Blockchain and the reshaping of investment management

World economy: cyclical divergence and structural fragmentation are major risks, but not central scenarios
Long-dated inflation-linked leased real estate
Standing out from the crowd in Asia-Pacific
The use of equity factor investing for portfolio insurance
Advancing the frontiers of factor investing

Risk & Reward
Research and investment strategies

This magazine is not intended for members of the public or retail investors. Full audience information is available inside the front cover.
Global editorial committee
Chair: Dr. Henning Stein and Marlene Konecny, Jutta Becker, Ann Ginsburg, Kristina Hooper, Dr. Harald Lohre, Lisa Neil, Paula Niall, Dr. Bernhard Pfaff, Stephen Smith.
As part of our continuing focus on disruptive trends and technologies, the feature article in this edition of Risk & Reward deals once again with blockchain technology. Last spring, we explored the potential benefits – and risks – of blockchain-based cryptoassets such as Bitcoin. In this issue, we examine the wider implications of blockchain for capital markets and the asset management industry in particular.

While blockchain has not yet been widely incorporated into investment management systems and processes, there is a clear trend in this direction, and our own experience leads us to believe that it will grow to play a critical role in the future of asset management. Our lead article and the related interviews with top industry and academic experts highlight four areas where we anticipate that blockchain will drive profound change: settlement and clearing, the use of “smart” contracts to facilitate transactions, transmission of index data and the “tokenization” of assets. Asset managers must be prepared to deal with advances in these areas as well as the new risks they introduce.

We also hear from Invesco’s Global Market Strategist Office, with views on the implications for global investors of increasing cyclical divergence and structural fragmentation due in part to elevated geopolitical risk. Next, we explore how the long-duration inflation-linked cash flows provided by long-leased real estate, as well as the income and lower volatility this sector has offered, may make it a good way to address pension fund and insurer liabilities. We also speak with my distinguished colleague Anna Tong, who shares some of the insights and experiences she has gained over more than three decades in the investment management industry in the Asia-Pacific region.

Of course, no edition of Risk & Reward would be complete without some in-depth research into factor investment, an area where Invesco has been an innovator for more than 30 years. Our research with Lancaster University, one of the leading institutions in the field of financial analysis, indicates that pairing low-volatility underlying equity holdings with a dynamic portfolio insurance element may position investors to benefit potentially from equity returns while limiting downside risk. Finally, our report on the Frontiers of Factor Investing Conference in Lancaster addresses important current topics such as the merits of integrated multi-factor strategies versus mixing single factors and the effects of transaction costs and trading strategies in factor portfolios.

We hope you enjoy this latest issue of Risk & Reward.

Best regards,

Marty Flanagan
President and CEO of Invesco Ltd.
Blockchain and the reshaping of investment management
Dave Dowsett and Heather Wied

Blockchain is attracting significant attention as a viable standalone infrastructure for executing and recording transactions. We examine how investment management could be transformed by the widespread adoption of smart contracts, digital identities and other innovative blockchain components.

“A blockchain isn’t a truth machine”
Interview with Bryan Zhang, Cambridge Judge Business School

Bryan Zhang, co-founder and Executive Director of the Cambridge Centre for Alternative Finance (CCAF) spoke about two of CCAF’s most recent publications – the inaugural Global Blockchain Benchmarking Study and Distributed Ledger Systems: A Conceptual Framework.

“I think a mindset shift has to occur for some investment managers”
Interview with Sandy Kaul, Global Head of Business Advisory Services, Citi

Read what Sandy Kaul has to say about Citi’s recent study Industry Revolution – Investment Management in 2033, which sheds light on how a combination of big data, artificial intelligence and distributed ledger technology could transform the investment management industry.
World economy: cyclical divergence and structural fragmentation are major risks, but not central scenarios
Arnab Das
Cyclical growth divergence and structural economic and financial fragmentation are driving up asset-price and FX volatility. We analyze the current state of the world economy with a particular focus on the emerging markets.

Long-dated inflation-linked leased real estate
Chris Brassington and Matthew Hall
With changing interest rates, low yields and an aging population, the need for pension funds and insurance companies to find inflation-linked approaches and match liabilities is increasingly prevalent. We believe that long-leased real estate offers a potential solution.

Standing out from the crowd in Asia-Pacific
A conversation with Anna Tong
Over the past three decades, Asia-Pacific has played host to several economic booms and busts, and Invesco’s Anna Tong has experienced all of them. Read what she has to say.

The use of equity factor investing for portfolio insurance
Dr Harald Lohre, David Happsberger and Alexandar Cherkezov
Portfolio insurance techniques such as constant proportion portfolio insurance (CPPI) are commonly used to protect investments. We examine the interaction of CPPI with different equity underlyings.

Advancing the frontiers of factor investing
Marie Brière, Michael Fraikin, Raman Uppal and Daniel Gimouridis
Invesco Quantitative Strategies co-hosted the Frontiers of Factor Investing Conference in Lancaster at the end of April 2018. We have summarized the main takeaways from each of the four keynote speakers.
In brief
In this article, we cover various aspects of the blockchain phenomenon, with a focus on capital markets. Our central argument is that the blockchain will transform the capital markets by speeding up settlement and clearing, enabling “smart contracts”, making data delivery faster and encouraging disintermediation. We also cover possible threats to this development, especially regulatory issues, and discuss potential risks arising from the new technology.
Blockchain initially gained prominence as the revolutionary technology underpinning high-profile cryptotokens like Bitcoin. Now it is attracting significant attention on its own as a viable stand-alone infrastructure for executing and recording transactions. In this article we examine how the investment management industry could be transformed by the widespread adoption of smart contracts, digital identities and other innovative blockchain components.

Throughout history, one sees evidence of technology's capacity to reshape markets and ways of doing business. Today's internet serves as a digital marketplace, a platform for economic activity and a storehouse for virtually all of human knowledge. Facebook and other social networks have redefined human interaction, recast the idea of “connectedness” and altered how people share information. The smartphone put a staggering array of information and direct access to the social networks at the fingertips of billions of people. In short, each of these innovations has fundamentally affected the structure of social and economic systems by altering how we exchange information, goods and services. What's more, none of these technologies existed 25 years ago.

So where will the next new technological paradigm emerge? We believe that blockchain will have a transformative effect on the capital markets. Blockchain offers the possibility of drastically redefining transactions, the structures and protocols of which remain largely inefficient. Professor Bryan Zhang, co-founder of the Cambridge Centre for Alternative Finance (CCAF) observes that: “Blockchain is beginning to rewire our digital infrastructure and challenge our thinking on how data, information, assets and even governance can be organized and reimagined.” Earlier this year, in a Risk & Reward article exploring the various aspects of cryptotokens, we provided a broad overview of blockchain’s capabilities. Here, we will concentrate more on blockchain’s likely impact on investment management, examining in more detail some of its applications in this space. We cover both those that are already being adopted and those that - for now at least - are somewhat further from implementation. Lastly, we survey not only the opportunities that the blockchain phenomenon presents but also the hurdles that must be overcome if its promise is to be fully realized.

Understanding blockchain technology
Simply defined, blockchain is a decentralized, distributed digital ledger system that records transactions in a secure, verifiable and permanent way. This technology holds the potential to radically transform a wide variety of practices and products throughout the global economy due to the three overarching benefits that it can offer: reduced costs, enhanced risk mitigation and greater efficiency. Astute organizations are already identifying which elements of their business models could be enhanced, or disrupted, by blockchain. According to Deloitte’s 2018 Global Blockchain Survey of more than 1,000 global executives, 39% of respondents indicated that their organizations will invest USD 5 million or more in blockchain technology within the coming year. Perhaps more strikingly, only 5% reported that no investment in blockchain is planned. As demonstrated in figure 1 below, the banking and finance sector has been leading the way in the development of blockchain applications.

Figure 1
Finance leads the blockchain revolution
According to the Cambridge Centre for Alternative Finance’s inaugural Global Blockchain Benchmarking Study, the banking and finance industry is by far the largest user of blockchain technology.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banking &amp; Finance</td>
<td>30%</td>
</tr>
<tr>
<td>Government &amp; Public Goods</td>
<td>13%</td>
</tr>
<tr>
<td>Insurance</td>
<td>12%</td>
</tr>
<tr>
<td>Healthcare</td>
<td>8%</td>
</tr>
<tr>
<td>Media, Entertainment &amp; Gaming</td>
<td>8%</td>
</tr>
<tr>
<td>Generic</td>
<td>6%</td>
</tr>
<tr>
<td>Technology Services</td>
<td>6%</td>
</tr>
<tr>
<td>Professional Services</td>
<td>4%</td>
</tr>
<tr>
<td>Energy &amp; Utilities</td>
<td>3%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>3%</td>
</tr>
<tr>
<td>Others</td>
<td>7%</td>
</tr>
</tbody>
</table>

Source: Cambridge Centre for Alternative Finance: Global Blockchain Benchmarking Study, 2017; based on 132 use cases frequently mentioned in public discussions, reports and press releases.
The blockchain concept first came to light in Bitcoin: A Peer-to-Peer Electronic Cash System, a white paper published in 2008 by the mysterious figure known as Satoshi Nakamoto, where it was presented as the basis for a public ledger system designed to track transactions in Bitcoin. Its importance lay in its unique approach to the problem of “double-spending” – the scope for a digital currency to be duplicated or falsified and thus spent more than once.

The notion of a distributed database or ledger is fundamental to addressing this issue. In a traditional centralized system, a single participant stores and maintains all the data. A decentralized system eliminates the need for a hub-and-spoke-style setup, allowing data to be shared on a peer-to-peer basis. A distributed system takes this a step further by allowing every participant to host a copy of the ledger and independently verify the integrity of the data at any time (see figure 2).

This “data democracy” requires a consensus mechanism to approve changes to the ledger. The underlying assumption is that the system operates within an adversarial environment and that malicious actors might supply it with incorrect information. Following a shared set of rules, every participant within a blockchain system validates all changes (new transactions) and recreates the ledger independently. Transactions are accepted only after validation by a majority of participants, which mitigates the risk of a single point of failure in the system.

Transactions are batched into blocks, which are cryptographically linked to produce a chain that contains the ledger’s entire history. The result is what is known as an “append-only” database, which effectively prevents any deletion or alteration of data entered into earlier blocks. It is the append-only nature of a blockchain ledger that distinguishes it from other types of distributed databases.

