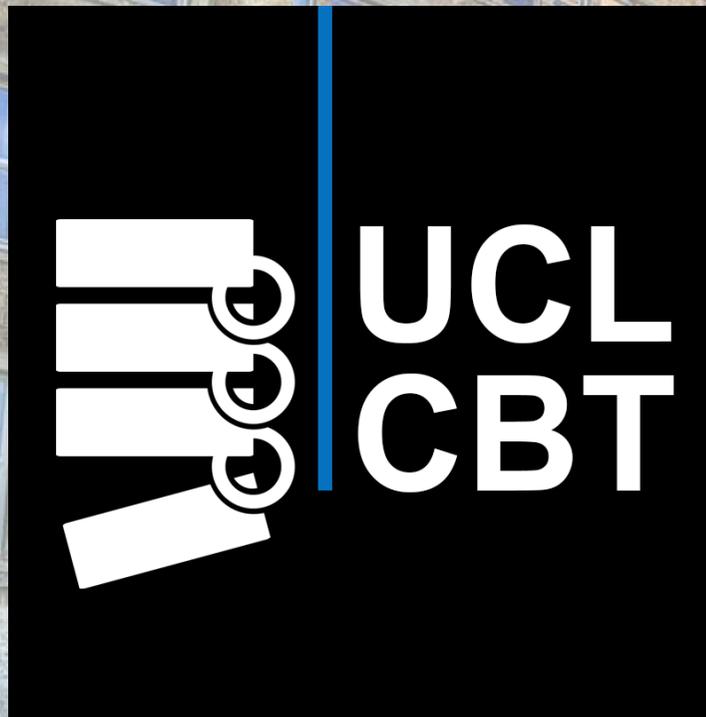


# Blockchain and Financial Risks



**Paolo Tasca**

**Digital Currencies: Principles,  
Trends, Opportunities, and Risks**  
ECUREX Tech Report 2015

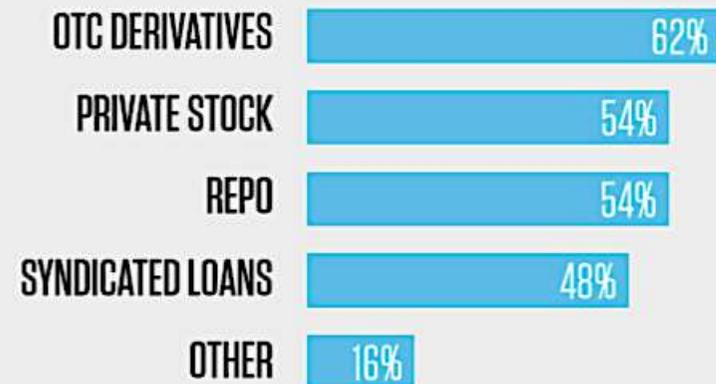
## Industry Survey – Risk Reduction

### DISTRIBUTED LEDGER TECHNOLOGY BENEFITS

Which of the following do you believe distributed ledger technology could help reduce?<sup>1</sup>



Other than payments and digital currency, what area / products could most benefit from the technology?<sup>2</sup>



1. Based on 58 respondents in 2015

2. Based on 61 respondents in 2015. Source: Greenwich Associates 2015 Bitcoin, Blockchain and The Capital Markets Study

- Can blockchain mitigate financial risks ?

1. Fraud Risk
2. Credit Risk
3. Operational Risk
4. Liquidity Risk
5. Settlement Risk
6. Derivatives: Risk Implications
7. Risk Measure

## Fraud Risk

**Fraud:** Any intentional act committed to secure an unfair or unlawful gain

**Misconduct:** A broad concept, generally referring to violations of law, regulations, internal policies, and market expectations of ethical business conduct

(2001) **Enron** - Shareholders Lose **\$74 Billion**

- Executives used special purpose entities – which went by names like ‘Whitewing’ and ‘Raptor’-- to keep huge debts off the firm’s balance sheet.

(2002) **Worldcom** - **\$11 Billion** Accounting Fraud

- The total cost to investors: \$180 billion.

(2003) **Freddie Mac** - **\$5 Billion** In Mistated Earnings

(2008) **Madoff Scandal** - Investors Left With **\$21.2 Billion** In Cash Losses

(2008) **Lehman Brothers** - **\$50 Billion** In Disguised Loans

- Execs and auditor allegedly manipulated the firm's balance sheets using an accounting trick called "Repo 105."

