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# BLOCKCHAIN

BACK-OFFICE BLOCK-BUSTER

See Page 2 for Disclaimers

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## COSTS & CAPITAL

Blockchain could simplify and speed up the financial system. Settlement could move from T+3 (or even T+30!) to T+0. Costs associated with paying a middle man and running a back office could be eliminated, and capital tied up by settlement risk could be reduced. We think blockchain could allow \$16bn of cost savings and \$6bn of capital release at the investment banks by 2021.



## WHAT IT MEANS FOR FINANCIAL SERVICES

The financial services industry relies upon central authorities to connect nodes and establish rules. Costly legacy systems and large rosters of employees record transactions and monitor workflow. In an increasingly “real-time” world, transaction settlement times extend into the days and sometimes the weeks. Blockchain could simplify much of the financial system – eliminating costs and risks.



## THE ABCs OF BLOCKCHAIN

A blockchain is a shared, decentralized, secure database. The technology originally underpinned virtual currency Bitcoin, which illustrated the power of connecting nodes without a central authority. Shared ledgers aren't new, but the concept of immutable entries has been made a reality by the use of cryptography and increased computer processing power.



**SECTION 1:**  
**Costs & Capital**

# Cost-Cutting is the Big Hope



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We Estimate

**\$54bn**

annual clearing & settlement costs globally

**30%**

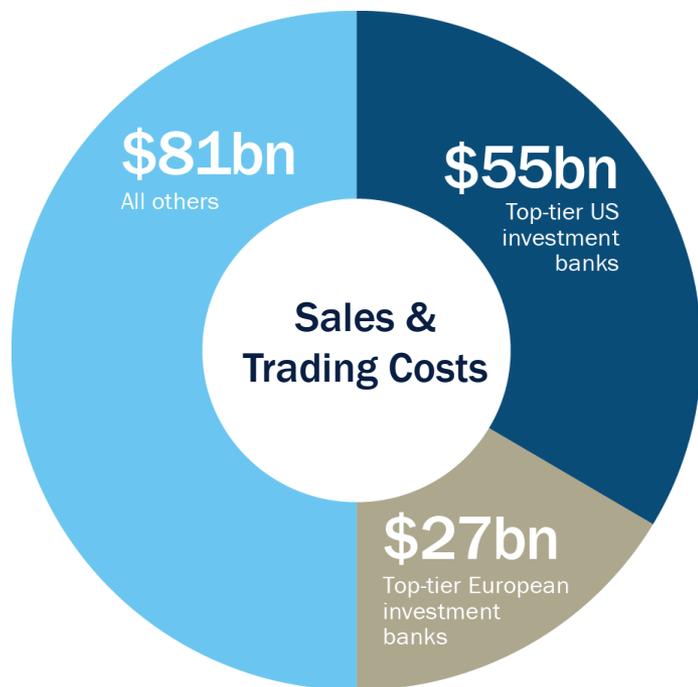
of these costs could be reduced by blockchain by 2021

**\$16bn**

of savings for the industry

**\$163bn**

bank sales & trading costs globally



**WE THINK ONE THIRD OF COSTS ARE BACK OFFICE – THAT’S \$54BN.** This includes costs for clearing and settlement of trades, custody, financing, books and records, reference data, reconciliations, corporate actions, tax, and regulatory reporting.

**PRESSURES ON FIRMS TO CUT COSTS ARE INTENSE.** If bankers don’t want to cut their own compensation, then they will focus on non-staff costs, which are already elevated relative to long-term averages.

**WE BELIEVE THAT BLOCKCHAIN HAS THE POTENTIAL TO BE A GAME CHANGER IN BACK-OFFICE COSTS**

In our view, game changer technology should be able to cut costs by at least 20%, and more likely 30%. This suggests potential global, industry-wide savings of between \$11bn and \$16bn.

Source: Company reports, Autonomous.

# Views on Cost Savings Are Mixed

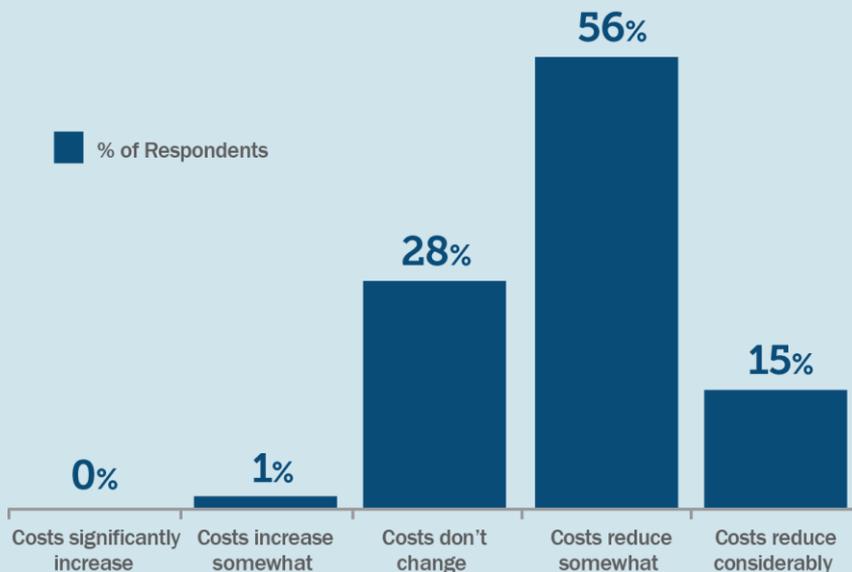


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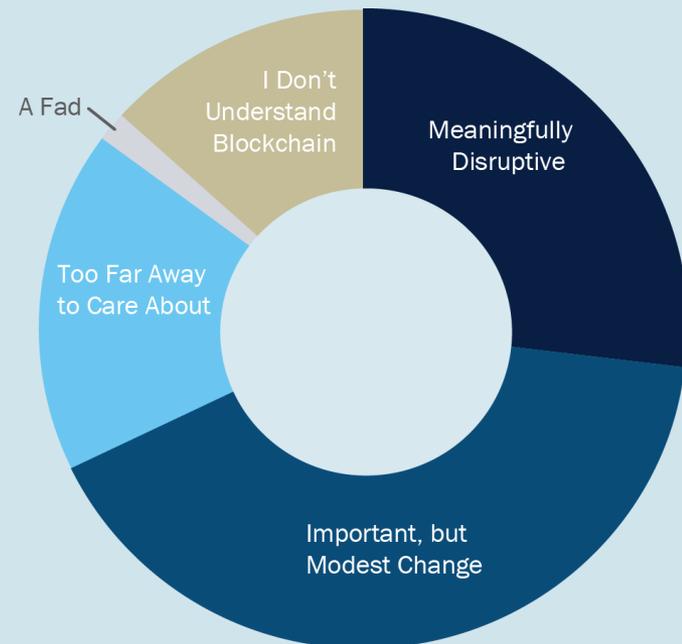
**MODEST COST SAVES EXPECTED.** We polled nearly 150 investors and industry participants. A majority of investors expected cost saves to come for banks from blockchain, but most pegged them as modest, not significant.

**ONLY A QUARTER EXPECT MEANINGFUL DISRUPTION.** If bankers don't want to cut their own compensation, then they will focus on non-staff costs, which are already elevated relative to long-term averages.

