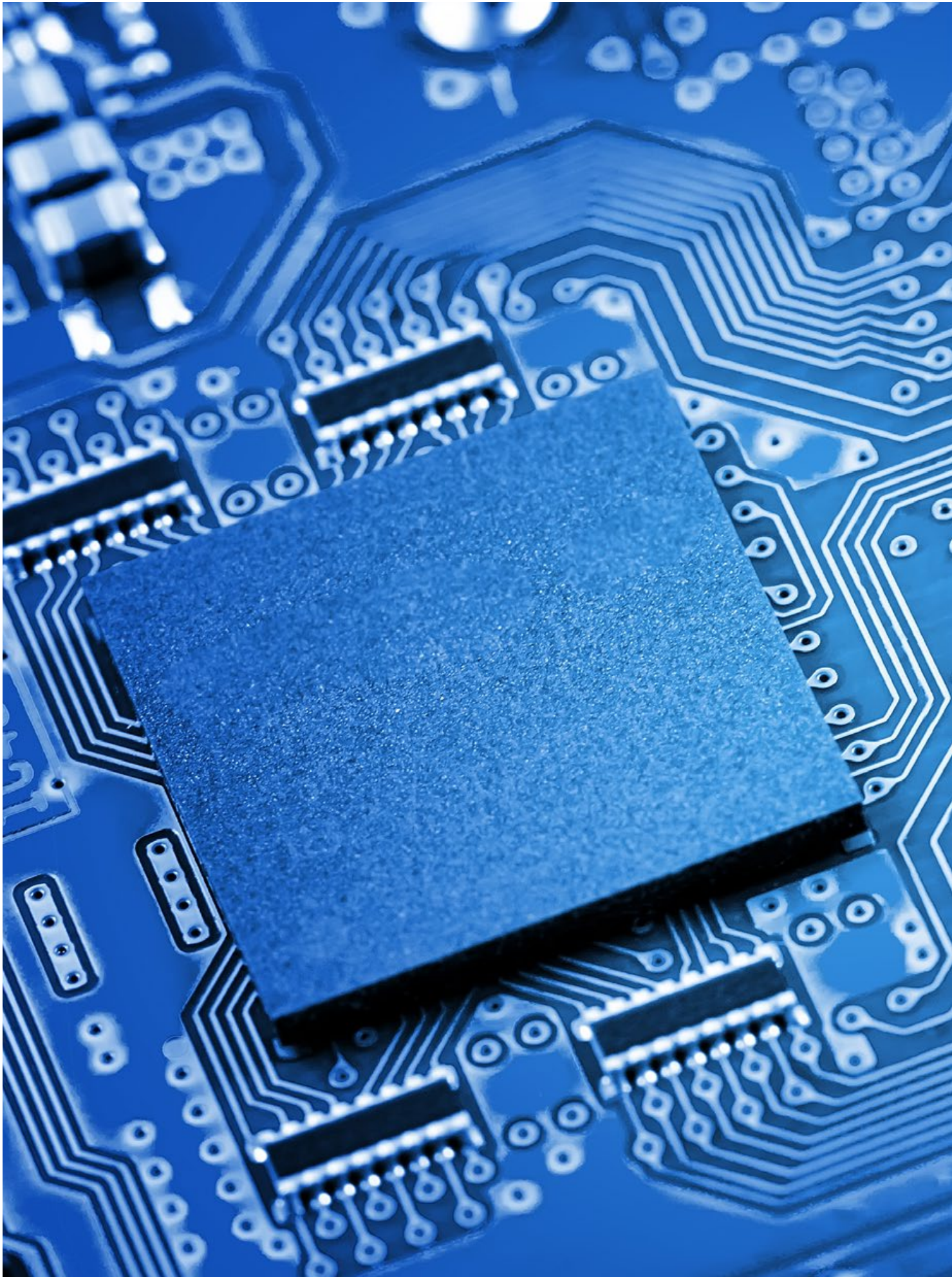



Thinking Ahead Institute

When securitisation meets blockchain







Asset classes of tomorrow working group

This document has been written by members of the Thinking Ahead Group 2.0 (Liang Yin, Tim Hodgson) following the research and discussion conducted by the Thinking Ahead Institute's asset classes of tomorrow working group. The authors are very grateful to the members of the working group for their input and guidance, but stress that the authors alone are responsible for any errors of omission or commission in this paper.