Trading, settlement and clearing

A snapshot of the history and likely future of trade settlement affords a striking insight into blockchain’s potential for “creative destruction”. It also underscores the critical point that blockchain opens the door to doing things not just better – but altogether differently.

Going nearly as far back as their inception, most stock exchanges favoured a period of 14 days for the completion of trades. In the 1970s and 1980s, this was cut to five and then three days with the advent of new technology. Today, the standard settlement cycle for many investment vehicles is two days. However, by limiting the need for intermediaries – central counterparty clearing and central securities depositories foremost among them – blockchain enables near-real-time settlement, making T+0 a reality.

Invesco has already participated in post-trade settlement clearing experiments that validated the concept using gold bullion and equities. The company we partnered with for this proof-of-concept work secured USD 65mn in series B funding earlier in 2018. We continue to study and test the best way to scale and implement blockchain for settlement purposes, actively preparing for potential future developments in this area. In addition to minimizing risk exposure, shorter settlement times create more liquidity for asset managers, freeing funds to be

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Figure 2

Three network paradigms

Blockchain technology uses a distributed network – in which every participant holds and can independently verify all data. This concept is different from both the traditional hub-and-spoke approach and the decentralized methodology used for more simplistic peer-to-peer networks.

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reinvested in shorter amounts of time. Kevin Cronin, Global Head of Trading for Invesco, observes: “We see great potential for blockchain in the post-trade settlement arena. While the promise of near real-time settlement is exciting, we believe we are approaching this emerging technology with the right amount of diligence and caution. We are most excited about the liquidity for reinvestment that near real-time settlement affords. Markets move on their own time, and the difference between days versus minutes can have real impact on trading strategies.”

Many clearing houses and depositories are also conducting their own blockchain proofs-of-concept, developing relationships with (or buying) blockchain startups and evaluating how the technology could impact their business models and operations. Breaking down the functions of central counterparty clearing performs helps to demonstrate blockchain’s potential. Broadly speaking, central counterparty clearing manages the operational tasks of settlement to reduce risk and maintain market integrity. The central counterparty monitors the individual credit risks of individual trade participants, addresses defaults and it oversees systemic risks in the market. Blockchain can streamline these management, monitoring and oversight functions through protocols known as “smart contracts”, which we discuss further in the next section. The reduction of manual tasks and the operational efficiencies gained from the execution of smart contracts allows financial market participants to reexamine and reallocate scarce resources.

Work towards using blockchain to increase the efficiency of capital markets has been underway for well over two years. For example, in response to regulators’ criticisms of settlement delays, a well-respected financial data vendor recently unveiled blockchain-based software designed to affect “seamless integration and straight-through processing” in the trading of syndicated loans, which have traditionally had settlement times far in excess of the T+0 potential of blockchain.5

Other proof-of-concept projects are analyzing how blockchain can expedite settlement of cross-border payments. For example, XRP, the architecture behind cryptocurrency Ripple, has been billed as, “built for enterprise use” and able to offer “a reliable, on-demand option to source liquidity” – and many companies are currently testing its viability.

Smart contracts and digital identities
In late 2013, teenage programmer Vitalik Buterin drew public attention to the idea of “smart contracts” in a white paper introducing Ethereum. The benefit of Ethereum, his own blockchain platform. Smart contracts are code that automatically executes a transaction or other protocol when triggered by an event or an absence of sufficient inputs. For example, one can specify that funds cannot be transferred until required information is provided, or that a payment cannot be made unless an asset has been transferred within an allocated amount of time. The benefit of smart contracts is that they are governed by programmatic rules and their execution is recorded on the blockchain, providing a transparent and auditable accounting trail.

Although pioneering computer scientist Nick Szabo coined the term “smart contract” almost a decade previously, the 2015 debut of Ethereum gave the concept greater prominence by creating a decentralized platform that replaced Bitcoin’s more restrictive scripted programming language with one that developers could use to write their own smart contracts or “autonomous agents”. Today, fulfilling Buterin’s prophecy that they would become an essential component of “systems... that we have not yet imagined,” smart contracts are firmly at the heart of blockchain’s ever-widening appeal: two thirds of CCAF’s Global Blockchain Benchmarking Study respondents – made up of blockchain startups, established corporations, central banks and various public sector institutions – indicated that their solutions included some sort of fully functional smart-contract capability.

With consumer preferences in investment management lowering barriers to entry and fees, smart contracts can offer clear benefits. They arguably improve almost any situation that necessitates a contractual arrangement to establish trust and security. This is why financial institutions of all kinds are investigating

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Data as of September 2017. ** The State of Blockchain Q2 2018 report summarizes key happenings in the world of blockchain up to date and illustrates the rapid pace at which the blockchain startup environment is changing. (https://www.coindesk.com/research/state-of-blockchain-q2-2018/?slide=63).
how best to use them in an array of settings where counterparty risk is a feature. Given their potential to eradicate delays, minimize inefficiencies and encourage transparency, it is easy to see how they might help to facilitate, for example, the instant calculation and payment of fund managers’ performance fees – as well as upending the settlement and clearance procedures already discussed. Invesco has experimented with smart contracts for the accounting of client fees in order to digitize the client lifecycle. The objective is to transform a complex process into a more transparent and verifiable record.

Derivatives represent another area where longstanding inefficiencies could be mitigated through smart contracts. Here, the manual processing of trades can be extremely complex and time-consuming, which tends to be reflected in the fees charged by brokers and intermediaries. Blockchain’s advocates say that it could bypass many, if not all, of these problems – although the International Swaps and Derivatives Association (ISDA) last year published a report claiming that smart contracts are not yet sufficiently "smart" to deal with legal clauses that may be subjective or in need of interpretation.

"Know your customer" (KYC) and "anti-money laundering" (AML) requirements constitute a particularly difficult challenge within financial services. At present, with regulatory obligations often taking weeks to satisfy, the onboarding and monitoring of clients is time-intensive and expensive. Blockchain startups specializing in the "tokenized" securities discussed below are currently paving the way for improvements by embedding KYC and AML information requirements into smart contracts. By granting real-time access to any changes in a client’s status, a smart contract-enabled distributed ledger could automate the onerous task of detecting and reporting fraud and enable institutions, regulators and other relevant agencies to react immediately to suspicious behavior.

Fund data and trading
Blockchain is also driving moves to revolutionize how investment managers process mutual fund index data. The goal is to use distributed ledgers to underpin a single source of real-time, immutable data from a range of providers.

Since the distribution of index data usually relies on a variety of parties and transmission channels, disintermediation is once again key. Tests have shown that blockchain increases the speed of data delivery and can cut out the errors that can occur when information – for instance, the names and share prices of companies – are inputted manually. Major institutional investors are actively experimenting in this space. Invesco participates in several blockchain consortiums, among them an index data consortium that includes major industry participants, providers of institutional blockchain solutions and the Center for Research in Security Prices – part of the University of Chicago’s Booth School of Business.

Yet this is in many ways only a first step. Attention is already turning to the question of how blockchain could impact index funds more generally, and it is here that some of the biggest changes could be witnessed.

Exchange-traded funds (ETFs), which were first developed in the early 1990s, have become an acknowledged engine of both disintermediation and disruption. Their ability to bypass third parties, and thus lower costs, has proven key to the sector’s massive growth. However, it has been suggested that a new generation of ETFs, dubbed blockchain-traded funds or BTFs, might further elevate disintermediation – and perhaps disruption.

BTFs could allow trading to occur without the involvement of custodians, exchanges, banks and other trusted third parties traditionally pivotal to the process, thus opening up a 24x7 trading cycle. This would further reduce the costs associated with “middlemen” and reconciliation. Proponents say that such a shift could be achieved if indices were “tokenized” – a potentially significant development that we will address next.

“Smart contracts and the “oracle” problem
According to skeptics, smart contracts – at least in their current guise – are not really very smart. This criticism is based on the premise that smart contracts cannot answer questions about the world beyond their blockchain, which means they must rely on outside help.

Help usually comes courtesy of what are known as “oracles”. The name is well chosen: like those of Greek mythology, the oracles that inform smart contracts serve as a connection between two realms. As a provider of data, an oracle effectively determines what a smart contract sees – and, by extension, what a smart contract does.

This gives rise to a paradox: the distributed nature of blockchains is intended to eliminate the threat of a single point of failure within a network, yet oracles usually operate on a centralized basis and therefore reintroduce the very same risk. So, the price of connecting with the outside world is to sacrifice the decentralization benefits that are fundamental to blockchain’s appeal.

One of the most promising proposed solutions to this dilemma is to create an oracle that is itself decentralized, by making several oracles retrieve data from multiple sources and then aggregating the results. Any contributing oracle that deviates significantly from the mean would be excluded from the aggregation and imbued with less influence in the future. Other potential responses, such as subjecting an oracle service provider to due diligence, would substantially increase transaction costs – again undermining a foundational reason for using blockchain in the first place. Many supporters of blockchain are not troubled by the oracle problem, arguing that blockchain protocols can naturally defend against bad oracles by identifying and recording their activity. Moreover, the oracle problem can be further mitigated through the use of private or permissioned blockchains, as opposed to public blockchains.

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In essence, tokenization represents a new take on an old idea: securitization. “Illiquid assets, such as real estate, can offer a great opportunity for tokenization,” says Colin Fitzgerald. “This is because tokenization creates liquidity and, potentially, a secondary market for such assets. Also, there aren’t many existing investment vehicles that enable the average investor to invest directly in asset classes like real estate.”

Sandy Kaul, Global Head of Business Advisory Services at Citi, argues that investment managers must take note of these novel ways of considering “ownership” of real assets and seize the chance to adjust and adapt. “The impact on business models could be significant,” she says. “There could be an arms race over deal sourcing and a need to partner with a new set of specialized players – anything from market-makers and administrators to realtors and art curators. There’s no doubt that distributed ledgers and smart contracts, along with big data and artificial intelligence, offer the potential to transform the industry.”

Risks, regulation and the road ahead
Blockchain offers no exception to the rule that new technologies involve some degree of risk and disruption. The road ahead is unlikely to be smooth, and the consequences will not be uniformly positive.