## What level of cost saves expected



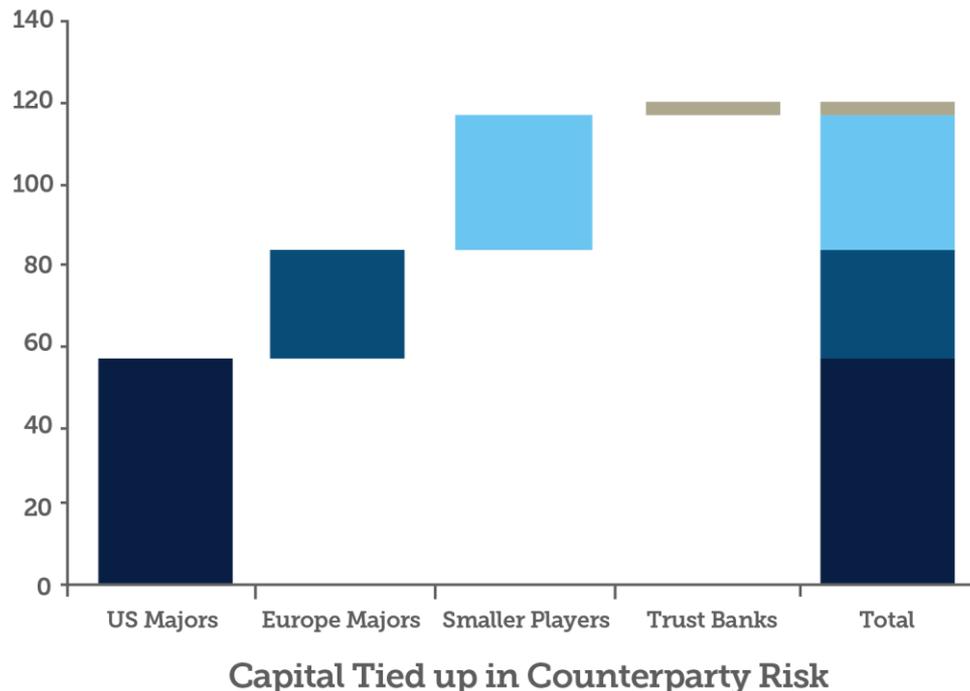
## How disruptive will blockchain be?



# The Capital Opportunity

We think that blockchain could free up \$6bn of capital for global banks and brokers. This is a helpful assist – but expense saves are the major story. The thirteen biggest capital markets players in the US and Europe have ~\$120bn of capital tied up in counterparty risk.

## We estimate \$120bn of capital tied up in counterparty risk



Source: Autonomous Estimates



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**Counterparty risk accounts for 9% of banks' capital requirements.** It's an important component, but is still outweighed by larger capital requirements for credit risk and operational risk.

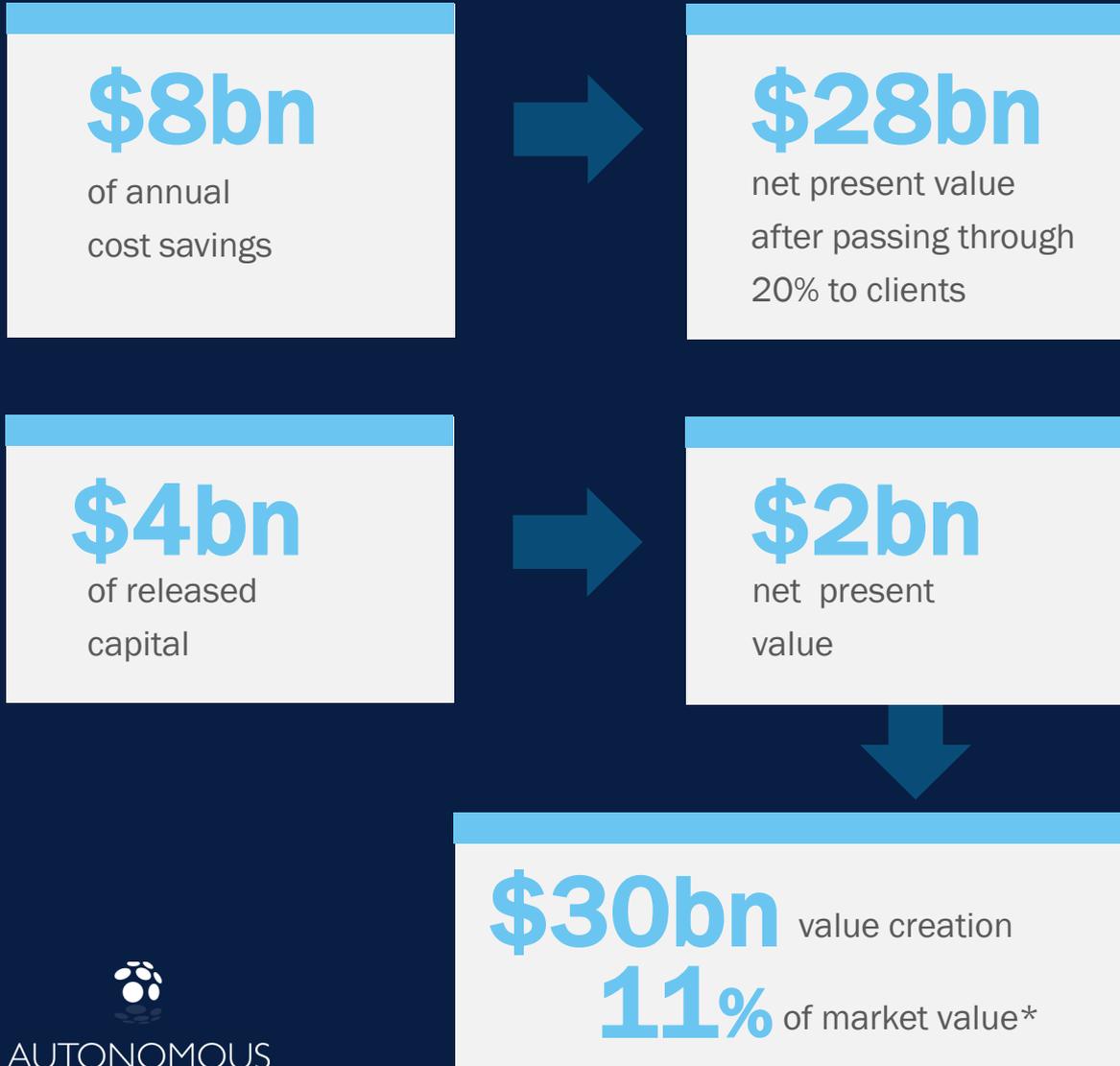
**Only a portion of this capital requirement could be released by blockchain.** Nearly three-quarters of counterparty risk is in over-the-counter derivatives – much of which could not be eliminated by blockchain.

## Blockchain could bring incremental capital benefits

We think that blockchain might free up 5% of capital requirements for counterparty risk. This is helpful, but not a game-changer.

# Value Uplift

## For the “Big Nine” Investment Banks



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\* of investment banking divisions, as of January 2016

# Payments & Correspondent Banking Are Further Down the Road



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	NETWORK TAKE RATE	TRANSACTIONS/ SECOND
Bitcoin	0%	7
Stock Exchanges	\$0.05 / 100 shares	29
Card Networks	0.2%	2,000
Cross Border Money Transfer	5.0%	28
EBAY	8.0%	1

With powerful network effects and strong incumbent players, we think it will be some time before the payments industry gets transformed:

## THE CARD NETWORKS DOMINATE RETAIL

**PAYMENTS.** Given the powerful network effect there is little incentive for merchants to switch. The networks already process many transactions quickly and cheaply.