This paper is part of a series that explores how the investment opportunity set of institutional investors might evolve in the years and decades to come.

The members of this working group are as follows:

- Benjamin Cooper (Wellington Management)
- Blair Reid (BlueBay Asset Management)
- Craig Baker (Willis Towers Watson)
- Frédéric Samama (Amundi Asset Management)
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In short

“All investors, including retail and DC investors, could potentially easily own and trade a fraction of Leonardo da Vinci’s Salvator Mundi, last sold for an eyewatering US\$450m in 2017.”

Blockchain is a record-keeping technology based on a distributed – as opposed to centralised – ledger. The goal of blockchain is to allow digital information to be recorded and distributed, but not edited, creating an immutable data record. Counterparties of economic and financial transactions can therefore trust each other’s digital records without relying on intermediaries (eg have an auditor to validate your business accounts) to establish trustworthiness first. As a result, the cost of building trust is reduced substantially.

When transactions are dis-intermediated, what is currently prohibitively expensive can become economically feasible, eg an initial public offering for a small business. Therefore, more assets can, and will, be issued and securitised.

Reduced market friction is expected to expand investors’ opportunity set into what is currently private and illiquid. All investors, including retail and DC investors, could potentially easily own and trade a fraction of Leonardo da Vinci’s Salvator Mundi, last sold for an eyewatering US\$450m in 2017.

While the future path is still very uncertain, investors should consider building a reliable information channel to monitor the creation of new tokenised assets. Investors might also want to debate whether blockchain technology itself presents an investment opportunity and whether they can build successful investment strategies via those companies that look to monetise it.

Investment is a subset, and not a representative one

Collectively, investors own an enormous amount of assets but we are far from owning everything. [One estimate](#) put the total value of global capital stock at well over US\$500trn (see figure 1).

This includes residential houses, private businesses, agricultural land as well as familiar financial securities. This is essentially the all-inclusive market portfolio¹, one of the foundational pillars of the Capital Asset Price Model.

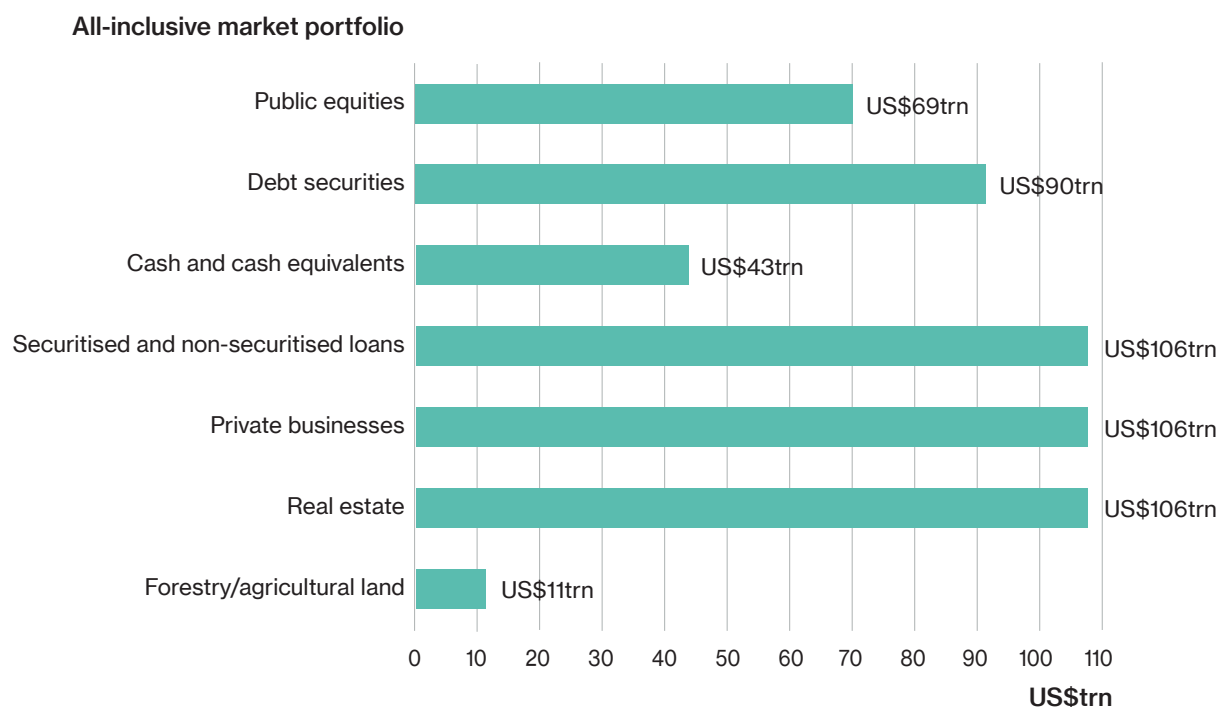
On the other hand, a 2019 State Street Global Advisors study² valued the collective portfolio held by global investors at around US\$130trn. That is an extremely impressive sum but still dwarfed by the value of the market portfolio.