(2012) **Libor Scandal** - At least **\$ 20 Billion** in int. rate manipulation by 20 banks

## Fraud Risk

### Public Accounting Book

- **Real-time information** and transaction distributed ledger which stores any accounting and financial record
- **Increased security**
  - Hard crypto, e.g Public/Private key infrastructure
  - Immutable, standardized, authenticated transaction records
- **Fraudulent conveyances** Any misconduct to keep debts off the firm's balance sheet or any other financial trick would be detected immediately. The transparency could guarantee the insiders have less ability to **tunnel** assets out of the firm
- **Trustworthy accounting** The opportunities for accounting **gimmicks** could drop dramatically <sup>1</sup>. **Inter-firm transactions** would also become much more transparent <sup>2</sup> and **invoice reconciliation** easier. Investors could ask for the same access permission as any 'insiders' to monitor the transactions on the firm ledger (**r-time vs. quarterly reporting**)

1. Hans Byström. Blockchains, Real-time accounting and the future of credit risk modeling. March 2016

2. Yermack, D. 2015, Corporate Governance and blockchain. Working Paper, NYU Stern School of Business

## Credit Risk

Credit risk arises when a borrower uses **future cash flows** to pay a **current debt**

Credit risk can be mitigated in a number of ways, such as:

- **Risk-based pricing** — Higher interest rate to borrowers with lower credit rating Real-time scoring
- **Covenants** — Agreements
  - Periodically report its financial condition
  - Refrain from paying dividends, repurchasing shares, borrowing further, or other specific, voluntary actions that negatively affect the company's financial position, and
  - Repay the loan in full, at the lender's request, in certain events such as changes in the borrower's debt-to-equity ratio or interest coverage ratio
- **Credit insurance, credit derivatives and collaterals**
- **Central Counter Party**

## Credit Risk

Transparent real-time data can help to reduce counterparty credit risks

Participants could selectively reveal **trusted data** to another counterparty ahead of trade time to provide **greater certainty** of their own worthiness

Once placed on a blockchain, assets not particularly liquid could be more easily considered as reliable sources of value to be **pledged as collateral**

Smart Contracts and Automation create efficiency in transaction processing, clearing and reconciliation

The contractual covenants are predefined and hard coded before the scripts being broadcasted and executed on the blockchain. **Rules are self-enforcing**

A firm entering into a smart contract could represent a **pre-commitment** not to behave opporunistically in the future<sup>1</sup>

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Role of Credit Agencies could diminish in importance

1. Yermack, D. 2015, Corporate Governance and blockchain. Working Paper, NYU Stern School of Business  
2016 :: Goethe University (Germany) P. Tasca, UCL 2016

## Operational Risk

Operational risk can be summarized as **human risk**; it is the risk of business operations failing due to human error

### Distributed Ledger

reduce risks of centralised solutions, necessary **internal controls** and reconciliation burden

The firm's routine accounting data could be recorded permanently with a time stamp, and it could **not be altered ex-post**. This reduces operational risk and eliminate the need of „specialised“ auditors

### Smart Contracts and Automation

reduce traditional manual work in many ways, such as transaction clearing and **reconciliation in post-trading**

The administrator of a centralised database/hardware (see e.g. a CCP), bears a great operational risk and the risk of controlling and changing unilaterally the rules and becoming a single point of failure

## Liquidity Risk

**Market liquidity** – An asset cannot be sold due to lack of liquidity in the market – essentially a sub-set of market risk

- **Real-time settlement** would increase greatly the liquidity due to the lower cost and faster speed of executing trades

**Funding liquidity** – If liabilities

Cannot be met when they fall due  
Can only be met at an uneconomic price  
Can be name-specific or systemic

- **Smart contracts in OTC agreements increase the collateral frequency** (up to a fraction of an hour) so the liquidity risk is reduced moreover the discrepancy between the last collateral and the closeout will be smaller as the change in few hours of the net present value
- **Smart contracts could provide a concrete insurance during financial crisis.** With this promising device, people won't be panic and liquidity will not drain from banks under stress

## Settlement Risk

It is the risk that 1) one leg of the transaction may be completed but not the other <sup>1</sup> or 2) the settlement agent will fail to perform

### Blockchain technology

1. shorten settlement and reconciliation time (T+0) ↩️  
reduce **costs**<sup>2</sup> and the amount of cash and **collateral** needed to be held

US	
Cash Equities	T+3
Equity Options	T+1
Equity Futures	T+1
Gov't Bonds	T+1
Corporate Bonds	T+3
Loans	T+20
Exchange-traded FICC Derivs	T+0
OTC FICC Derivs	T+2*
Europe	
Cash Equities	T+2*
Equity Options	T+1
Equity Futures	T+1
Loans	T+20
Exchange-traded FICC Derivs	T+0