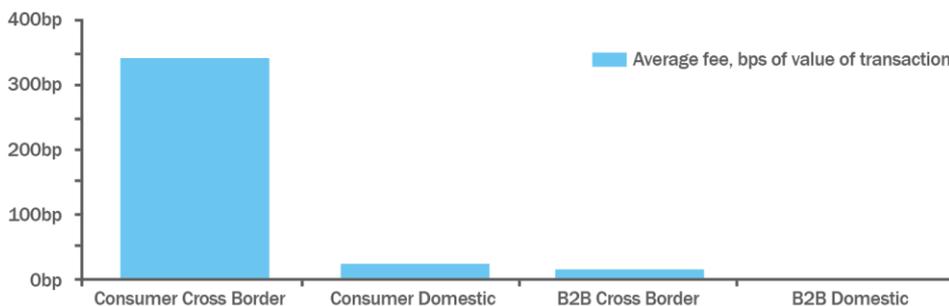
## B2B CROSS-BORDER PAYMENTS ARE CLUNKY, BUT EXPENSES ARE QUITE LOW.

The cost of a transaction relative to the headache of replicating the system creates barriers. Thus we think it is a later stage opportunity, not one of the first movers.

## CONSUMER-TO-CONSUMER CROSS-BORDER PAYMENTS ARE EXPENSIVE.

Transaction costs here are far higher. But there are challenges here too. How do you use blockchain to send a cross border remittance to someone in a developing country without a bank account?

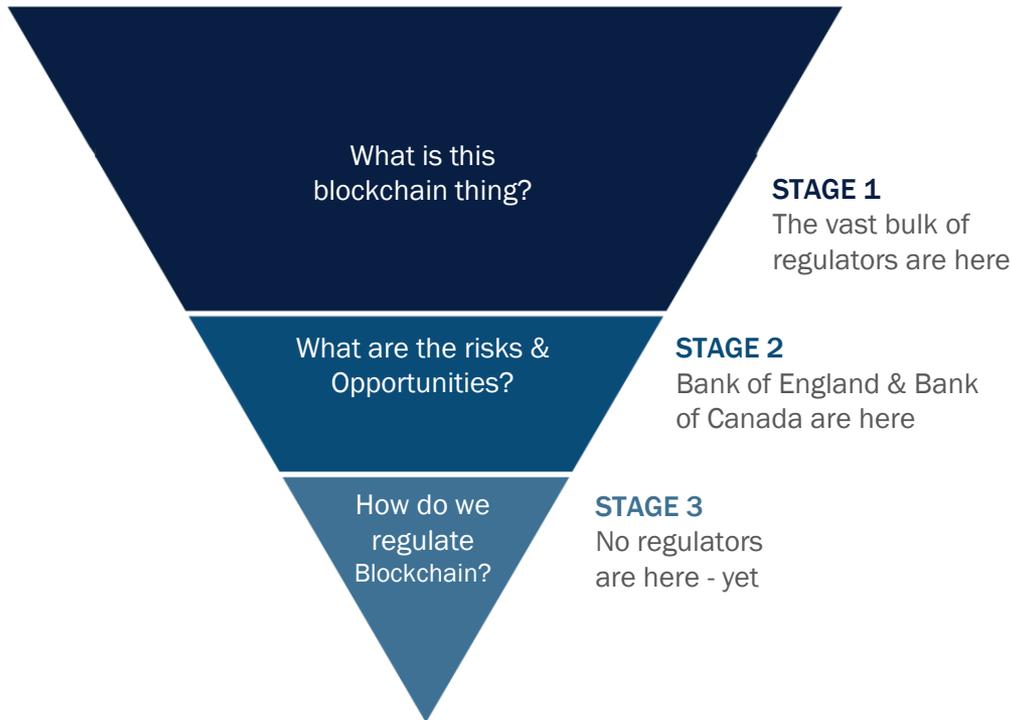
## Cost per transaction is tiny for B2B cross border transfers



Source: McKinsey 2015 Payments Report, Autonomous

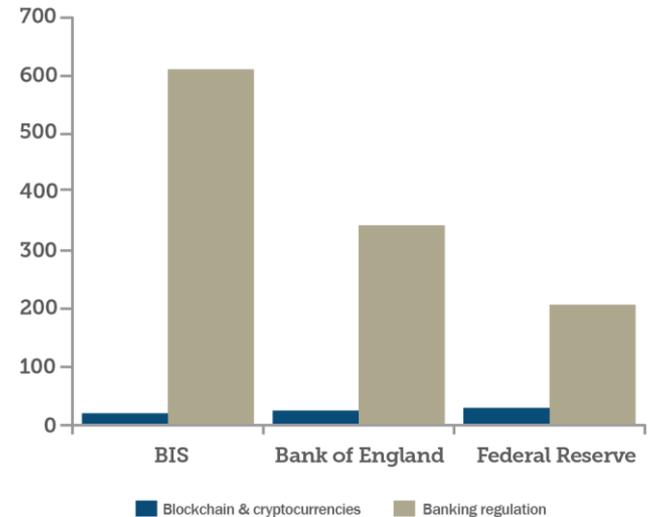
# Still Early Days on Regulation

Regulation of blockchain still feels relatively hands-off as the regulators themselves get up to speed on the technology. We think this will change at some point over the next two to five years – putting a temporary brake on the speed of development.



## Regulators are not very focused on blockchain for now

Page count of regulatory publications in 2015



Source: National regulators



# Regulators Will See

## Both Positives & Negatives in Blockchain



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### + Key Positives

- Greater transparency
- Reduced counterparty risk
- Greater diversity in settlement systems
- Reduced infrastructure costs
- More automation

### - Key Negatives

- Legal clarity over ownership?
- Jurisdictional clarity?
- Too systemic for start-ups?
- Can KYC & AML be dealt with?
- Unintended consequences of automation – no circuit breakers?

Regulators are conservative by nature and will worry about lack of legal and jurisdictional clarity. That said, the transparency, simplicity and reduced counterparty risk brought by blockchain will all be appealing.

## FINANCIAL TIMES

### Lengthy US loan settlements prompt liquidity fears

By Michael Mackenzie and Tracy Alloway in New York

Share Author alerts Print Clip Comments

The market for US bank loans is suffering from a blockage that risks creating turmoil as investors start retreating from what has been a boom area of financial markets in recent years.

An internal study by the Loan Syndications and Trading Association (LSTA) reveals that a quarter of new loans being issued are taking more than 30 days to settle, meaning investors buying or selling loans do not get title to their investment, or their money back, for a month or more after the deal is struck.

Loan settlement times are already a source of contention - perhaps an obvious area where Regulators would welcome change



**SECTION 2:**

**What it means  
for financial services**

# Why Do Financial Services Companies Care So Much?



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Traditionally a central authority has been required to connect nodes and establish rules. These companies include clearing houses and exchanges. Moreover, banks have developed legacy systems and maintain large rosters of employees to keep records of transactions and monitor the workflow processes.



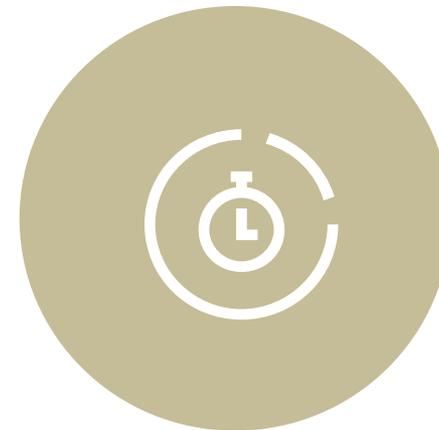
## **COSTS**

Reduce costs of paying a middle man or running a back-office with manual processes.



## **CAPITAL**

Settlement risk is minimized with automation, which reduces the collateral and counterparty risk.



## **SPEED**

Simply put, T+3 or even sometimes T+30 could go to T+0.

# What Banks Are Saying

Banks' technologists are favoring private, permissioned blockchains to test and learn. Until regulation catches up, leveraging purely public chains (like Bitcoin) is difficult. The key bank concerns are:



**PRIVACY** – Existing ledgers like Bitcoin, Ethereum and Ripple are open to the public, and consensus methods let all nodes see the transaction. In many trades, banks want trade information kept secret to avoid other counterparties seeing their and clients' positions.