Of course it is unrealistic for investors to own the entire world. Individuals prefer owning the houses they live in; banks tend to hold on to their loan assets; many business owners do not like diluting their ownership stakes.

What is more revealing, however, is that the composition of the two portfolios – invested vs market – is very different. For example, investors' equity exposure is heavily concentrated on listed companies even though private companies collectively are worth more. While real estate and land account for more than 20% of the total value of the market portfolio, they are only around 6% of the invested portfolio.

So what drives the discrepancy? What prevents investors from holding an aggregate portfolio that mirrors the weights in the wider world? After all, that is the theoretical definition of a fully diversified portfolio. Richard Thaler, the renowned behavioural economist, has [reportedly](#) said “if you want people to do something, make it easy”. Our working assumption is therefore that investors own the assets they currently own (largely) because these assets are easy to buy and sell.

Figure 1 – Total value of global capital stock, in total around US\$530trn



¹ Technically there are still assets that are not included here but should be part of the market portfolio – eg, state assets like roads, schools, power stations

² “What is the portfolio of assets held by the world?”, State Street Global Advisors, September 2019

Investors will extend their reach if things are made easier for them

What exactly do we mean by “easy”?

Pretty much all economic activity can be dumbed down to the exchange of assets, tangible and intangible. Your employment “deal” allows you to exchange your human capital for a pay check which you can then exchange for the goods you want. Investing is also a form of exchanging assets: cash for an ownership stake in a business; cash for a fixed-income security; or the reverse when selling.

Investing activities are “easy” when they can be done cheaply and quickly. They get “harder” with the involvement of expensive intermediaries, transaction costs, delays in executing contracts, information asymmetry, asset indivisibility, taxes, lack of trust, fraud and more. These factors act as a drag on investment activities. They are all elements of [market friction](#).

Take equity ownership as an example. To own a stake in a private company one faces almost all the hurdles mentioned above. For listed companies many of the frictions are reduced: disclosure requirements reduce information asymmetry; regulations and independent auditing practice reduce the risk of fraud; stock exchanges provide ready markets for the purchase and sale of securities. Therefore investors own disproportionately more listed equity in their portfolios.

We have reasons to believe that, at least in principle, the reduction of market friction can expand investors’ opportunity sets, extending their reach to assets that they don’t currently own. And technology has always been and will always be an important driver of reducing market friction. The focus of this paper is on one particular type of potentially revolutionary technology – blockchain.

“Investing activities are “easy” when they can be done cheaply and quickly. They get “harder” with the involvement of expensive intermediaries...”