Source: ICE, OCC, SIFMA, World Federation of Exchc

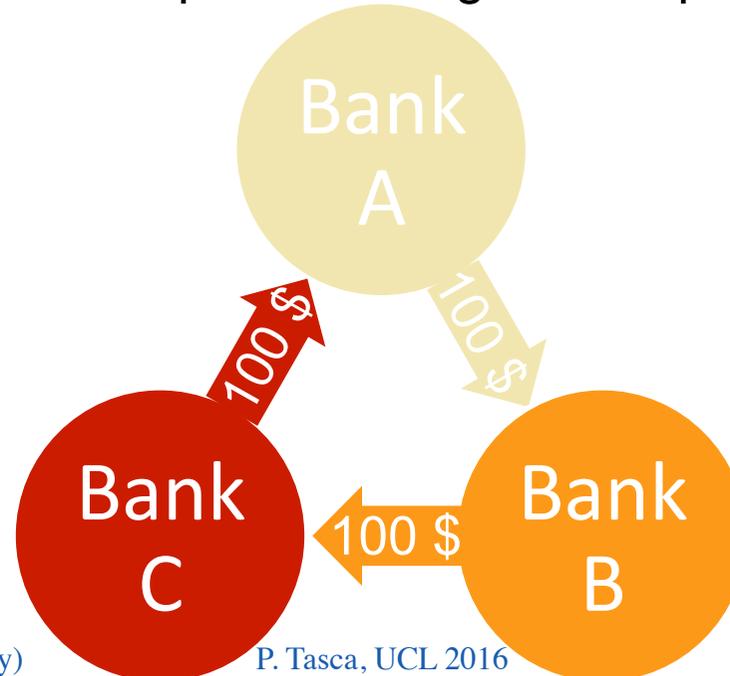
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2. Autnonmous Research (2016) estimates blockchain could reduce settlement costs by **30%** by 2021

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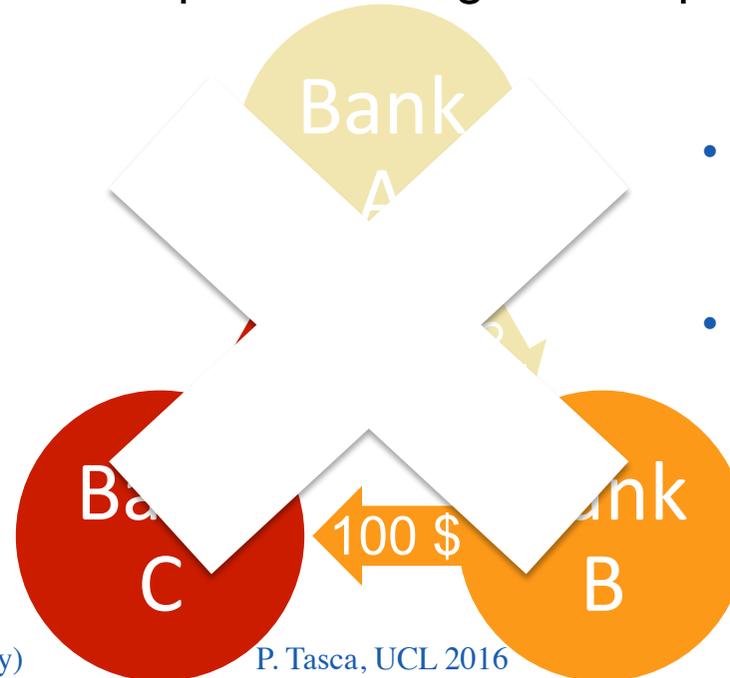
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- **Trade compression** by pooling risks together
- **Netting effects** when a bank default its obligation are netted with those of the counterparties

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## Settlement Risk

### Business / Project Website

Symbiont <http://symbiont.io/>

Coinprism / Open Asset <https://www.coinprism.com/>

Omnilayer <http://www.omnilayer.org/>

Blockchain Clearing Corp  
<http://blockchainclearing.com/>

Tzero <https://t0.com/>

Digital Asset Holdings <http://digitalasset.com/>

Clearmatics <http://www.clearmatics.com/>

Setl <https://www.setl.io/>

BankChain <https://www.bankchain.com/>

Counterparty <http://counterparty.io/>

### Relevant News

- New Research Group - CME Group, Euroclear, LCH.Clearnet, LSE, Soc Gen, and UBS:  
<http://bit.ly/CMELSEBlockchain>
- NASDAQ enables private securities issuance using Blockchain Technology:  
<http://bit.ly/nasdaqblock>
- Australian Stock Exchange announced that is building a blockchain for clearing and settlement:  
<http://bit.ly/ASEblock>

## Derivatives: Risk Implications

What are the implications for financial risk management?