**REGULATION** – Operating in a blockchain does not allow banks to avoid know-your-client and anti-money laundering rules. A public ledger could allow banks to make transactions with the wrong parties. Permissioned, private chains solve this issue.



**SPEED / COST** – Permissioned ledgers reduce the time and costs created by consensus requirements. On the other hand, the full scale benefits of a global ledger cannot be realized.



**INTEROPERABILITY (i.e. future proofing)** – Longer term, the dominoes may fall and a network of banks working together could yield more global blockchains. This is why interoperability is key to stitching together the work put in today.

Products First,  
Networks Later

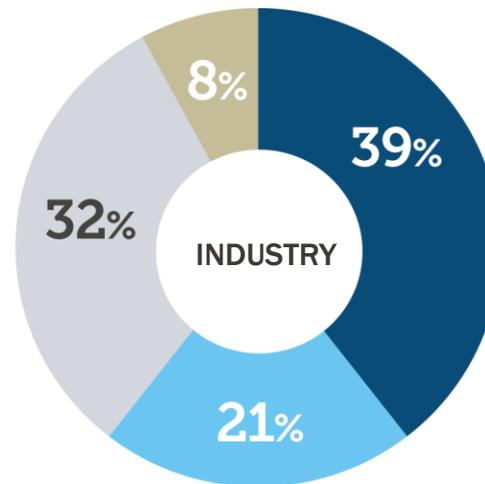
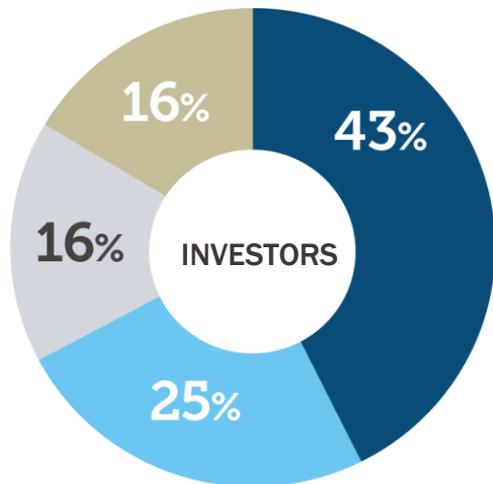
Private Over  
Public

DTCC has highlighted  
blockchain's limitations:  
INTEGRATION, DATA  
RETRIEVAL, SEARCHING,  
HIGH-SPEED ACCESS.

Inter-operable

# Investors & Industry Say That Clearing & Settlements Impacted First

Where will blockchain be disruptive first?



Hardly surprising... settlement times are LONG in a real-time world



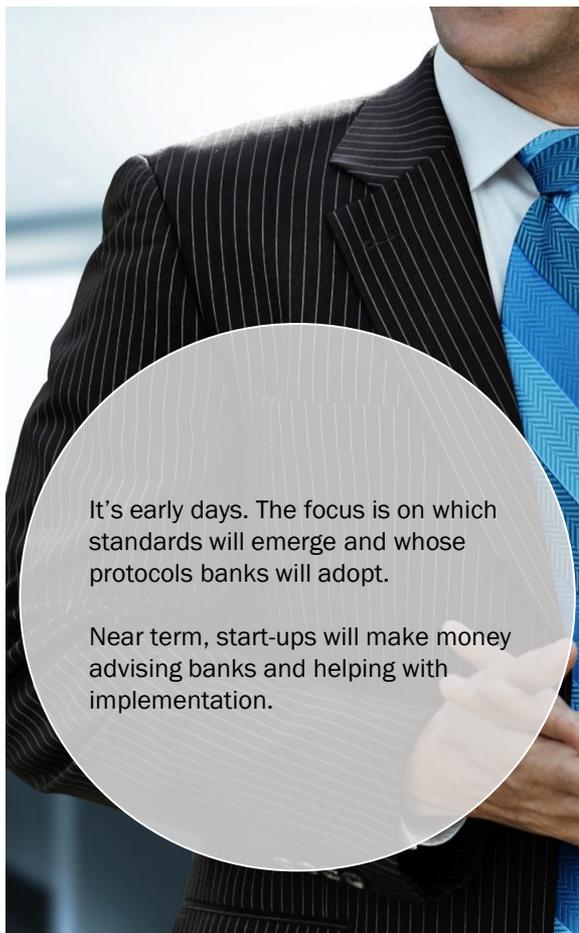
# The Potential for Disruption To Financial Service Incumbents



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Focus on processes that are the *most expensive*, take the *most time*, and *lack scale*.

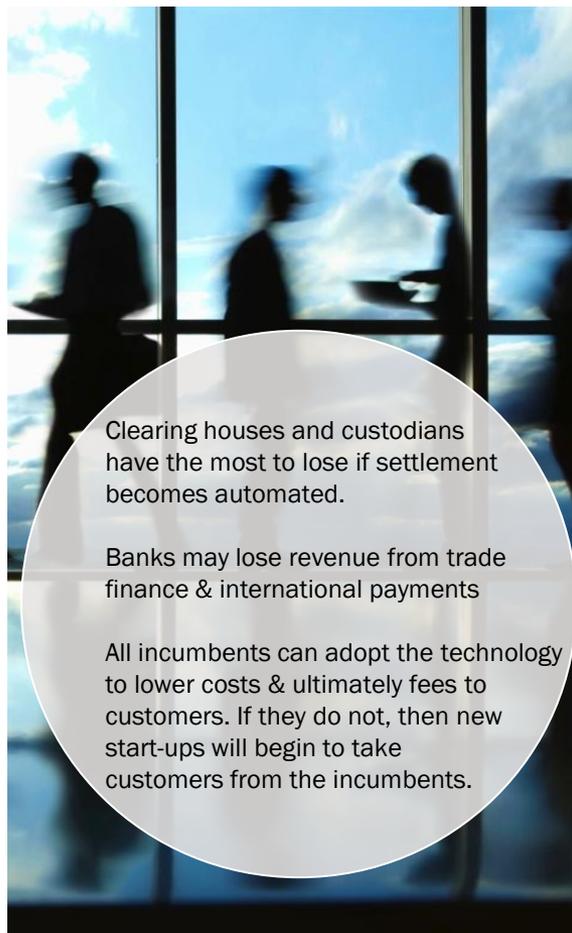
## WHO ARE THE WINNERS?



It's early days. The focus is on which standards will emerge and whose protocols banks will adopt.

Near term, start-ups will make money advising banks and helping with implementation.

## WHO ARE THE LOSERS?



Clearing houses and custodians have the most to lose if settlement becomes automated.

Banks may lose revenue from trade finance & international payments

All incumbents can adopt the technology to lower costs & ultimately fees to customers. If they do not, then new start-ups will begin to take customers from the incumbents.