Blockchain 101

Blockchain is a record-keeping technology – it is a distributed (as opposed to centralised) ledger. It is the underlying technology (think internet) behind cryptocurrencies like bitcoin (think email or e-shopping) but its implications go beyond cryptocurrencies.

Blockchain is literally a chain of (virtual / digital) blocks. Each block is made up of a set of digital information (such as a list of transactions) and the word chain highlights the fact that these blocks are linked (using cryptography).

Most existing record-keeping systems operate in a centralised manner (think land and property registry). There is a central authority to maintain the integrity of the system. Blockchain is decentralised. The goal of blockchain is to allow digital information to be recorded and distributed, but not edited.

When a new piece of information is created – eg a new transaction – it becomes part of a new block added to the end of the blockchain (ie append-only). Each participant in the system maintains a replica of the entire chain in sync with all other participants. Therefore all participants know what is going on within the network (technically speaking, the data has provenance) – where the asset came from, how its ownership has changed over time, and at what price.

The ledger needs to be safe from tampering. There are three primary protection mechanisms: **1** the cryptography is really hard to crack (eg in the bitcoin network it involves solving computational maths problems at 1 in 5.8 trillion odds as of [Feb 2019](#)); **2** there is a self-policing mechanism in place, which means there are incentives for participants of the network to detect and correct faulty records – this is called proof of work; and **3** the computing power required to force adoption of a hacked chain is enormous - you need more than 50% of the participants to agree with your manipulated record in order to change the “consensus”. In practice a so-called 51% attack on the bitcoin network at the time of writing this paper (November 2019), according to our estimate³, would require computing power equivalent to 200,000 copies of the world's fastest supercomputer! It is safe to say that these records are undeniable and immutable⁴.

³ On 20th November 2019, the total computing power for the Bitcoin network stood at around 80million PFLOPs (a measure of computer performance). The world's current fastest supercomputer, Summit, has a peak of around 0.0002 million PFLOPs.

⁴ A breakthrough in quantum computing technology could unleash currently inconceivable computing power so this remains a tail risk.

Blockchain is a potentially disruptive force to the cost of trust

To understand how disruptive blockchain can be to trust building, we need to start with how trust is currently established. Capitalist economies are built on repeated exchanges of value, which requires us to trust each other's claims about what we own, what we are owed and what we owe. But how do we trust people we don't know? For centuries, we have turned to institutions – essentially trust gatekeepers such as banks, auditors, lawyers, stock exchanges – to vouch for them. The flip side is that they charge fees, create frictions and don't always act in our best interest.

Imagine a world where all economic transactions are recorded in this immutable digital distributed ledger: exchanges of money, transfer of ownership, an instruction, an agreement, and so on. It could also include so-called smart contracts which are instructions written in computer programs that are verified and enforced automatically (eg to buy a stock when the price drops below US\$10).

In this scenario, businesses could opt to transparently report their business activities in real time, reducing the need for traditional accounting practices. The need for external validation of these accounts is also much reduced. Why pay estate agents thousands of dollars to essentially stand between the owner and the buyer? The need for lawyers might also be reduced if contracts could not be tampered with and are automatically enforced with no dispute. The roles of all these “trusted intermediaries” would be questioned.

This “[triple-entry bookkeeping](#)” system – one entry on debit, one on credit and a third into an immutable shared ledger – shifts the source of trust from fallible humans or institutions to cryptology. In doing so, the cost of trust can be substantially reduced. When the cost of building trust goes down, the total cost of economic transactions is lower as a result.





Securitisation meets blockchain

Having discussed one of the most recent technologies to emerge, let's move back in time and think about an older technology: securitisation⁵.

Securitisation is a mechanism to turn an illiquid asset (or a portfolio of assets) into tradeable, fungible claims. It is a great technology that has reduced market friction. Once assets are turned into marketable financial instruments, buying and selling becomes a lot easier and less costly. It is the driving force behind institutional investors diversifying into new areas such as loans and insurance contracts.