Regulation may pose the greatest threat to blockchain’s widespread adoption in the short term. This was certainly the consensus among CCAF’s Global Blockchain Benchmarking Study respondents, who deemed extant legal frameworks “unclear”. The fact that distributed ledgers, by their very nature, have neither a specific location nor a centralized source of administration raises substantive hurdles in terms of jurisdiction and applicable law. Obtaining a framework that recognizes blockchains as genuinely tamper-proof is likely to prove a contentious affair, as is the task of persuading multiple agencies to reach consensus on global standards: at present, for instance, the US Securities and Exchange Commission and Commodity Futures Trading Commission do not even...
agree on what constitutes final settlement of a transaction. How regulators will eventually come to view the likes of cryptocurrencies and tokenized assets is an open question, as is the issue of how to reconcile supposedly immutable public ledgers with legislation such as the EU's Global Data Privacy Regulation (GDPR), which grants individuals the "right to be forgotten".

With governments and investors increasingly focusing on environmental considerations, it may also be hard to disregard the environmental effects of the intense computational power needed to confirm blockchain transactions at scale for mining. At least in countries such as China and Russia, the sheer size of "mining farms" is an emerging cause for concern. According to data from Digiconomist, an online platform dedicated to the analysis and discussion of cryptocurrencies, a single Bitcoin transaction uses enough energy to power an average US household for eight days. It has been estimated that Bitcoin has the same environmental impact annually as more than 2.38 million cars.13

Finally – and inevitably – disintermediation driven by the adoption of blockchain is bound to be felt in the jobs market. While it should not be forgotten that new roles – most obviously in the fields of computer security and encryption – will be created, there will undoubtedly be casualties. Just as driverless cars are poised to remodel the labour landscape in the transport industry, so too are positions revolving around reconciliation, authentication and the processing of mountains of paperwork unlikely to escape blockchain's march. What remains to be seen is whether those affected will be rendered as superfluous as buggy whip manufacturers, or whether they might be able to develop new skills aligned with the blockchain business model. For example, in light of the aforementioned regulatory issues, it could be that not everything is left to machines: auditors and agents might still need to scrutinize the actual contents of a distributed ledger, even if computer programs handle the order in which entries are processed.

The history of innovation has repeatedly demonstrated that wheels are not easily stopped once they are in motion – and often with good reason. Radical advances invariably bring about winners and losers, and the cost of ignoring novel technologies is frequently higher than the cost of embracing them. All things considered, this is likely to be the case when it comes to blockchain. The genie is well and truly out of the bottle, and it seems foolish to deny or overlook the likely long-term impact – even if nobody can presently say with absolute confidence precisely what that impact might be.

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**The “leapfrogging” phenomenon**

A curious feature of modern-day innovation is that countries at or near the cutting edge of technology are not always the swiftest in adopting a novel concept. Consider, for example, India's recent move towards smartphone technology.

According to a Credit Suisse analysis, India's market for mobile phone payments is the fastest-growing in the world and could increase five-fold over the next five years – reaching approximately USD 1 trillion in 2023. Although demonetization policies and the government's Digital India Initiative have undoubtedly fuelled this shift, the fact is that India – unlike more developed nations – has not been held back by legacy issues: in effect, it is in the process of "leapfrogging" an entire generation of technology.

By bringing about further disintermediation, blockchain is likely to further accelerate this process. There is little reason for a country like India to invest in systems such as ATMs, or even contactless credit cards, when it could be easier and more cost-effective to adopt a far faster and more seamless method of transacting. Since any street merchant with a QR code and any consumer with a smartphone can already engage in digital payments, the future is likely to lie in embracing the state of the art rather than in regressing to technologies that are even now being superseded.

The Blockchain Council, which seeks to, "raise awareness among businesses, enterprises, developers and society by educating them in the blockchain space," supports this view. It argues: "The lack of existing infrastructure in developing countries is a good thing when it comes to further development. It allows developing countries to skip a few iterations of technological progress, to jump to the most advanced iteration directly. Developing countries like India, Kenya and South Africa already have a massive network of active smartphone users, thanks to the low-cost data services in these countries... and this provides a unique opportunity for blockchains."

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* Digital Payments: Trends, Issues and Opportunities, National Institution for Transforming India (NITI) Aayog.
The value of investments and any income will fluctuate (this may partly be the result of exchange rate fluctuations) and investors may not get back the full amount invested.
"A blockchain isn't a truth machine"

Interview with Bryan Zhang

As a Co-founder and Executive Director of the Cambridge Centre for Alternative Finance (CCAF), Bryan Zhang has co-authored some of the most influential national and international reports on financial innovation. We spoke with him about two of CCAF’s most recent publications – the Inaugural Global Blockchain Benchmarking Study and Distributed Ledger Systems: A Conceptual Framework.

Risk and Reward
What was the thinking behind the release of the first Global Blockchain Benchmarking Study? Did you feel it was time to place the emerging phenomenon of Distributed Ledger Technology (DLT) in some sort of context?

Bryan Zhang
We became aware of the increasing scale of blockchain activities - in terms of general interest, service offerings, funding and many other factors - but couldn't find hard empirical data on this emerging landscape. Given our expertise in conducting global benchmarking studies in different fields of alternative finance, it seemed only natural to broaden our research scope and embark on a new study series exclusively focused on blockchain technology. This is also a testament to the growing recognition of blockchain's transformative potential, though certainly there's a real need to strike a balance against the hype and hyperbole that often accompany new technologies.

Risk and Reward
CCAF’s research has made a point of debunking some of the “myths” that surround DLT. Could you tell us more about those and why it’s important to recognise them for what they are?

Bryan Zhang
There's tremendous hype surrounding blockchain and DLT: one can observe a tendency to overstate the actual capabilities while ignoring or downplaying inherent limitations. This then leads to unrealistic expectations as to what the technology can actually deliver.

One of the most common blockchain myths is that a blockchain is “trustless”. The fact is that you always need to trust someone or something in the end - at the very least the code you’re running. There's also no absolute immutability, at best, you can have probabilistic immutability.

A blockchain isn't magically more secure than other databases. In some cases, due to its distributed nature, it might even be less secure when it comes to data breaches. When we talk about “security” in the blockchain context, we primarily mean the difficulty of changing past records or transaction history. So it's not true to say a blockchain is 100% secure.

A blockchain isn't a “truth machine” either - it doesn't make data magically true. It faces the same issues as every other recordkeeping system when it comes to the veracity and accuracy of the data that it records. The old principle “garbage in, garbage out” (GIGO) still applies.

Finally, there's the myth of enforceability. A blockchain is a mere recordkeeping system, just like any other database. When it comes to tracking external objects and events, it can't effectively or automatically enforce decisions that relate to external occurrences. External agents are still required to enforce decisions in the “real world”.

So the main issue really is that blockchains are being sold as a silver bullet and magic cure. We need to have a balanced and objective discussion about the advantages and downsides of these systems to cut through the hype. Our recently published study, Distributed Ledger Systems: A Conceptual Framework, led by our Lead in cryptocurrency and blockchain, Michel Rauchs, kicks off that discussion and highlights some of the key misunderstandings.

Risk & Reward
The Global Blockchain Benchmarking Study suggests DLT is still lacking maturity and points out that the landscape remains fragmented. How can we most effectively move on from here?

Bryan Zhang
One of the key issues plaguing the ecosystem is the lack of rigorous terminology. A “blockchain” today can mean anything from a simple data structure to a complex, permissionless socioeconomic system. As a result, many projects are sold as “blockchain-based” but rarely fit the definition.

For this reason, we've set out to create a unified terminology and provide a formal definition of “DLT systems". In addition, we propose a conceptual framework that breaks down a system into individual elements whose interactions can be studied in three layers - protocol, network and data.

When it comes to closed, private permissioned blockchains that operate in an enterprise context, we currently observe only very few networks that have been deployed and are operating in production, while thousands of firms are testing their own private networks in proofs-of-concept or trials/pilots. As a result, there's been a re-emergence of closed data silos that are often non-interoperable.
However, to leverage blockchain's full potential, different entities need to join forces and operate on the same shared blockchain network. We expect to see the emergence of large-scale networks - application-specific, industry-specific and geography-specific - in the coming years, although we're hesitant to provide a clear timeline. After all, it takes longer to deploy new backbone infrastructure for entire industries than to launch a single application.

**Risk & Reward**

*Even if a meaningful degree of consensus and standardization is achieved, how significant are the regulatory and legal hurdles that DLT must overcome to truly enter the mainstream?*

**Bryan Zhang**

Our first *Global Blockchain Benchmarking Study*, published in September 2017, found that an unclear regulatory environment and legal risks are most often mentioned as the main barriers to broader adoption of blockchain technology. The reasons are manifold, as are the open questions.

For instance, will tokens issued on distributed ledgers be legally recognized as a rightful medium/form for traditional assets? How will blockchain forks - that is, a system splitting in two, with assets now existing on both sides - be handled from a legal perspective? Will participants running nodes be considered financial market infrastructure agents and be regulated as such? How can we balance the alleged immutability against the "right to be forgotten"?

I believe these questions will be addressed over time thanks to the practical considerations that will arise as more networks are deployed. It's also worth pointing out that most regulatory and legal hurdles apply to public, permissionless blockchains and their native cryptoassets rather than to enterprise blockchains.

**Risk & Reward**

*Despite the potential problems, the financial services sector has shown significant commitment to DLT in terms of both investment and R&D. To what extent do you think the sector could be transformed, and is it possible to say at this stage who the winners and losers from that transformation are likely to be?*

**Bryan Zhang**

Going back to the terminology problem, “true” blockchains or DLT systems with decentralized consensus and no authorities will likely play little to no role in a new financial market infrastructure. Instead, “potential” DLT systems - or “almost-blockchains” - with centralized elements of control have a good chance of becoming the backbone of a new financial market infrastructure.

It seems that blockchain's major contribution to date has been to act as a catalyst driving organizational change and putting long-overdue IT infrastructure upgrades back on the table. Many financial institutions are running legacy software stacks that date back to the 1970s and haven't seen a major upgrade for decades. The blockchain hype represents a good opportunity for rethinking inter-enterprise business processes and moving towards an increasingly shared infrastructure with common data formats and enhanced interoperability.
“I think a mindset shift has to occur for some investment managers.”

Interview with Sandy Kaul

Earlier this year, Citi published a report entitled *Industry Revolution – Investment Management in 2033*. Based on a global survey of fintech companies, venture capital firms, technology experts and investment managers, the findings shed light on how a combination of big data, artificial intelligence and distributed ledger technology (DLT) could transform the investment management industry. We spoke with the report's author, Sandy Kaul, about the potential opportunities and challenges that lie ahead.