## TIMING



Basic infrastructure developed in next 18 months

Some products go live in the next 3 years

Major disruption will take 5 or more years

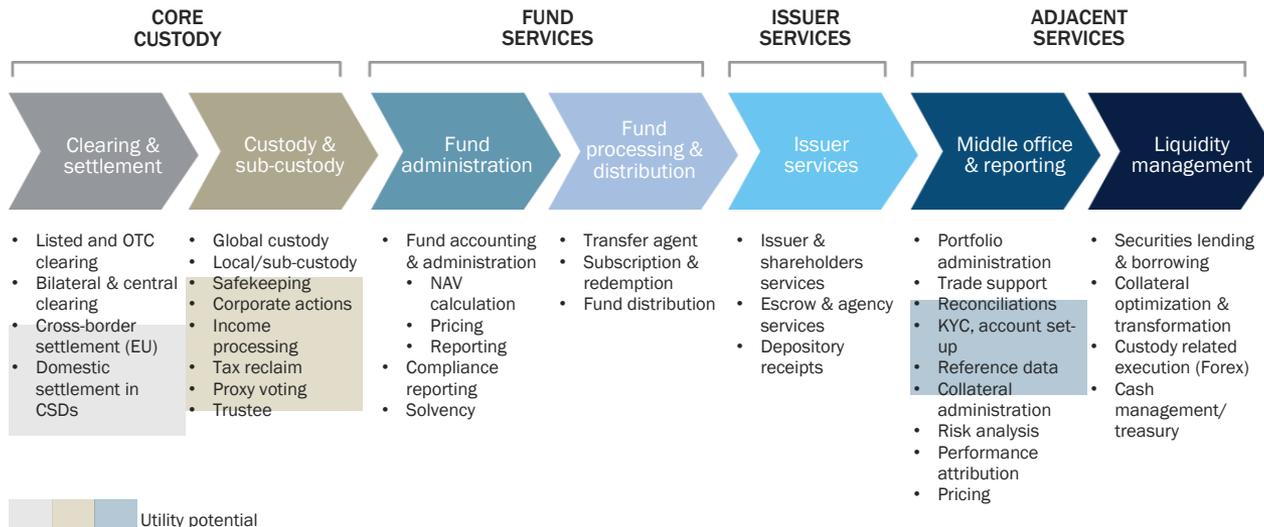
# Disruption Risk for Custodians

Through billions of dollars of investment the custodian banks have build a technological moat. The moat could evaporate if blockchain allows accessible low cost solutions for custody, clearing and settlement.

**THE CUSTODIANS INVESTED IN TECHNOLOGY AND BECAME INCREASINGLY SPECIALIZED.** From the 1970s onwards it became apparent that only a few banks could make the investments needed to provide custody and related services across asset classes and geographies. The industry consolidated around a handful of global players.

**THE CUSTODIAN BUSINESS HAS UTILITY POTENTIAL –** Consultancy Oliver Wyman has identified settlement, safekeeping, processing of corporate actions and income, and proxy voting as elements of the core custody business model with “utility potential”.

## Significant “utility potential” in core custody businesses

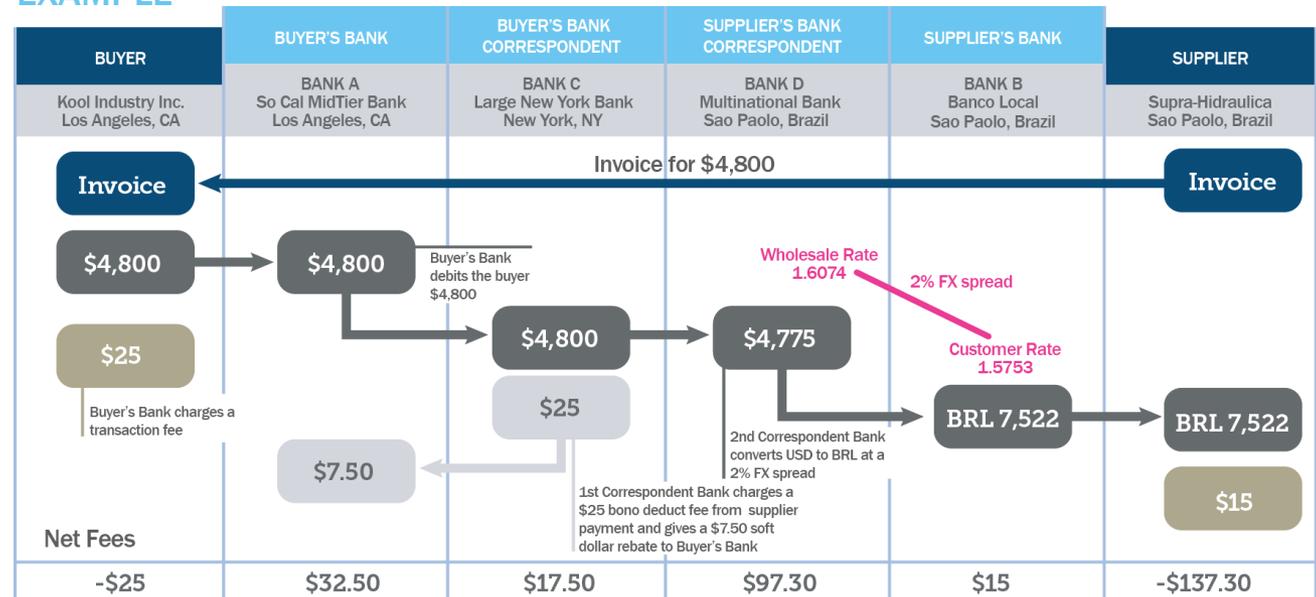


We think that custodian-bank fee income which is related to asset servicing, treasury, payments, clearing and treasury could be vulnerable to disintermediation. That's a quarter to a half of all revenues.

# Correspondent Banking

- International payments rely on a of complex network of correspondent banks.
- The result is expensive - every intermediary takes a cut.
- The status quo is also unreliable - it can be hard to get confirmation that funds were received.
- Distributed ledger provider Ripple is focused on correspondent banking.
- Even incumbent Swift (the communications platform which connects thousands of banks worldwide) is exploring blockchain.

## EXAMPLE



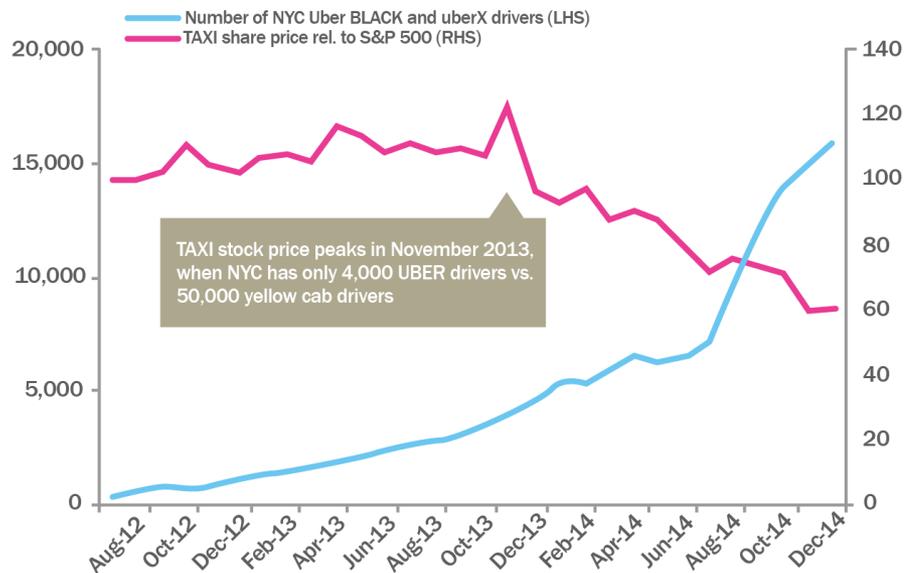
Source: Glenbrook Analysis



# Waiting for the Uber Moment

Investors in traditional financial services firms worried about disruption by blockchain will look for lessons from history.

## Taxi shares started falling when UBER was still nascent



Source: Uber Technologies, Bloomberg, NYC Taxicab Factbook 2014, Autonomous Research

Incumbents may start to underperform once the new technology has demonstrated its popularity with customers and growth potential, but before it has taken significant share

Shares in Medallion Finance Corp (NASDAQ: TAXI) peaked in late 2013 when UBER had established its growth trajectory – but it still had only 4,000 drivers in New York, compared with 50,000 yellow cab drivers.

Incumbents seem to be embracing blockchain technology. This offers some reassurance that they won't be the finance world's equivalent of Kodak.