However, securitisation is hamstrung by a number of issues.

The costs can be high, precisely because of the involvement of intermediaries: management and system costs, legal fees, underwriting fees, rating fees and ongoing administration. The originator typically needs the help of an investment bank in setting up the structure of the transaction. For example, [PwC](#) found that on average, companies incur an underwriting fee equal to 4-7% of the total capital raised, plus an additional US\$4.2m of offering costs directly attributable to the IPO.

Securitisations often require large scale structuring, and thus may not be cost-efficient for small and medium transactions. Again, this is linked to the role of intermediaries. A small scale deal is simply not lucrative enough for the banks or, if it is, becomes prohibitively expensive for the issuer.

Ultimately it is the high cost of building trust between sellers and buyers of the securities that leads to the high cost of securitisation. A business owner can't just go to eBay and sell 5% of her company without having paid a bunch of financial institutions to earn the trust of the general public. At least not until a technological solution – such as blockchain – disintermediates the building of trust.

“Securitisation is a mechanism to turn an illiquid asset (or a portfolio of assets) into tradeable, fungible claims. It is a great technology that has reduced market friction.”

⁵ An early example of securitisation was found in Amsterdam in the 17th century. The term securitisation is tainted largely due to the role that mortgage backed securities played in the 2007-08 global financial crisis but in our view that was more to do with mis-selling of securitisation as opposed to the technology itself.

Tokenised assets might just be the beginning

We are already witnessing the emergence of tokenised assets.

A token represents a particular fungible and tradeable asset. Tokenisation is the process of converting ownership rights of a real-world asset into a digital token. Tokenisation is similar to securitisation in the sense that they both create fungible and tradeable instruments. Instruments created via securitisation are traded on traditional marketplaces such as stock exchanges. When an asset is tokenised (the process is called STO – security token offering), it is equivalent to being listed, albeit on a blockchain network as opposed to a conventional stock exchange⁶.

Tokenisation is considerably more cost-efficient than the current model of selling your assets or raising new capital. Instead of paying all those intermediaries for the paperwork, you just write a smart contract to do the job. And ownership and transaction information is immutably recorded in a blockchain powered network.

But the disruptive force of blockchain can go well beyond just the process of capital raising. Imagine the entire global economy being supported by a huge network powered by blockchain. All the business transactions would be recorded in an immutable way. All the contracts with customers, suppliers and employees would be smart contracts, automatically enforced in the same blockchain network. Essentially every business would be building a complete business record that everyone else could trust, without the involvement of intermediaries.

⁶ This distinction becomes increasingly blurred given that stock exchanges have started to embrace blockchain technology.

Tokenised economy promises to further reduce market friction

Costs related to securitisation come down


A reduced need for intermediaries results in a reduced cost of creation of securities (tokens). Raising equity or debt, as opposed to solely relying on loans, becomes economically feasible for small and medium-size businesses. With smart contracts, execution of various administrative processes also becomes more efficient such as profit sharing, voting rights distribution, buy-backs, and so on.

Trading of these tokenised securities becomes cheaper, faster, less risky, more transparent

As opposed to the current practice of T+2 (days!), the settlement of trades can be completed in a matter of minutes. Trading becomes 24x7, facilitated by smart contracts triggered by predefined parameters instantaneously completing transactions. Faster deal execution reduces counterparty risk (delay of settlement increases the risk of either side failing to fulfil its trade commitment). Transparency will also improve as the tokenholder's ownership rights are embedded directly onto the token with an immutable historical record of ownership. When the market accepts the immutable nature of trading data, the need for reconciliation – therefore the cost related to it – might be completely removed.