**Risk & Reward**

At the start of your report, you outline four general phases of an industrial revolution: problems that the current status quo can't adequately address; signs that change is beginning to occur; new solutions based on signs of change; and opportunities that result from a new status quo. Where are we right now?

**Sandy Kaul**

I think we're still in the “signs of change” phase. We haven't started to see what the new structure will look like yet, but we're experimenting in a variety of areas. There are several drivers for what's happening.

First, there are a number of operational concerns that people have with the industry - areas where there's still a lot of inefficiency, manual processing and excessive exchange of papers. There are a lot of new asset classes, such as bank loans, peer-to-peer lending packages and trade financing, where there's a tremendous amount of manual work that has to go into making transactions occur. This is limiting the ability to grow in these asset classes, and it's happening at a time when there's a lot of money looking for opportunities on the sidelines in more illiquid markets or in areas outside public markets.

Second, the whole cryptocurrency space has revealed the desire of the average person to participate in markets that only institutional and qualified investors can usually access. So it's really a case of democratizing access to illiquid assets.

Finally, we're starting to see experimentation in how to break down physical assets. I think the model here will begin to shift and that we'll see more people offering tokens to own an asset rather than to merely access an asset. We're at a very early stage, but we could see this accelerate pretty quickly over the next 18 to 24 months.

**Risk & Reward**

Your report features some fascinating examples of DLT-based investment vehicles that reflect both a demographic shift towards retail capital and the issue of limited diversification in retail accounts. Could you tell us more about new models of asset ownership and breaking down investments into affordable units?

**Sandy Kaul**

Let's take two examples that highlight an interesting difference in approach: The first is BrickX, which purchases properties and separates the assets into fractional units, and the second is Maecenas, which aims to democratize access to fine art.

BrickX is based in Australia, which has a very tight real estate market. It has created a model whereby it purchases a residential property and breaks the equity portion of the purchase into 10,000 units, called “bricks”. It issues “bricks” through a primary offering on its platform and allows people to do secondary trading to create liquidity around their investments.

Many younger people who are having trouble getting on the property ladder are using “bricks” to hold their savings, because doing so gives them the additional benefit of property ownership. But these units are still traditional contracts - they're not tokenized. One “brick” is the lowest level and the lowest denomination of liquidity you can purchase.

Contrast this with Maecenas, which is looking to tokenize access to different pieces of art. When you purchase a portion of art from Maecenas, you may be buying just fractions of a share of a token. Whatever size purchase you make, you're going to have the option of selling pieces of that unit rather than having to exchange the entire unit. That's really the major difference between the two.
Is this what you mean when you talk about novel ways of viewing the concept of ownership?

Sandy Kaul

We think the Maecenas-type model offers superior liquidity, but we also think there may be one more evolution that has to happen to make these innovations truly effective trading instruments - and this involves using an instrument to create actual utility for the underlying investor.

We think people will increasingly want their investments to have longevity, appreciation and utility - to get cost savings from them, to get direct cash flow from them, to get personal enjoyment out of them and even to get a sense of doing good in the world. Their portfolios will have to be all-encompassing to meet all of these needs. And we think the tokens and smart contracts that DLT enables will provide a perfect vehicle for that, because you can build in the monitoring and triggering of individual rights without having to bring a lot of people into the process.

This all sounds like great news for investors, but where does it leave investment managers in terms of repositioning themselves and redefining their offerings?

Sandy Kaul

This is why I think it’s a very exciting time for investment managers. When I look at Invesco, for example, I see the company already moving in the right direction. Over the past several years, we've seen many of the leading investment managers starting to add alternative investment options to their portfolio building blocks, bringing in real estate ventures, infrastructure ventures and individuals with expertise in dealing with illiquid assets. So I think we’re already on the path to seeing large, well-diversified investment managers having the raw building blocks and talent to get into these new assets.

Is regulation the biggest challenge?

Sandy Kaul

I do think there is a point of reckoning. An investment manager might have chosen not to be engaged in any way with ETFs for many years, but eventually - as asset flows started to move in that direction - it became very difficult to be a diversified asset manager and not have ETFs as a product offering. So some investment managers could make the choice to step back and not pursue these new assets, but in the end they might have to concede that they missed the boat and need to go back and re-engineer their organizations - and their competitors will surely have a significant edge over them by that time.

You said at the start of this interview that we're still in the “signs of change” phase. Is it possible to predict when these new instruments might come to be seen as the norm?

Sandy Kaul

Well, when we wrote our report, we thought this could become the norm within around eight to 10 years. I may have to revise that forecast a little bit! I think we might see some broad, widespread trading of these instruments within the next three to five years. I've been surprised by the level of interest and uptake shown by some significant firms that are really looking at their own asset portfolios and thinking about how to use these new offerings to open up investment pools in novel ways.

Thank you.
World economy: cyclical divergence and structural fragmentation are major risks, but not central scenarios

By Arnab Das

In brief
The global economy seems to be shifting from synchronized recovery to cyclical divergence as political risks threaten economic and financial fragmentation along geopolitical fault lines. After assessing the current state of the world economy, we analyze in greater detail the possibility and implications of a US dollar/interest rate shock as well as the risks of greater protectionism, in each case from a historical perspective. Risks clearly exist, but an extremely negative outcome is not our central scenario. Nevertheless, the era of extremely low volatility and synchronous growth seems to be over. Investors thus might want to engage in tactically defensive relative value strategies.

The dual risks of cyclical growth divergence and structural economic and financial fragmentation are driving up asset-price and FX volatility. This combination points to greater dispersion of risk premia and returns across countries, asset classes and, indeed, instruments – varying according to exposure to these cyclical and structural risks. We analyze the current state of the world economy and its consequences for investors, with a particular focus on the emerging markets (EM).

We believe tensions in major bond and currency markets owe more to growth divergence than the US Federal Reserve’s (Fed) paradigm shift from extraordinary back to “normal” monetary policy alone. Fed policy normalization proceeded smoothly during 2017 when the world seemed to be experiencing a synchronized Goldilocks recovery with solid and widespread growth and low inflation. In 2018, however, risks of a de-synchronization across major economies have risen, with downside surprises in the rest of the world and potential upside in US growth and inflation.

US growth and inflation had remained in line with expectations until Q1 2018, when the risks began tilting to the upside due to tax reforms and fiscal stimulus unprecedented in a mid-/late-cycle economy with little, if any, output gap left. The other major economies have decelerated, led by Europe and China, causing global growth to de-synchronize noticeably, undermining the Goldilocks narrative of
2017 and the risk-on portfolio allocations built up for the first time since the taper tantrum.

In Q2 2018, these challenges have increased. Evidence has accumulated that the US will accelerate compared to other major economies, even as the eurozone recovers from its mid-cycle winter slowdown and with China still decelerating in response to tighter credit policy. The preliminary estimate of US Q2 GDP was 4.1%, in line with the consensus after major upward revisions. Invesco Fixed Income Nowcasts lie in the 3.6% range for Q2 (figure 1), but others - notably the Atlanta Fed - are in the high 4% range.

In any case, a US growth surge should support global growth and trade, offsetting deceleration in Europe and China, to the benefit of the emerging markets, as well as eurozone and Chinese exports. The caveats, however, are trade and technology tensions. US growth in the mid-3 to high-4% range with inflation near target would imply a 2018 US contribution to global nominal demand of some USD 1-1.4 trillion at an annual rate, up from a 2017 run rate of about USD 750 billion. By contrast: the 1% deceleration in real eurozone GDP, now being baked into consensus annual GDP forecasts, would subtract the equivalent of some USD 100-150 billion over the course of 2018 compared to 2017. Thus, accelerating US GDP adds more to global demand than the eurozone deceleration subtracts, but at the risk of greater cyclical global economic divergence, in turn raising the risk that the Fed will have to move further and faster than the European Central Bank (ECB), boosting the US dollar and tightening global and EM financial conditions.

Rising challenges
As long as the US doesn’t overheat, the global economy should tick over nicely. However, challenges have risen - not so much in global final demand as in global financial conditions, due to divergence and US dollar strength. This is caused by a combination of downside risks in the US and upside risks elsewhere. Mistimed US fiscal stimulus might boost inflation and prompt the Fed to be more hawkish, possibly bringing the next US recession forward even as global economic divergences widen along the way. Furthermore, monetary and fiscal policy responses may be constrained when the effects of the next downturn finally feed through. All of this is consistent with the flattening of the US yield curve despite surging growth, capacity constraints and increased bond supply from both increased US Treasury deficit funding and Fed balance sheet tapering.

As long as the US doesn’t overheat, the global economy should tick over nicely.

A sharp rise in the US fiscal deficit, already expected to reach 5-6% of GDP, in an economy operating at or above potential, could reduce headroom for countercyclical fiscal easing in the next recession. Moreover, the Fed will probably not be able to cut rates by the 500-600 bps that it makes during a typical recession before hitting the zero lower bound and could thus find itself forced to resume quantitative easing (QE). And recession may come forward despite the fiscal stimulus if trade/technology tensions sufficiently tighten financial conditions or dampen confidence and global corporate investment intentions.

Downside surprises outside the US have contributed to cyclical divergence in Q1 2018 and remain a risk in the face of trade/technology tensions and the after-effects of credit policy tightening in China, which are not being fully offset by the easing of monetary policy. The eurozone had been growing above trend through 2017, but in Q1 seemed to be decelerating (figure 2). The ECB has already responded with plans to delay rate hikes until well into 2019, rather than alter plans to bring its QE programme to closure by year-end. This should help mitigate eurozone growth and inflation downside risks, but delayed rate hikes are another euro-negative on top of US dollar-positive upside US risks. US dollar strength due to these macro divergences is, in our view, tightening financial conditions, especially in the emerging markets that rely heavily on dollar funding.
Eurozone deceleration could become more severe and recession risks rise in a full-blown trade war, a disruptive hard Brexit or a major political confrontation between populist governments and the EU - and the ECB's room for manoeuvre could be called into question. Policy and short rates remain negative, a factor that continues to pose problems for eurozone banks, also because their lending capacity has suffered as their equities have been hit by eurozone economic deceleration and trade tensions. The room for additional ECB QE already faced bond supply constraints under the ECB's capital key, which effectively limits bond buying across member states according to their eurozone GDP weights.