Uncleared OTC derivatives continue to be traded on a bilateral, principal-to-principal basis with a counterparty under an ISDA Master Agreement between the parties basis with your ultimate counterparty being the entity with whom you executed the trade

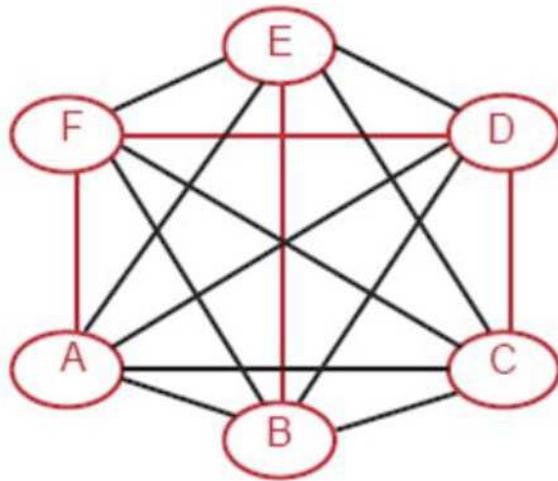
Cleared OTC derivatives are submitted through a clearing member, acting in an agency capacity, to a Central Clearinghouse (CCP) for clearing. (The trade flow for cleared swaps is similar to that of futures.)

Once cleared, the Clearinghouse is the counterparty to all trades, and the regulatory bodies (CFTC and SEC) require that the Clearinghouse has appropriate tools and procedures for risk mitigation.

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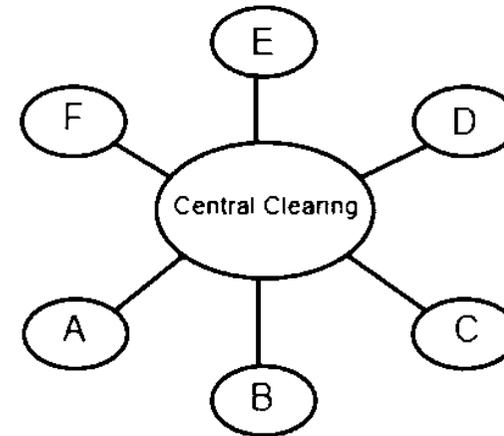
Pre Dodd-Frank: Bilateral



Reduce/eliminate processes, overhead, and risks associated with the central clearing operation

Real-time monitoring and audit capabilities for regulators: system is inherently transparent and accountable.

Post Dodd-Frank: Mandatory Central



Greater security, flexibility, and cost savings for entities that are non-centrally cleared; reduces intermediation

## Risk Measure

With a real-time accounting system, **default risk might be found timely** to reduce the possibility of financial crisis in scale

Hans Byström(2016)<sup>1</sup> uses Z-score to illustrate what the model output would be more accurate if we have daily based input from real-time accounting system, compared with quaterly based input currently



$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.99X_5$$

$X_1$  = working capital/total assets

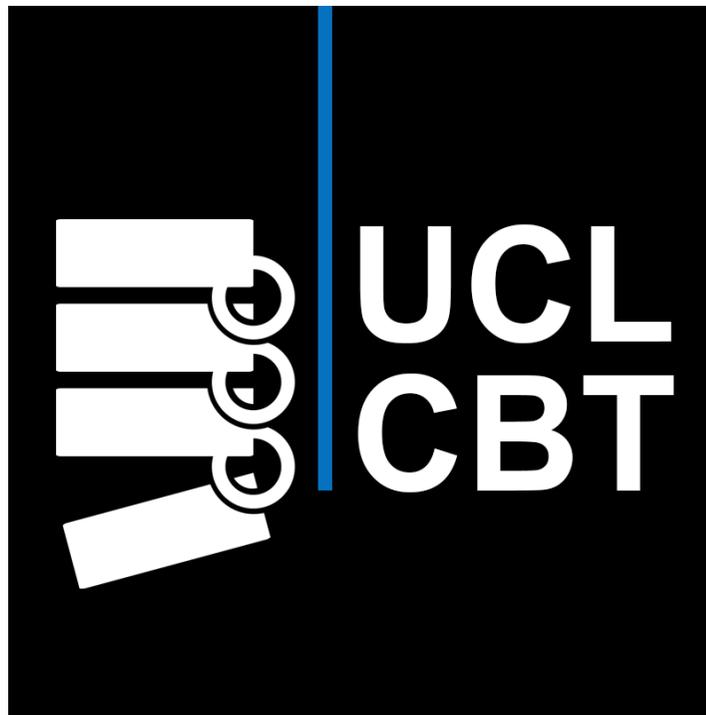
$X_2$  = retained earnings/total assets

$X_3$  = earnings before interest and taxes/total assets

$X_4$  = market value of equity/book value of total liabilities

$X_5$  = sales/total assets

1. Hans Byström. Blockchains, Real-time accounting and the future of credit risk modeling. March 2016



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