Programmable securities facilitate bespoke design of rights, more precise risk-taking and automated compliance

Programmable securities open the door to amazing innovation. Say a company wants to reward long-term investors – more dividend, more voting rights etc. This can be easily programmed into the security token that can distinguish between you, who have been holding the stock for five years, and Joe, who just bought the stock two weeks ago. A company can also issue stocks that are linked to a particular revenue stream as opposed to the whole balance sheet. This gives freedom to investors to choose more precisely the risk / return profiles they would like to include in their portfolios (eg you are only interested in three drugs that GSK propose to develop). Another benefit is in the area of automated compliance. One of the most difficult aspects of trading securities is related to regulations, which vary by asset type, investor type and buyer/seller/issuer jurisdictions. Because security tokens are programmable, compliance can be baked right into the token, operating automatically.



```
36  
37 it("should merge multiple fixed fields", function() {  
38   f.addPair({name: "a[1]", value: "b"});  
39   f.addPair({name: "a[3]", value: "c"});  
40   assert.deepEqual(f.serialize(), {a: [ , "b" , , "c"]});  
41 });  
42  
43 it("should merge mixed field types; named, quoted", function() {  
44   f.addPair({name: "a[b][]", value: "c"});  
45   f.addPair({name: "a[b][]", value: "d"});  
46   assert.deepEqual(f.serialize(), {a: {b: ["c", "d"]}});
```

"Transparency will also improve as the token-holder's ownership rights are embedded directly onto the token with an immutable historical record of ownership. When the market accepts the immutable nature of trading data, the need for reconciliation – therefore the cost related to it – might be completely removed."

Fractional ownership

This is one of the often mentioned benefits of security tokenisation although it is nothing fundamentally new as securitisation has been turning illiquid assets into tradeable, fungible instruments for centuries. What is new is that the much reduced costs associated with the securitisation process means a much wider range of assets will be tokenised – real estate; precious metals; art; fine wine; carbon credits, brand names; copyright to works of authorship (eg music) – that can and will be owned fractionally by investors. Markets for these typically illiquid assets could potentially become highly liquid.

What does this mean for investors?