“ We will see massive pressure on incumbent banks, which will struggle to implement new technologies at the same pace as their new rivals. That will make it increasingly challenging for them to deliver the returns and profitability that their shareholders demand. ”

- ANTHONY JENKINS

*former CEO of Barclays*

November 2015

# Selected Start-ups to Watch

## In Capital Markets & Money Transfer



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	NAME	DESCRIPTION	FOCUS
	<b>R3 CEV</b>	Leads a consortium of 40 global banks for R&D on blockchain in financial services including a protocol and standards. Founded by David Rutter in 2014.	Commercial paper settlement, trade finance, OTC derivatives.
	<b>DIGITAL ASSET HOLDING</b>	Working to build blockchain applications that assist banks with settlement post transactions. Founded in 2014 by Sunil Hirani and Don Wilson, with Blythe Masters subsequently appointed CEO.	Corporate syndicated loans, US Treasury Repo central clearing, Securities settlement
	<b>CHAIN</b>	Works with financial institutions to design, deploy and operate blockchain solutions to settle assets in many markets. Strategic investments from Visa & Nasdaq.	Securities settlement (Nasdaq private market), gift card spending, mobile top-up
	<b>RIPPLE LABS</b>	Creator and developer of the Ripple payment protocol. An open-source ledger that also uses digital currency XRP. Founded in 2012.	Cross-border payments using the Ripple Protocol to stitch together bank ledgers.
	<b>CREDITS</b>	Credits is a hybrid platform that allows banks to stitch together multiple ledgers, called cross-chains.	Encrypted digital identities and blockchain to process any asset class.
	<b>ITBIT</b>	Operates bankchain which is focused on bringing faster settlement to existing financial transactions. Uses private, permissioned distributed ledgers.	Gold trading, securities settlement

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# 2016 Year of the Use Case



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2016 will be the year to demonstrate that blockchain works in practice. 2,300 companies requested to be part of the Linux Foundation's Hyperledger Project within a day of its December 2015 launch – four times the previous record.



## DAH

Digital Asset Holdings has won a contract with Australia's main exchange operator, and is partnering with JP Morgan on streamlining loan trades. Acquired Hyperledger platform and contributed it to Linux Foundation.



## NASDAQ

Nasdaq is rolling out blockchain technology to allow T+0 settlement on its market for private companies – recording its first transaction in December 2015.



## OVERSTOCK.COM

The online retailer's t0 subsidiary is dedicated to using distributed ledgers. In July 2015, Overstock issued a proof-of-concept \$5mn "cryptobond". In December, it was granted SEC approval for a secondary share issue via blockchain technology.



## SYMBIONT

Symbiont unveiled its smart securities platform in August and has demonstrated debt trades as a proof-of-concept. Plans include a \$100mn debt issue for a Fortune 100 company, partnering with a bulge bracket bank.



## EVERLEDGER

Partnering with BigChainDB to work on a permanent ledger to record diamond certification and transaction history. The company believes this could eventually eliminate up to \$50bn of fraud-related costs for the insurance industry.



Digital Asset  
Holdings



symbiont



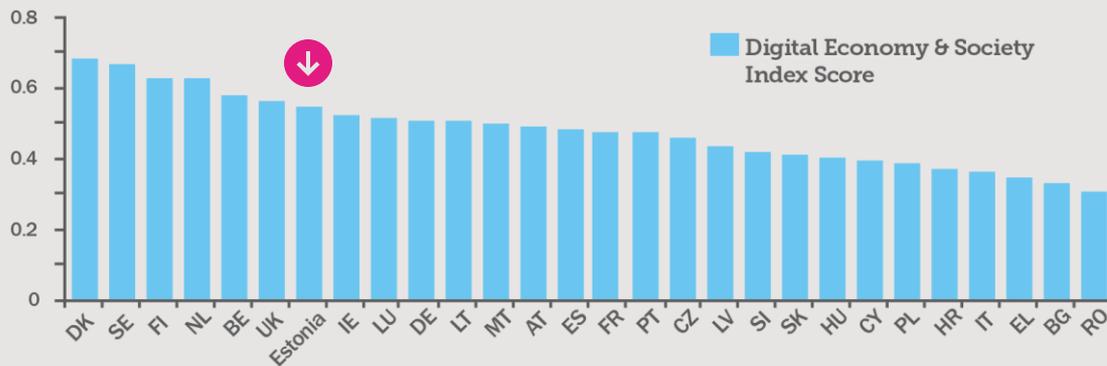
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# A Tale of Two Countries

Two very different markets are emerging at the forefront of deploying blockchain technology – Australia and Estonia. What they have in common is that the stock exchange and central securities depository have the same owner – ASX in Australia and Nasdaq in Estonia.

**Australia.** Digital Asset Holdings is working with ASX to design a new post-trade solution for the Australian equity market. The initial six-to-twelve months will be used to develop a private permission solution to demonstrate the benefits before a final decision is made in 2017.

**Estonia.** Nasdaq is using Estonia as a test case for Blockchain. In February 2016, Nasdaq announced that it is partnering with the Republic of Estonia's e-Residency platform to facilitate a blockchain-based e-voting system to streamline the proxy voting process.



Source: European Commission, Autonomous.

**Estonia** is surprisingly ahead of the digital curve, and Nasdaq owns both the stock exchange and central securities depository, *the perfect test case for blockchain*

# Case Study

## Digital Asset Holdings



### PEOPLE

Founded by Don Wilson, CEO of DRW, one of the world's largest proprietary trading companies, and Sunil Hirani, CEO of trueEX interest rate exchange. Digital Asset's CEO is Blythe Masters, who held a variety of senior positions at JPMorgan and is widely credited with being part of the team which created the modern credit default swap.



### TECHNOLOGY

In June 2015, Digital Asset acquired the Hyperledger technology, which is capable of processing thousands of transactions per second and allows financial institutions to create multiple private blockchains. This was subsequently moved to the open-source Linux Foundation.



### INITIATIVES

In addition to its partnership with ASX to apply blockchain technology to the Australian equities market, Digital Asset has announced partnerships with consultancies Accenture and PwC, focused on systems integration and education. It is also working with technology-provider Broadridge to identify use cases.



### INVESTORS

Digital Asset recently announced a \$60mn plus financing round from 15 firms across the financial ecosystem.



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**SECTION 3:**  
**Blockchain**  
The ABCs



# What is Blockchain?

A database or a ledger that maintains a continuously growing list of data records or transactions.

## So, it's a spreadsheet, like Excel?

In a way yes, but it has special qualities that make it better than traditional databases.



### SHARED PUBLICLY

Servers, or nodes, maintain the entries (known as blocks) and every node sees the transaction data stored in the blocks when created.



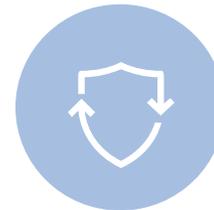
### DECENTRALIZED

There is no central authority required to approve transactions and set rules.



### SECURE

The database is an immutable and irreversible record. Posts to the ledger cannot be revised or tampered with – not even by the operators of the database.



### TRUSTED

Distributed nature of the network requires computer servers to reach a consensus, which allows for transactions to occur between unknown parties.