Nevertheless, we expect Europe to return to trend rather than continue slowing towards a recession, as some of the transitory effects of a severe winter, anti-reform strikes in France and the political season in Germany and Italy pass out of the data. European political risks remain high, but the challenges of dealing with populism around migration, refugees, fiscal and structural reforms today pale in comparison to the urgent, existential risks of the euro disintegration during the height of the eurozone crisis in 2010-12.

And China?
China's policy-led credit tightening, economic slowdown and rebalancing could also be affected. Efforts to rebalance from net trade and investment to a consumption and services-led economy - all while maintaining strong growth to reduce debt ratios - would be complicated by a trade war. Rising US trade barriers, short of outright restrictions on trade or widespread curbs on foreign investment inflows required to finance the trade deficit, would imply a stronger US dollar and a weaker renminbi. Indeed, the People's Bank of China may be accommodating pressure on the renminbi and other financial assets as trade tensions have risen.

Reminbi depreciation could be a natural market response to rising trade barriers, and implicit threats of devaluation could be a strategic response to trade/investment friction as part of bilateral US-China bargaining given the prominence of currency valuations in US assessment of unfair trade practices. A large devaluation would be negative for China, the US and the rest of the world - including the eurozone and the emerging markets; it would retard China's rebalancing towards domestic demand, which would benefit from the greater consumer purchasing power arising from a stronger real exchange rate. And devaluation would import inflation into China, which might prove useful for the debt ratios in the short term; but it would also export deflation and probably weaken global trade growth to the detriment of the eurozone and emerging markets, including China.

The economic cost of populism and protectionism
The already challenging combination of cyclical divergences and macro policy risks is compounded by geopolitical tail risks that could conceivably complicate both the cyclical and structural global growth outlook, especially for the emerging markets. The rise of populism, in the US and Europe in particular, threatens to disrupt the globalization of international trade, investment and migration that has spanned decades of Western economic liberalization, the opening up of China, India, the former Soviet bloc, Latin America and Africa. As if that were not enough, geopolitical tensions between the US and China stand in stark contrast to the peace dividend that began with the Soviet collapse. In a worst case scenario, the investment thesis for the emerging markets could be called into question.

We now turn to key risk scenarios and historical parallels to analyze the current situation in more depth - not because history repeats itself per se, but because it does often rhyme with patterns that can provide useful guideposts.

Geopolitical tensions between the US and China stand in stark contrast to the peace dividend that began with the Soviet collapse.

Risks and consequences of a US dollar shock, an interest rate shock or a joint US dollar/rate shock
We break down the combination of cyclical economic and structural geopolitical risks into a US dollar shock, an interest rate shock and a joint US dollar/rate shock in order to help assess how the world economy and emerging economies and asset classes are likely to fare in various scenarios.

- We would define a US dollar shock for these purposes as a scenario in which the US dollar rises largely because of downside risks and surprises in other major economies, without a US interest rate shock. Such a scenario would occur if the US economy were on track while the other countries surprised on the downside. US policy rates and yields would not rise, but global rates would fall, causing other currencies to depreciate relative to the US dollar. Global financial conditions would tighten meaningfully, but not severely. This scenario was arguably unfolding in Q1 2018.
An interest rate shock would be one in which US policy rates and yields rise without significant US dollar strength because of domestic overheating and excessive US imbalances – notably inflation, but also the so-called “twin deficits” in the fiscal and external current accounts at a time when other economies were growing robustly without significant imbalances. Rising global rates amid rising US refinancing needs and expected currency depreciation would keep the US dollar from rallying significantly even as US policy rates and bond yields rise. This scenario is reminiscent of the 2004-06/07 US business cycle.

A joint US dollar/interest rate shock would be a scenario in which US overheating requires a strong Fed response beyond expected tightening, likely in the context of relative weakness elsewhere. The result would probably be a significant, even severe tightening in global financial conditions, one which could severely dent emerging market and global growth. Features of this scenario could include downside geopolitical risks – including trade/technology tensions which could drive down global investment and growth, combined with a cyclical upswing in the US driven by short-term fiscal stimulus. This risk has risen in Q2 2018 and may well remain elevated in coming months.

We expect US dollar strength to pose idiosyncratic adjustment pressures on emerging market countries with excessive imbalances, especially current account deficits and high short-term financing needs. We do not expect a systematic market shock as occurred during the 2013-14 Taper Tantrum because the external financing needs and macro imbalances – inflation and current account deficits of most countries across the market have been substantially reduced since then.

Furthermore, relatively buoyant commodity prices on the back of a strong US dollar suggest that the world economy is in reasonable shape – even granting that the oil price rally probably owes partly to geopolitical risks such as Iran or Venezuela sanctions. These shifts in the commodity terms of trade also point to divergences across different categories of emerging market countries and currencies – commodity importers, metals/minerals versus hydrocarbon exporters.

A sustained US interest rate shock resulting from a significant inflation surprise could be reminiscent of the Reagan era; high real interest rates and a yield curve steepening which might require the Fed to respond with a significant monetary tightening that could in turn generate a US dollar shock. Such a risk scenario is more likely to pose a systematic risk to the emerging market asset class by raising global risk premia significantly. The yield curve would not flatten but rise and steepen, eventually inverting in anticipation of a US - and a significant global - slowdown. Emerging countries would face significantly higher refinancing costs, and sequential corporate, financial or serial defaults might well occur.

We believe the emerging market asset class is far more exposed to a significant interest rate or joint US dollar-rate shock than a US dollar shock. A US dollar shock, driven by downside in other major economies, would be less of a challenge for the overall market because the emerging market asset class as a whole has experienced a significant current account adjustment already (figure 3) in response to the withdrawal of

A sustained US interest rate shock resulting from a significant inflation surprise could be reminiscent of the Reagan era.
US dollar financing precipitated by the eurozone financial crisis and the taper tantrum.

A global interest rate or a joint US dollar/rate shock is more likely to be systematic because emerging countries as a whole have a high level of debt — public or private depending on the country. A large part of this debt, especially public debt, has been “domesticated” in the context of a general shift from fixed to floating exchange rates, but much of it is still owed to US dollar-based investors, even when issued in domestic currency in domestic jurisdictions (figure 4).

But we don’t want to invite trouble: we see the joint US dollar/rate shock as a risk scenario rather than a central scenario, because we believe the current pressures originate in downside surprises and risks in the rest of the world rather than upside surprises to growth and inflation in the US itself. That said, such a risk scenario should be factored into the calculations of policymakers and investors alike because of the late cycle US fiscal stimulus.

The geopolitics of geo-economic fragmentation
Turning to geo- and domestic politics, we see parallels to the 19th century - a period of rapid innovation with competing economic and political models, considerable global and financial integration and significant Luddite-style resistance to change. The current so-called Fourth Industrial Revolution poses risks to employment and labour income in both skilled and unskilled segments of the workforce, across countries developed and emerging, suggesting that both widespread insecurity and resistance to progress will persist. Furthermore, the balance between private property rights, consumer preferences and insecurity in the labour market suggests continued competitive pressures for productivity growth and contained real wage/inflation pressures.

We do not expect a reassertion of a Cold War-type world economy fragmented by ideologically motivated barriers to trade and investment. Nor do we expect a breakdown of international political dialogue or economic and financial integration as occurred during the inter-war period. We expect that the Trump administration will continue to respond to resistance from businesses and specific states and other interest groups that are harmed by protectionist policies or retaliation. There is, after all, evidence of willingness to change course if policies should prove self-harming, as can be seen with the Rusal sanctions or the change of heart on ZTE following commitments to a recalibration of policies.

Even so, tensions in international trade and investment are likely to remain a persistent challenge. The structural tension in the global economy lies in the US-China geopolitical rivalry, given explicit identification of China as a threat by the US National Security Review. Trade tensions are clearly crucial, but are amenable to negotiation through lower tariff or non-tariff barriers. But lying at the heart of the issues between the US and China are two different political-economic models which are non-negotiable: the United States revolves around private property and market forces as the basis of technological and economic progress. In contrast, China’s mission statement centres on the collective national interest, which now includes industrial policies targeted at reaching and maintaining the global technological frontier and thus implies both economic and geopolitical rivalry, supported by the resources of the state.

Such sustained, elevated tensions are likely to cause periods of financial market stress that could tighten financial conditions and weigh on growth, especially in emerging market countries that are at the cutting edge of globalization, trade tension and investment restrictions. Resulting pressures on emerging market currencies could boost imported inflation, pushing central banks into a policy dilemma with the possibility of slower growth accompanied by higher inflation, or expectations thereof.
Even so, we do not expect a major crisis, given global experience in previous episodes of severe protectionism and geopolitical barriers to trade and investment. Severe protectionism is associated with deep recession and open conflict, most obviously following the Great Crash of 1929, arguably in a parallel to today's post-Global Financial Crisis protectionism: the 1930s US Smoot-Hawley tariffs exacerbated the Great Depression, and were overcome by World War II mobilization. Less famously but no less notoriously, President Jefferson's 1807 imposition of tariffs was motivated by geopolitical tensions with Great Britain and France and is believed to have precipitated a 5% collapse in US GDP and led to the War of 1812 and burning of the White House.

However, it need not end so badly - and has not always done so. Threats of trade war precipitated the 1987 Black Monday, the largest one-day correction in US stock market history, but there was no actual trade war. The solution to the 1980s wave of Reagan-era US protectionism was a shift of auto investment into the United States - a result of negotiations and reconciliation among the major economic powers of the time - US, Europe and Japan.

The stakes are high this time and extend to both basic economic relationships as well as geopolitics. Relations with Russia are very tense amid allegations of interference in the US political process as well as upending the post-World War II/Cold War perception that national borders are inviolate, at least in Europe, with the annexation of Crimea, destabilization of Donbass and frozen conflicts in Georgia and Moldova. Furthermore, President Trump's domestic political strategy seems to play a major role in foreign security and economic practices, in a break with the past. He is focusing on the core issues of his core US rust-belt, swing-state constituency, which has been deeply affected by globalization and technological progress.

Yet there are reasons for hope because most other countries want to remain engaged in the international system, and the Trump Government is making some progress, as with Mexico for example. Although tensions are highest with China, the Trump administration is not singling out China. Meanwhile, Trump himself is undertaking major personal efforts to connect personally with President Putin, apparently to make Russia feel more confident that NATO and Europe do not represent a threat. And, he has responded to President Xi's personal overtures, as in the case of the Chinese telecommunications equipment manufacturer ZTE. After paying a billion US dollar fine, the smartphone maker is now once again allowed to do business with US companies.