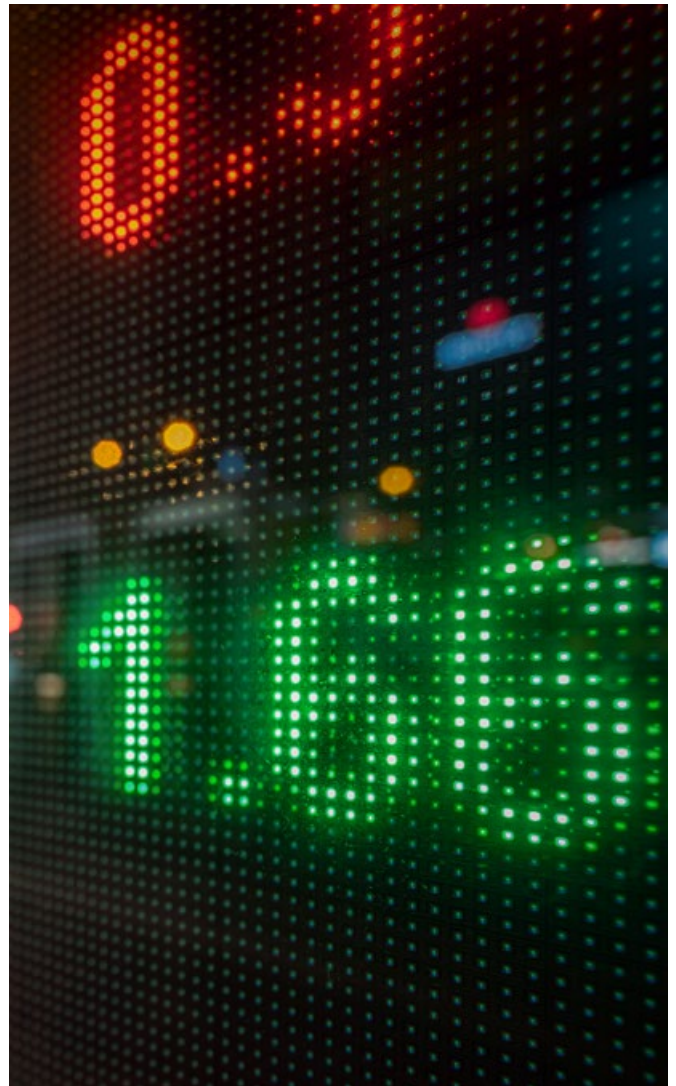
More private assets owned

Assets that are tokenised become easy to own and trade, and therefore they will be owned and traded. In the new tokenised economy, we expect investors to greatly expand their ownership of assets that are currently unlisted and illiquid. What is currently under the private market umbrella is likely to grow its share significantly in investors' aggregate portfolio. Fees associated with managing those assets will likely come down, possibly substantially. All investors, including retail and DC investors, could easily own and trade a fraction of any number of currently illiquid assets.

One of the foundational pillars of the Capital Asset Pricing Model is the existence of an all-inclusive market portfolio. In 1977, Richard Roll made a famous [critique](#) that the market portfolio should include every single possible asset, but the returns on most of the possible investment opportunities are unobservable. That was a perfectly reasonable critique in 1977. How reasonable is it going to be in say 2027?

More precise risk management

More precise risk-taking and hedging are made possible by programmable securities. New types of securities could emerge as risk / return characteristics can be more precisely defined. ETF markets may see further innovations and become more cost-efficient due to disintermediation. When we add programmable securities with machine learning and artificial intelligence, we are really just limited by our own imagination as to what the future capital market might look like. Theoretically investors could hold the precise combination of risks they wish to⁷.



"One of the foundational pillars of the Capital Asset Pricing Model is the existence of an all-inclusive market portfolio. In 1977, Richard Roll made a famous critique that the market portfolio should include every single possible asset..."

⁷ This would be the actualisation of the complete set of securities postulated by the [Arrow-Debreu model](#) (1954)

This is a possible scenario; not a prediction

Blockchain technology has the potential to change the world.

But there is still a huge gap between that potential and the reality. While some of us are thrilled about this potential tokenisation revolution, we shouldn't lose sight of the fact that there are some enormous [challenges](#) to overcome.

One challenge is to ensure that the digital token stays linked to the real-world asset. The system might indisputably verify that you own a piece of gold bar but who bears the risk when the gold bar is stolen?

Security tokens are treated as securities and therefore subject to security regulations. Blockchain as an internet-based technology is global by default. Dealing with global securities law alignment (eg a Chinese seller and American buyer) is no easy task. In general, many of the advantages of tokenisation can be undermined if there is a lack of accommodating legal and regulatory backdrop.

Because of the proof of work required, it takes time to add a new block to the blockchain (10 minutes in the case of bitcoin). At that rate, it's [estimated](#) that the blockchain network can only manage seven transactions per second (TPS). Credit card brand Visa, for context, can process 24,000 TPS.

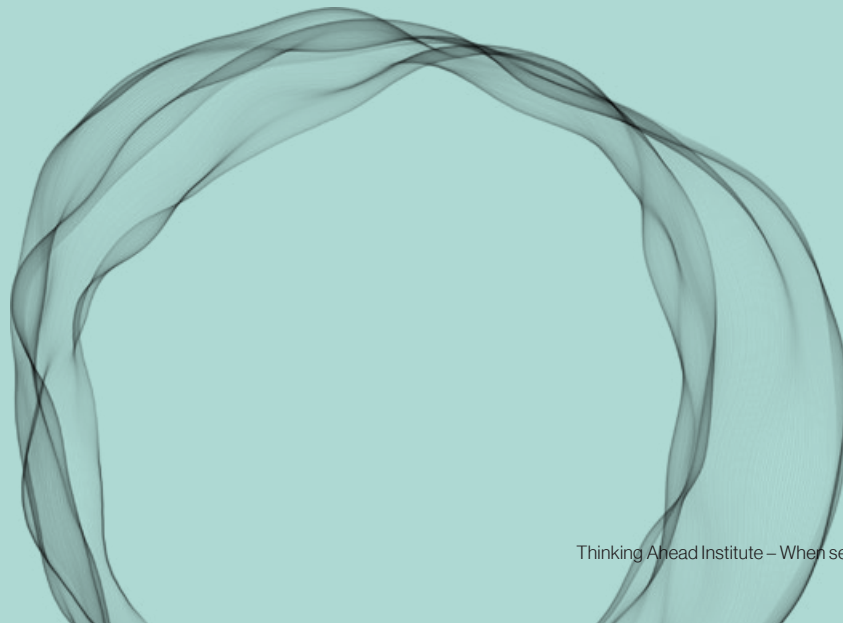
More importantly, blockchain doesn't eliminate the need for trust. It just shifts its source from institutions to technology. To what extent is the society going to be comfortable with, or resistant to, this grand shift?