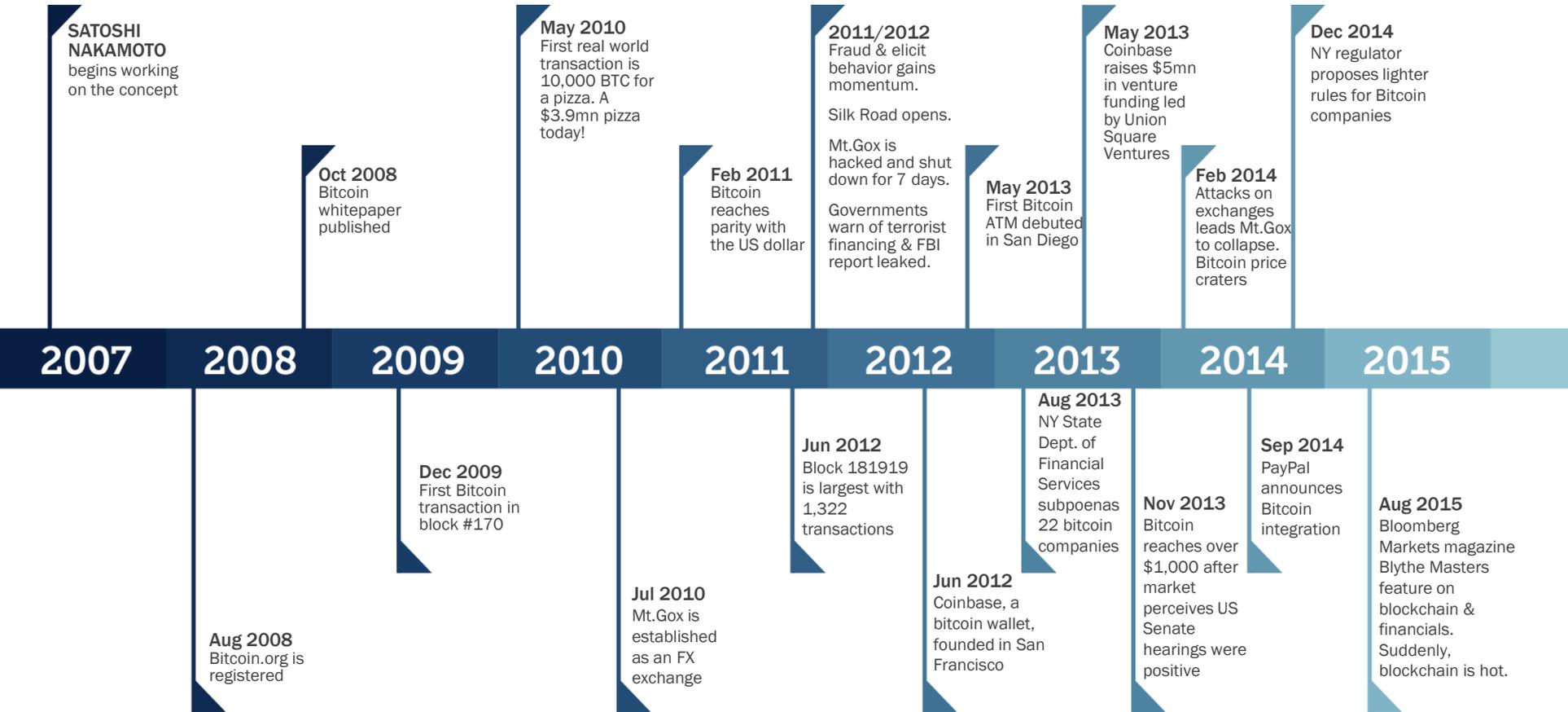


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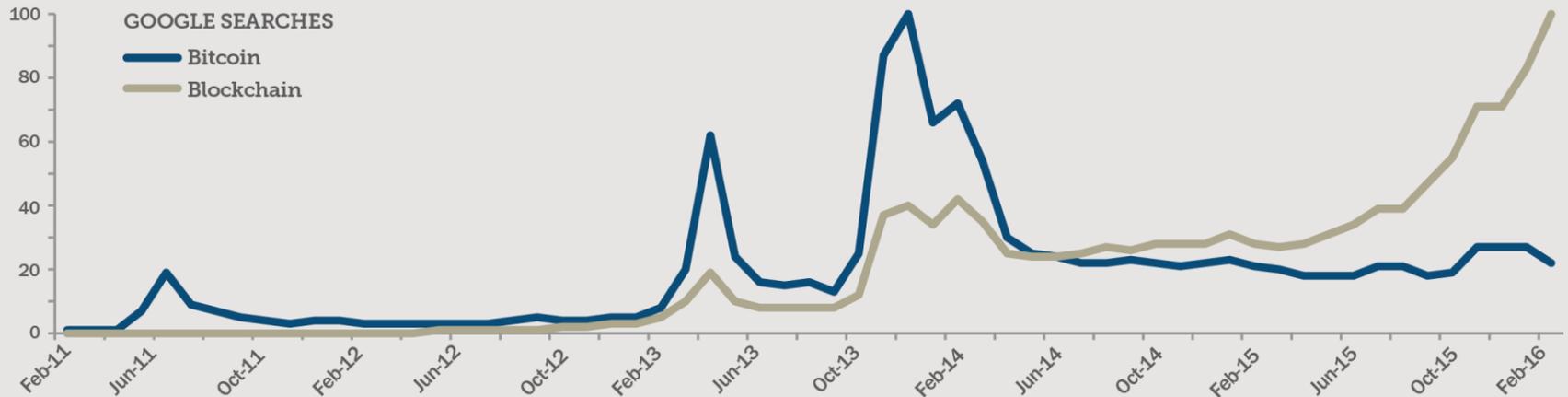
The software is written so that conflicting or double transactions do not become written in the data set and transactions occur automatically.

# Blockchain is the Main Innovation Behind Bitcoin

Bitcoin has a negative connotation among many regulators, payment players, and bankers for its involvement in illicit commerce. The underlying technology, however, is the basis for today's blockchain enthusiasm. A record of transactions stored in blocks has many potential uses including the maintenance of healthcare records, financial settlement, trade processing, etc.



# And Now Everyone Is Talking About Blockchain



Source: Google Trends.

Note: Each series separately indexed so peak searches are 100 for each index. Bitcoin searches are still 9x searches for blockchain.

## Why?



Shared ledgers have existed since the 1970s but the concept of immutable entries has been made a reality by the use of cryptography and increased computer processing power.



Advancements in speed in other areas of finance make settlement times and money transfer look archaic and costly.



Compliance changes, capital regulations, and low interest rates are continuing to burden banks with cost issues and margin pressures. Blockchain technology could help cut costs in a variety of ways.