The desire to avoid economic closure is very likely as strong in the major EM countries as it is in the West. During the Cold War, the comparative economic isolation of the USSR, China, India, South Africa and even, to a lesser degree, many other countries throughout Latin America, Africa and Asia help to explain their relatively low levels and growth of income per capita, lower productivity and distance from the technological frontier.

Thus, there are reasons to believe that accommodations can be made and so-called “off-ramps” be found, even though the stakes are high and tensions are likely to persist. Ultimately, it is more likely that there will be engagement rather than isolation. After all, no major power is likely to change its economic model or goals, and history suggests that geopolitical isolation and economic autarky actually encourage rather than prevent tension, conflict or technological and military competition.

Conclusion: tactically defensive relative value rather than strategic hunkering down
The policy and investment implications, in our view, are the same for all other risky assets: the global economy is alive and kicking, but it's not in the best of health; amid major risks and challenges, a full-blown crisis seems unlikely. Despite justified concerns about antidotes to the next downturn or the cure for structural shifts in global integration if barriers should rise, we do not expect any sudden changes.

The global economy is alive and kicking, but it’s not in the best of health; amid major risks and challenges, a full-blown crisis seems unlikely.

But time is of the essence and is crucial if the real economy is to adapt based on the behaviour and national interests of all concerned governments.

For most emerging market governments, this means applying tighter macro policies to contain macro imbalances - whether above target inflation or excessive fiscal or external deficits; for those with already outsized imbalances, this means reducing them rapidly. For both, this means structural change to adapt to a global environment that may be structurally less forgiving of excessive imbalances because of the heightened risks of cyclical divergences and structurally higher barriers to further global economic integration.

We believe these are reasons for tactical defensiveness rather than strategic hunkering down for a nuclear winter in financial markets or the real economy. We expect the impact of political and policy risks to continue to be reflected in high volatility episodes, arguing for tighter monetary policy and slower growth in many emerging market countries, as well as a much greater variation in performance at the country level. Furthermore, the asset class as a whole does not need to go through a systemic shakeout, but some countries with excessive imbalances need to undergo major cyclical and structural adjustments - notably Turkey, Argentina and Venezuela. Others need significant structural reforms and fiscal adjustments to boost potential growth - notably South Africa and Brazil, among others.

All of these factors - top-down global and bottom-up country stories - could argue for relative value opportunities rather than a “sell-the-market” mentality. Although we are likely entering into a more varied, volatile global environment, we believe it should
ultimately result in greater selectivity rather than a generalized outflow from the emerging market asset class. If Europe's and Japan's economies continue to surprise on the downside or US fiscal policy boosts inflation, causing the Fed to become more aggressive, we could see a sharp US dollar rally, with beta dominance most likely reasserting itself. Flare-ups in geopolitical risks or trade tensions would also likely resurrect beta dominance. In any such systematic, global downside scenario, emerging markets as an asset class would be very heavily exposed, as countries that have had the most growth and investment inflow benefit from globalization over time, and from cyclical global economic recovery, low global inflation and easy monetary policy.
Long-dated inflation-linked leased real estate

By Chris Brassington and Matthew Hall

In brief
The pension industry is heading towards a pinch point as an increasing number of defined benefit schemes move closer to the drawdown phase, more and more people enter retirement and traditional low risk asset classes continue to deliver persistently low yields. Add in potential for increased inflation, and those seeking to match liabilities are in a difficult position. Under these conditions, long-leased real estate may provide an excellent substitute for traditional fixed income-type assets by seeking to deliver high income returns with links to inflation. Our analysis indicates that, in the past, long-let real estate has delivered strong returns at extremely low volatility when compared to other major asset classes. However, in our view, careful asset selection is key to returns.

In a world of changing interest rates, low yields and an aging population, the need for pension funds and insurance companies to find inflation-linked approaches and match liabilities is increasingly important. We believe that long-leased real estate offers a potential solution.

The past ten years have been characterized by exceptional economic conditions last seen in the Great Depression, featuring financial institution bailouts and large-scale government interventions. Record low interest rates, quantitative easing and risk aversion have driven asset values to record highs, particularly for assets generating income at low risk.

Government bonds have traditionally been the preferential asset class for liability-matching investors, but the extended period of low yields in government securities has driven many investors to expand their horizons to additional fixed income-type assets.

In the UK, for example, insurance companies and pension funds have slightly raised their exposure to government bonds over time (figure 1). Proportionally speaking, however, their share of national debt has shrunk in comparison to other debt holders, diluted by monetary financial institutions and overseas buyers (figure 2).

Figure 1
UK insurance companies and pension funds have raised their government bond exposure ...

Source: Debt Management Office, as at May 2018. Holders of UK government bonds by investor type.
When government bonds no longer suffice...
As quantitative easing at the Bank of England and the European Central Bank tapers off and the economy recovers, insurance companies’ and pension funds’ market share is likely to increase again. However, this will do little to improve returns – as central banks reduce their holdings and bond yields potentially rise, relative returns on insurance companies’ and pension funds’ existing holdings will likely suffer.

Between 2017 and 2040, the number of people in France, Germany, the UK, Italy and Spain aged 65 and above is forecast to grow by 44%.

Long term, there is another difficulty: demand for annuity-type assets is set to grow substantially over the next 20 years in response to a major demographic shift. Between 2017 and 2040, the number of people in France, Germany, the UK, Italy and Spain aged 65 and above is forecast to grow by 44%, while the working age population is expected to simultaneously shrink by 10% (figure 3). This growing demand is likely to maintain downward pressure on yields of government bonds and other perceived low risk assets.

Growing demand for secure income is likely to maintain a degree of downward pressure on bond yields, even in the face of rising inflation. But the overriding pressure on government bond yields is likely to be on the upside in the medium term and, even if bond yields move out by only 200bps, it will be difficult to match liabilities for existing defined benefit funds.

...real estate may help
Delivering performance for this growing pool of retirees will pose an enormous challenge for institutions tasked with driving real returns on the basis of low-risk, inflation-protected assets. One asset class with a proven track record of delivering such performance is real estate. Real estate may share some characteristics with bonds, but it has the potential of offering higher returns to compensate for liquidity, credit and depreciation risks - in particular where the fundamentals such as location, building quality and sector positioning are strong.

Traditional real estate shares some characteristics with bonds, i.e. contracted income payments, and some characteristics with equities, i.e. no direct covenant to secure a final principal repayment.
Instead, real estate is reliant on future earnings potential, notably the residual value of the land and buildings.

But the residual value of the underlying real estate is relatively certain: a ‘standard term’ lease as foresight of secular trends gives investors a measure of certainty that, for example, the market will still need offices when the existing lease expires, supporting the final principal repayment. This is why established Central Business District locations are identified as lower risk in the office sector.

Market standard lease lengths vary by country, but somewhere like the UK, for example, has a market standard lease agreement for commercial offices of around 10 years, with upward-only rent reviews every five years. Longer-term leases (upward of 20 years) with inflation-linked increases based on secure covenants become more bond-like. Again the key difference in relation to bonds is the residual value of the asset, which can be higher or lower than the original investment and not as certain. This means the asset ownership is less passive; however, this can be managed and secured through asset selection, direct asset management and a disciplined exit approach aiming at stable values.

MSCI reported that real estate funds have performed strongly on the whole over the past 8 years, averaging above 9% p.a. compared to 10% for the FTSE 100 over the same period, while bonds averaged 5.9% p.a. (figure 4).

Led by the above-mentioned shift in allocations and seen most clearly by pension funds seeking to match their inflation-linked liabilities, long-let indexed assets have been growing in prominence in recent years as investors are attracted by potential long-term income security and inflation protection. This has led to increases in prices and strong returns. Since Q1 2010 (when the MSCI Long Income Property Fund Index began), long income funds have performed strongly.

The level of risk associated with long income real estate funds is less than half that of all property and bonds.

Furthermore, the level of risk associated with long income real estate funds over the period is less than half that of all property and bonds. Over the comparison period, long income property funds have demonstrated extremely stable performance. While long-let real estate is unlikely to deliver the extreme upsides of equities or standard real estate, there is a clear mitigation of the downside.

... and future prospects

Long-let real estate may deliver the potential returns required by pension funds and insurance companies in the current environment thanks to strong demand and limited new supply creation. While there is a growing realization among corporate occupiers that their covenant strength is a valuable commodity to trade in the annuity market, new accounting legislation has further reduced the attractiveness of signing long leases as the full liability is recognized immediately on the tenant’s balance sheet, thereby limiting the creation of long-let stock.¹

Asset management of long-let investments by real estate professionals is still considered essential for strong returns. As mentioned, some caution is required when investing in ‘bond-like’ assets: ensuring that assets have a long-term use at the end of the lease is essential to drive performance. Few assets in the current market deliver a yield high enough to fully amortize the capital value to zero and deliver returns throughout the life of the lease. Management of

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In a pan-European version of the strategy described here, the potential impact of Brexit on real estate values in the UK is generally expected to be negative in the short to medium term, with most investors wary of short-term vacancy (assets with two or three years remaining on the lease). Assets with more than seven years remaining are viewed more positively as the market expects Brexit-related volatility to have subsided in that timeframe. Long-let real estate is therefore viewed by us as even more attractive in the UK given the contracted income during the current uncertainty.

**Conclusion**

Long-let real estate may be a strategic long-term allocation within real estate portfolios and, in the context of the broader capital markets environment, we remain confident in the segment's potential risk-adjusted returns. The sector can offer long-duration inflation-linked cash flows together with the prospect of very low volatility and high certainty of income. The new supply of long leases will be unlikely to meet this demand. However, it is important to remember that the underlying real estate is still key to real returns.
Note
1 IFRS 16 requires that all leases be recognized in the balance sheet beginning 2019 and differently treated in the income statement, thus leading to a reduction in profits.