Is this utopian state of a tokenised economy likely to become a reality anytime soon? No. We think it is a tail scenario – hard-to-quantify but categorically very low probability given where we are and what we know today. But its impacts would be so enormous and revolutionary that we shouldn't ignore it.

Is blockchain going to bring more tokenised assets to the investment opportunity set? Yes, very likely, given that it is already happening. Stock exchanges like [Nasdaq](#) and [Swiss SIX Exchanges](#) have already started supporting the trading of digital tokens.

What is the tangible action for investors? We think it is worth starting to establish an information channel to monitor the space. So when attractive tokenized assets are created and accessible, they can be included in the mix of investable assets. Investors might also want to debate whether blockchain technology itself presents an investment opportunity and whether they can build successful investment strategies via those companies that look to monetise it. For those who have high conviction on the tokenised economy vision, it is also worth debating how to position their portfolios for such a disruption – there will be winners and losers.

No one knows if blockchain will be the next world-changing technology. But we do know that the speed of technological adoption is [rising rapidly](#). If the tokenised economy is indeed coming, it might arrive a lot sooner than you expect.



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Limitations of reliance – Thinking Ahead Group 2.0

This document has been written by members of the Thinking Ahead Group 2.0. Their role is to identify and develop new investment thinking and opportunities not naturally covered under mainstream research. They seek to encourage new ways of seeing the investment environment in ways that add value to our clients.

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The Thinking Ahead Institute

About the Thinking Ahead Institute

Mobilising capital for a sustainable future.

Since establishment in 2015, over 60 investment organisations have collaborated to bring this vision to light through designing fit-for-purpose investment strategies; better organisational effectiveness and strengthened stakeholder legitimacy.

Led by Tim Hodgson, Roger Urwin and Marisa Hall, our global not-for-profit research and innovation hub connects our members from around the investment world to harnesses the power of collective thought leadership and bring these ideas to life. Our members influence the research agenda and participate in working groups and events and have access to proprietary tools and a unique research library. They have also helped form our top ten investment beliefs.

1. Economies and markets are complex adaptive systems, requiring different thinking
2. Sustainable value creation starts with purpose. It can, and should, be measured and communicated. Integrated Reporting is a transparent and effective method
3. A new interpretation of sustainability is needed to advance a better social purpose in the investment industry
4. Long-horizon investors have a significant advantage because there is a quantifiable premium
5. Climate change will significantly affect investments
6. The asset classes of tomorrow will be substantially different
7. The returns you need will only come from a system that works
8. Pensions are worth more in a world worth spending them in
9. Culture is a unique ingredient in gaining a competitive advantage and effecting change
10. Collective decision-making is a skill that can be developed.

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We seek collaboration with like-minded organisations to achieve our vision, so for more information about us please contact:

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About the Thinking Ahead Institute

The Thinking Ahead Institute seeks to bring together the world's major investment organisations to mobilise capital for a sustainable future. Arising out of Willis Towers Watson's Thinking Ahead Group, formed in 2002 by Tim Hodgson and Roger Urwin, the Institute was established in January 2015 as a global not-for-profit group comprising asset owners, investment managers and service providers. Currently it has over 40 members with combined responsibility for over US\$12trn.

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