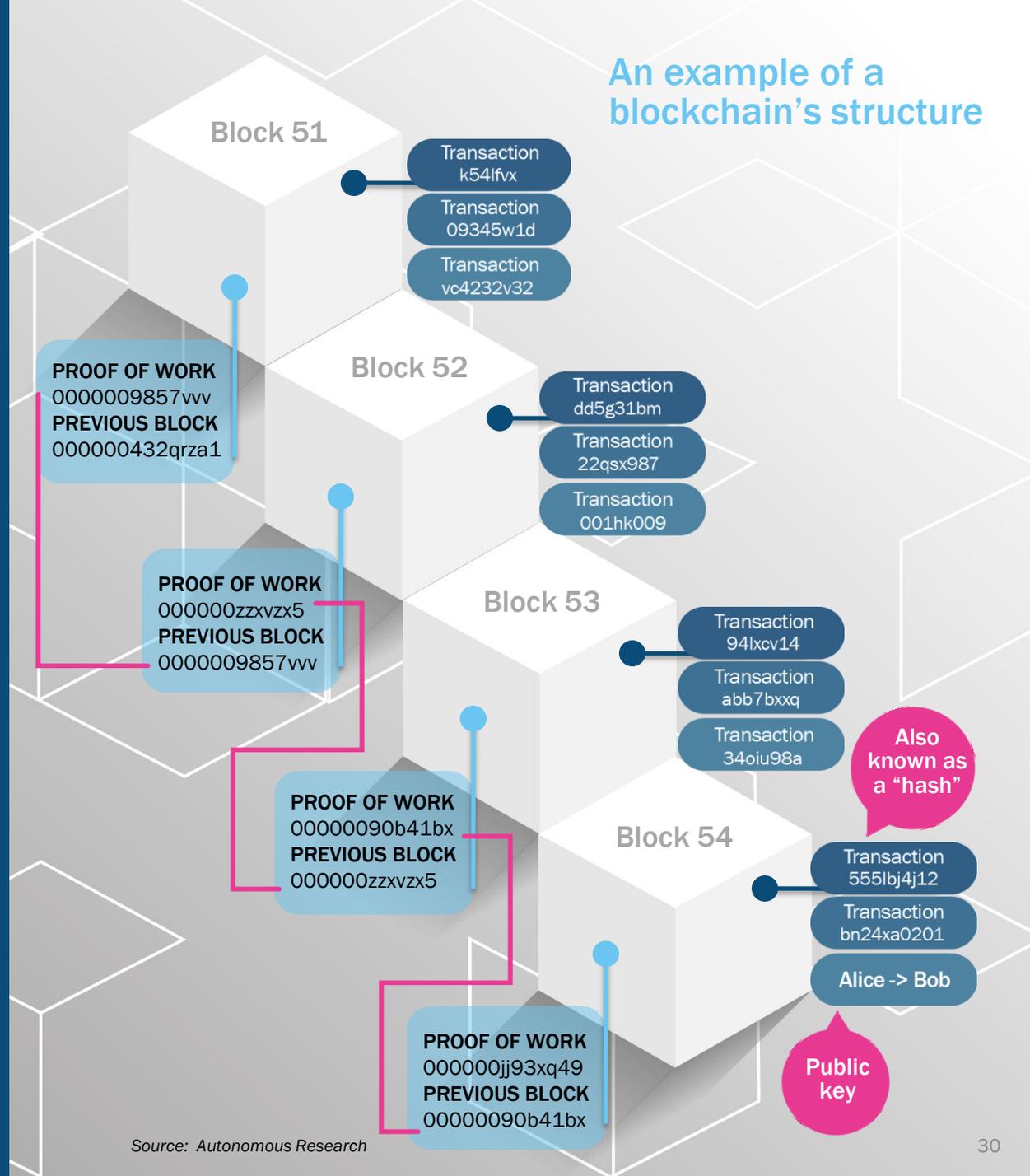
# How Blockchain Transactions Work

Blockchains solve two major challenges for digital transactions, controlling the information and avoiding duplication, at once.

There are four major pieces of information in a block:

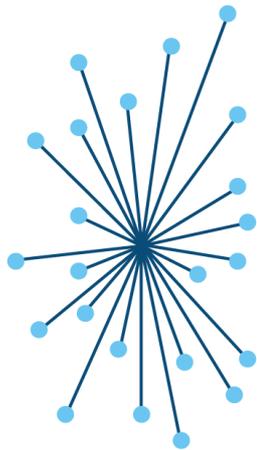
1. An ID referred to as a “hash” or consensus identifier. In the example below, it’s called “proof of work.” This is a random set of encrypted numbers.
2. The hash number from the previous block, which sets the chronological order in the ledger
3. Transactions that are included in the block. Can be one, but can also be thousands of transactions.
4. Public key (identities) for the sender and receiver to identify the transfer of information.

## An example of a blockchain's structure

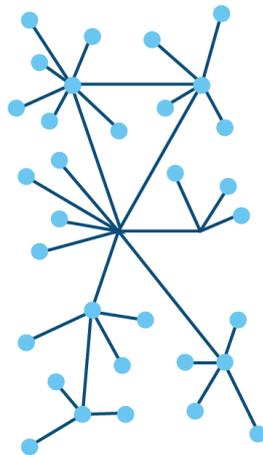


# What is a Distributed Ledger?

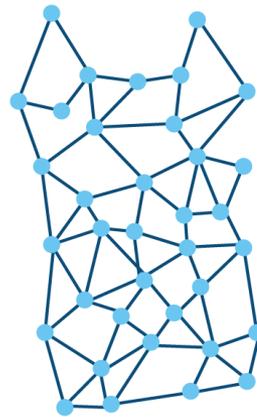
Each block is created when multiple nodes agree and validate the transactions. This is where the term “distributed ledger” comes from as there is no need for a centralized source to validate a transaction.



Centralized



Decentralized



Distributed

Source: *On Distributed Communications Networks*, Paul Baran, 1962



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**VALIDATION OCCURS WHEN THE NODES REACH CONSENSUS.** There are two major consensus mechanisms:

- 1. PROOF OF WORK** – A proof-of-work (POW) protocol is an economic measure to deter ledger hacking requiring some work from the service requester, usually meaning processing time by a computer.
- 2. PROOF OF STAKE** – While the proof-of-work method asks users to repeatedly run hashing algorithms to validate electronic transactions, proof-of-stake asks users to prove ownership of a certain amount of currency.

## Store of value or record of value?

The ledgers do not show ownership of value but only a record of all past transactions. From these past transactions wallets can infer ownership because the record is immutable and infinitely stored.

# Smart Contracts

Smart contracts allow for logic to be programmed on top of the blockchain transaction. When a transaction takes place, the smart contract seamlessly executes the contract. Some industry experts think that smart contracts could be the next FinTech “hype cycle”.



Cryptographer Nick Szabo coined the term ‘smart contract’ in 1994. At the time implementation was difficult because it was not easy for a computer program to trigger payments, but Bitcoin and Blockchain are changing that.



Firms such as Symbiont and TO.com (the Overstock off-shoot) have said that smart contracts will underpin securities transactions using their technologies. Smart contracts would likely be crucial to integrating blockchain architecture into the legacy systems of financial institutions.



Smart contracts could be used in real estate transactions to transfer title and release escrow when ownership is confirmed, potentially greatly reducing transaction and insurance costs. Honduras is one of the first countries experimenting with blockchain to record real estate transactions.



Peer-to-peer insurance is potentially another use-case – being pioneered by start-ups like Dynamis and Friendsurance in Germany.



Some industry participants criticize the Bitcoin blockchain’s limited capacity to handle smart contracts. Ethereum is a decentralized platform run by a Switzerland-based non-profit organization which runs smart contract applications.

# Summary



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1

Blockchains are special databases that contain immutable records and allow decentralized nodes to transact without a central authority.

2

Banks are primarily working toward **permissioned “private” chains** among themselves to solve issues related to compliance and privacy.

3

The early focus by most in financial services has been securities settlement.

4

Banks are excited by **blockchain’s ability** to clarify operations, save time, and reduce capital commitments.

5

Too early to know exactly how **blockchain will impact financial services**. It’s going to be a 5 to 10 year process. Regulation is a major unknown.





# Blockchain Definitions

**NODES** – A node is a participant in the ledger. A node in the case of financial services would be a transactor like a bank, custodian, or asset manager.

**CONSENSUS** – The means by which all of the nodes agree on a transaction's validity. Consensus is important in ensuring the ledger's fidelity.

**BITCOIN** – A digital currency that is managed by a distributed ledger of the same name.

**CRYPTOGRAPHY** – Cryptography dates back to the beginning of written language, and is derived from the Greek words *kryptós*, which means “hidden” or “secret”. In a blockchain cryptographic puzzles are used to verify transactions.

**MINING (also called “proof of stake”)** – Mining is specific to the Bitcoin blockchain. Miners are computer servers that solve cryptographic problems which keep the blockchain moving forward. In Bitcoin, miners are rewarded with Bitcoin for their effort.

**SMART CONTRACTS** – Smart contracts allow for logic to be programmed on top of the blockchain transaction. When a transaction takes place, the smart contract seamlessly executes the contract. Examples include a derivatives contract or the additional information needed for customs in a Bill of Sale.





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