About risk:
The value of investments and any income will fluctuate (this may partly be the result of exchange rate fluctuations) and investors may not get back the full amount invested. Property and land can be difficult to sell, so investors may not be able to sell such investments when they want to. The value of property is generally a matter of an independent valuer’s opinion and may not be realized.
Standing out from the crowd in Asia-Pacific

A conversation with Anna Tong

Over the past three decades, Asia-Pacific has played host to several economic booms and busts, and Invesco's Anna Tong has experienced all of them. We spoke to her about capitalizing on the growing investment opportunity set and meeting the increased demand for outcome-oriented solutions – as well as discussing how asset managers can navigate the region's crowded playing field vying for a greater share of fund flows from foreign and domestic investors.

Anna Tong is Invesco's Regional Head of Investments Asia-Pacific and has helped oversee the first offshore fund investing in Hong Kong-listed Chinese companies as well as other single country, sub-regional and regional portfolios.

When Anna began her investment career in 1985, Japan was in the inception stage of a prolonged bull market on the back of the ‘triple merits’: strong yen, low oil prices and low interest rates. The bubble eventually burst in 1990 and led to two decades of deflation before giving way more recently to an economic revival under Prime Minister Shinzo Abe's expansionary policies.1

Elsewhere in the region, China and India have also figured heavily in Anna's investment priorities. Once reliant on export-led growth, China has been shifting toward a domestic-driven model following structural reforms based on consumption and rising tides of individual income. The world's two most populous countries now rank among the six largest economies. By 2023, China and India could combine to account for 22.9% of the global economy, up from 3.5% in 1993.2

The positive outlook for Asia-Pacific economies, along with increasing foreign access, could drive greater investment activity in the region. Asia-Pacific is underrepresented in global investment portfolios – boasting 32% of the world's wealth but only 14.5% of its managed assets.3 Going forward, China is expected to become the second largest asset management market globally by 2019, and could account for more than US$17 trillion in addressable assets under management by 2030.4

Anna Tong
Regional Head of Investments Asia-Pacific, Invesco
Why did you choose to enter the field of asset management and what do you find most fulfilling about it?

Anna Tong
My first experience in the industry was as an intern with a leading fund house in Hong Kong. That gave me a taste of what it would be like to work as an asset manager in fast-moving markets. Now, having been in the industry for 33 years, I’ve yet to experience a dull moment!

Markets across the region are very dynamic and we need to monitor developments closely to stay ahead of the curve. Take Japan, for instance. In just one generation, it completely overhauled its industrial system and emerged as the world’s second-largest economy.

More recently, China provides another example of how dramatically economies and markets can evolve in Asia-Pacific. When I began my investment career, there was no way anyone could foresee the rapid pace of development that has taken place in China. Back then, it was a country at the very earliest stage of economic reforms, trying to attract foreign direct investments and increase exports. Domestic stock markets were non-existent. Since then, of course, both the Chinese economy and its capital markets have grown by leaps and bounds, and they now have a major influence on global markets.

Chinese A-shares were added to the MSCI Emerging Markets Index in June 2018 after years of consultation on how to include the country’s onshore listings. Is this a significant milestone?

Anna Tong
While the initial weighting of A-shares is just 0.4% of the overall index, I still view this as significant. China’s onshore equities provide exposure both to core sectors - like consumer discretionary and staples, industrials and financials - and to fast-growing niche areas like electronics, media, household furnishings, biotechnology and renewable energy.

Meanwhile, the percentage of A-shares will increase over time as MSCI raises the inclusion factor. Going forward, the combination of onshore and offshore China-related equities could grow to account for around 40% of the index.

This decision also recognizes the positive strides China has made on financial reforms. Measures like the Qualified Foreign Institutional Investor Scheme.

To succeed, we have to adapt, innovate, problem-solve and deal with the unexpected.
and, more recently, Stock Connect and Bond Connect, have enabled incrementally larger amounts of inbound and outbound investment. We are also encouraged by China’s announcement in 2016 that wholly foreign owned enterprises (WFOE) would be allowed to manage onshore investment funds.5

**Risk & Reward**
*How has your investment approach evolved as financial markets in Asia-Pacific become increasingly more sophisticated?*

**Anna Tong**
In the early days of my career, we placed more emphasis on top-down than bottom-up stock analysis. I covered several markets during that time because there simply weren’t that many listed companies to consider and few investors were conducting in-depth stock research.

It is a different ballgame now. You cannot generalize based on top-down analysis because the industry is much more competitive and markets are more efficient. If you want to stand out from the crowd, you must have a very good grasp on individual companies, a high conviction approach and a long-term perspective. When you really understand your portfolio companies, you can stick to fundamentals without getting carried away by market sentiment.

Over the years, we have built an experienced investment team in the region. Our diverse sector specializations allow us to identify companies with sustainable competitive advantages and strong business models. Our analysts typically cover 20-25 names on an in-depth basis and have a thorough understanding of the strategic direction and financial positioning of each company.

**Risk & Reward**
*You oversee a diverse group of investment professionals located across the region. How do you build collaboration within the team and create connectivity with other regions?*

**Anna Tong**
In Asia-Pacific, we operate in many different markets, so diversity and local knowledge are very important. I have an open mind and do not believe there is only one correct approach to investing. However, from a quality control perspective, all investment professionals in specialized investment teams are expected to adhere to their clearly defined investment philosophy and discipline through market cycles.

Within the region, we have strategy meetings to bring people together so they can share knowledge and get to know one another. We operate in an environment of information overload. Getting investment team members to know and understand each other is the only way to build trust, and it helps them to appreciate one another’s research and recommendations.

We also look to our colleagues from more mature markets in areas where they may have specialized knowledge. I am very grateful to our US fixed income team, for example, for sharing international best practices and providing training for colleagues at our joint venture in China – Invesco Great Wall – on managing short term assets and credit analysis. This type of partnership exemplifies our ability to develop an investment franchise built on local knowledge and global expertise.

**Risk & Reward**
*What are some of the key challenges you have encountered as you help to build Invesco’s Asia-Pacific footprint?*

**Anna Tong**
It was easier to add alpha in the past, when markets were less efficient and the playing field was still limited to a select group of fund houses. The market has since become much more crowded and investors have their pick of active, passive and factor-based strategies. To put it into perspective, there are now more than 3,000 onshore funds focusing on China A-shares alone.6

If you want to stand out from the crowd, you must have a very good grasp on individual companies.

It was easier to add alpha in the past.

With so many competitors, you must deliver strong performance relative not just to the benchmark but to your peers as well. So how do you differentiate yourself and give people a reason to buy your fund? Demonstrating a positive performance history is critical, of course. But you also need to maintain a clear investment philosophy and a strong brand. These are things we cannot take for granted and must continually work to improve.

Clients are also seeking more customized solutions. Since their needs can vary greatly, it is imperative that we develop a trust-based relationship with each client and understand their unique investment objectives. From there, it’s a matter of working across specialized investment teams managing investments across a wide range of asset classes and investment styles to package an optimal mix of asset classes and building blocks into a single solution that matches each client’s outcome objectives.
Risk & Reward

Which characteristics will asset managers need to be successful in the future, particularly in Asia-Pacific?

Anna Tong

Another thing I learned early in my career is that asset managers must not get carried away by market sentiment. In October 1987, the US market crashed in what became known as “Black Monday”, and we sold stocks the following morning in Asia-Pacific amid the panic. Of course, selling at that point turned out to be a painful lesson about the importance of sticking to valuations and fundamentals.

Asset managers must not get carried away by market sentiment.

I expect asset management to continue evolving over time, just like the fast-moving markets that we cover. What will not change, though, is the need for passion, dedication, hard work and stamina during both good times and bad. Asset management is a very competitive industry, and only the fittest will survive.

Having a clearly defined investment discipline can help asset managers withstand unexpected market events with high conviction and relatively low turnover. This is especially important in Asia-Pacific, where equity markets tend to be more volatile and sentiment-driven than in other regions. If we can deliver consistent performance on a risk-adjusted basis, that will be more helpful to our clients in the long term than a feast-or-famine approach.

In Asia-Pacific equity markets tend to be more sentiment-driven.

Notes

2 “World Economic Outlook Database”, International Monetary Fund, retrieved 23 May 2018.
5 Invesco’s WFOE in Shanghai registered as a private fund manager with the Asset Management Association of China in November 2017.

About risk

The value of investments and any income will fluctuate (this may partly be the result of exchange-rate fluctuations) and investors may not get back the full amount invested. When investing in emerging and developing markets, there is potential for a decrease in market liquidity, which may mean that it is not easy to buy and sell securities. There may also be difficulties in dealing and settlement, and custody problems could arise.
The use of equity factor investing for portfolio insurance

By Dr Harald Lohre, David Happersberger and Alexandar Cherkezov

In brief
Equity investments promise high expected returns, but not many investors can tolerate the associated risks. A possible solution may be to complement the equity strategy with a portfolio insurance element which ideally reduces the equity exposure whenever necessary to prevent the overall strategy from breaching a pre-defined floor. Based on a block-bootstrap methodology, we show that the choice of equity underlying is key in this context; in particular, low-volatility underlyings are to be preferred, with other multi-factor propositions forming suitable alternatives when considering additional elements of dynamic risk management.

Portfolio insurance techniques such as CPPI (constant proportion portfolio insurance) are commonly used to protect investments from downside risk. This risk is obviously pronounced in the case of pure equity investments. We examine the interaction of CPPI with different equity underlyings, including standard market cap index, multi-factor and low-volatility investments.

To evaluate CPPI strategies for different equity underlyings, the usual way is to consider their historical performance. Yet, given the inherent path dependency of CPPI, any conclusion from this would be mostly anecdotal. Instead, we have earlier suggested a block-bootstrap methodology which utilizes historical returns to simulate a large number of consistent alternative price paths and CPPI outcomes. Rather than evaluating just one price path, we base our analysis on the overall portfolio return distribution associated with a given portfolio insurance underlying. While the initial CPPI analysis is based on a static assumption for overnight risk (i.e. a constant multiplier) we go on to look for the incremental value of...
including volatility targeting and dynamic risk forecast elements rendering the dynamic portfolio insurance dynamic (DPPI).

Rather than evaluating just one price path, we base our analysis on the overall portfolio return distribution associated with a given portfolio insurance underlying.

**CPPI in a nutshell**
For a given investment period, a CPPI strategy seeks to respect a pre-specified floor by actively managing the exposure to the risky underlying. A key ingredient is the cushion \( C_t \) - i.e. the difference between the invested wealth \( W_t \) and the net present value of the floor \( NPV(F_t) \):

\[
(1) \quad C_t = W_t - NPV(F_t)
\]

To maintain the floor, the associated risky investment can be written as \( E_t = e_t \cdot W_t \) so that the above condition (2) translates to

\[
(2) \quad C_t \geq E_t \cdot \text{MaxLoss}(W_t)
\]

This reformulation introduces a further key element: the CPPI multiplier \( m \). It can be interpreted as the number of times the cushion can be invested in the risky underlying without risking a breach of the floor (provided the maximum loss assumption holds). To play it safe, a static multiplier derived from a worst-case risk estimate could be imposed. In our initial analysis of CPPI for equity style underlyings, we have chosen a constant multiplier of 6, which corresponds to an overnight risk assumption of 16.7%.

**Equity investing with style**
Equity investments often closely follow broad market cap-weighted indices. Yet there are investment styles that differ from simple index investing, such as the popular styles value and momentum. For instance, a value investor would prefer stocks that are relatively cheap according to some measure of intrinsic value and would avoid relatively expensive stocks. While a value investor ultimately relies on stocks reverting to their fundamental value, a momentum investor would bet on the stocks’ recent price momentum continuing. He would therefore be actively chasing recent winner stocks while cutting recent loser stocks.

These two investment philosophies are particularly common amongst quantitative factor-oriented managers. Alongside value and momentum, there are many more stock characteristics deemed relevant in explaining the cross-section of equity returns. For the subsequent analysis, we are particularly interested in capturing the most salient equity styles and additionally consider a “quality” style as well as defensive “low-volatility” style. While quality would favour companies with healthy balance sheet ratios and/or sustainable investment and financing activities, the low-volatility style seeks to improve a portfolio’s risk-adjusted returns by avoiding highly volatile stocks.

Table 1 illustrates the performance of these various equity style investments for a European investment universe over the period 31 October 2006 to 31 May 2018. As the sample period begins with the onset of the global financial crisis (GFC), the overall equity index performance is moderate. The MSCI Europe returned 3.25% p.a. at 19.4% annualized volatility while suffering a maximum drawdown of -58.5% over the course of the GFC. Yet the style returns differ considerably, ranging from 1.29% (value) to 6.53% (momentum). Notably, value investing was the most risky style over the sample period in terms of volatility (21.7%) and maximum drawdown (-65.1%). Quality and minimum volatility investments have been more resilient, as characterized by maximum drawdowns of -46.8% (quality) and -50.5% (minimum volatility).

<table>
<thead>
<tr>
<th>Performance of various equity style investments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Index</strong></td>
</tr>
<tr>
<td>Return p.a. (%)</td>
</tr>
<tr>
<td>Volatility p.a. (%)</td>
</tr>
<tr>
<td>Sharpe ratio</td>
</tr>
<tr>
<td>Maximum drawdown (%)</td>
</tr>
</tbody>
</table>

The table shows performance measures of equity style investments; for Index we use the MSCI Europe, Value, Momentum and Quality are the respective MSCI Europe Value, MSCI Europe Momentum and MSCI Europe Quality indices. QMV represents an equally-weighted combination of Quality, Value and Momentum based on the corresponding MSCI indices. Minimum volatility is the MSCI Europe Min Vol index. All MSCI indices give net total returns in EUR. Active Low-Vol is based on backtested returns of an integrated multi-factor equity portfolio optimized according to quality, momentum and value signals but targeting a considerably lower risk than the market. Cash returns are based on EONIA. Reported are the annualized return and volatility figures, the corresponding Sharpe ratios and maximum drawdowns. Sources: MSCI, Bloomberg, Deutsche Bundesbank. Period: 31 October 2006 to 31 May 2018. This is simulated past performance and past performance is not a guide to future returns.
Nevertheless, quality investing comes with an annualized volatility of 18.4%, whereas minimum-volatility investing actually has the smallest realized volatility of 14.9%, reducing volatility by at least 20%.

While these figures refer to the full sample performance, it is worthwhile to investigate equity style performance in two sub-periods. We thus divide the sample into two before and after March 2009, when global equity markets reached their lows during the global financial crisis. In the volatile first sub-period, we find that quality and low-volatility fared particularly well compared to value which performed even worse than the market index (figure 1). Interestingly, value was also lagging in the subsequent bull market, again finishing last in the league table of equity style factors. Momentum was the best performing style from March 2009 onwards, with quality coming in second place. Most interestingly, we find that minimum-volatility exhibited index-like returns, yet at a lower volatility.

In quantitative investing, it is common to combine different investment styles to create a more diversified multi-factor portfolio.6 In that regard, a typical combination would include quality, momentum and value to obtain a core equity proposition with similar risk characteristics as the market index but potentially better returns. Indeed, a simple equal weighting of these three styles (labelled QMV in table 1) would have outperformed the MSCI Europe by 1.63 percentage points p.a.

To further exploit the notion of defensive investing, we also consider an integrated multi-factor approach that optimizes an equity portfolio according to quality, momentum and value signals, but targeting a considerably lower risk target than the market (labelled Active LowVol in table 1). Such an active low-volatility proposition would indeed have been highly attractive, with a 5.87% return at 16.0% volatility (i.e. a Sharpe ratio of 0.32). Moreover, its maximum drawdown is even less than that of the quality style investment (-46.3%).

**Factor investing and CPPI**

In light of the stark differences in equity style performance, the corresponding CPPI strategies may also differ. Yet the bulk of the CPPI literature focuses on index investments as the equity underlying of choice. A notable exception is Ardia, Boudt and Wauters (2016), who provide a thorough treatment of the topic in question. In particular, they carefully examine CPPI strategies based on different equity underlyings, including standard market cap, fundamental and low-volatility weightings.

We follow Ardia, Boudt and Wauters (2016) in analyzing the equity style investments from the preceding section in the context of CPPI strategies. As in a previous article7, we do not base our analysis on the historical CPPI performance but on 5,000 block-bootstrap samples.8 Given the inherent path dependency of CPPI, this setup is a meaningful improvement over standard analyses, as we can assess the probable portfolio return distribution of a given equity factor underlying.

Figure 2 shows the results for a floor of 85% and a static multiplier of 6. As for the chosen equity underlyings, we focus on the most relevant, i.e. index, multi-factor core (QMV), minimum-volatility and an active low-volatility investment.9 Needless to say, all equity underlyings exhibit significant tail risk, but this is less pronounced for the two low-volatility propositions. Interestingly, the post-CPPI return distributions are quite different across the board.

To allow for a direct comparison of the return distributions, we have merged these into one chart (figure 3): for the index underlying, CPPI produces a relatively large number of outcomes rather close to the floor, for QMV this effect is less pronounced. Minimum-volatility or active low-volatility underlyings better transform the tail shape of the ensuing CPPI return distribution. These first-glance conclusions from figure 3 are by and large backed by the statistics in table 2: panel B for the static CPPI strategy clearly supports the above ranking from active low-volatility down to index investments, in terms of return, Sharpe ratio and Calmar ratio.

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**Figure 1**  
Equity style investments over time

<table>
<thead>
<tr>
<th>Year</th>
<th>MSCI Europe</th>
<th>MSCI Value</th>
<th>MSCI Min Vol</th>
<th>MSCI Momentum</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2007</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>2008</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>2009</td>
<td>130</td>
<td>130</td>
<td>130</td>
<td>130</td>
</tr>
</tbody>
</table>

Sources: MSCI, Bloomberg. Data as at 31 May 2018. Past performance is not a guide to future returns.
figure 3 visualizes the close alignment of the return distributions. Nevertheless, tail risk statistics are barely altered by the volatility adjustment. It is evident that the CPPI performance wedge is not only driven by the reduced volatility of the underlyings but also by the distinctive relative return pattern of low-volatility strategies in bearish markets. Given these results, it is straightforward to additionally consider a dynamic risk forecasting element which allows the investment exposure to be actively managed in order to further smooth tail risks.

What about adding a dynamic portfolio insurance element?

A conservative multiplier assumption might severely undermine participation in any given underlying. Alternatively, we consider a dynamic multiplier

$$m = m_t := \frac{1}{ES_t^{99\%}(\text{risky asset})}$$

Introducing a volatility target in equity factor underlyings

Ex ante, low-volatility underlyings are expected to outperform given the negative vega of the CPPI strategy. As the underlying’s volatility increases, the CPPI payoff declines, as shown in Black and Jones (1987). Thus, one may question whether it is merely the lower volatility of the low-volatility investments that makes CPPI so promising. Therefore, we will now investigate whether an explicit volatility targeting element can help index and multi-factor core investments to close the gap versus the low-volatility underlyings. With volatility targeting, the exposure to index or multi-factor core investments is reduced while one dynamically replicates the volatility of the minimum-volatility strategy.

Indeed, panel C of table 2 reveals that volatility targeting is beneficial for index and other core underlyings: we observe an increase in returns and a decrease in volatility, helping to reduce the gap in risk-adjusted performance. The middle chart in figure 3 visualizes the close alignment of the return distributions. Nevertheless, tail risk statistics are barely altered by the volatility adjustment. It is evident that the CPPI performance wedge is not only driven by the reduced volatility of the underlyings but also by the distinctive relative return pattern of low-volatility strategies in bearish markets. Given these results, it is straightforward to additionally consider a dynamic risk forecasting element which allows the investment exposure to be actively managed in order to further smooth tail risks.

The chart shows the distribution of block-bootstrapped yearly returns of the CPPI portfolio (blue shading) and that of a pure buy-and-hold portfolio invested in the simulated equity underlying (pink shading). The floor level of the CPPI strategy is 85%. Below the two density plots we have added the corresponding support and the mean levels of the return distributions. The upper left is for the index investment, the upper right is for the equally weighted multi-factor investment in quality, momentum and value (QMV), the lower left is for minimum-volatility and the lower right is for the active low-volatility strategy.

Sources: MSCI, Bloomberg, Invesco.
Table 2

Performance of simulated strategies

<table>
<thead>
<tr>
<th></th>
<th>Underlying index</th>
<th>Underlying QMV</th>
<th>Underlying Min-Vol</th>
<th>Underlying Active Low-Vol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Pure equity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return p.a. (%)</td>
<td>6.10</td>
<td>7.57</td>
<td>6.51</td>
<td>9.17</td>
</tr>
<tr>
<td>Sharpe ratio</td>
<td>0.31</td>
<td>0.42</td>
<td>0.43</td>
<td>0.58</td>
</tr>
<tr>
<td>Mean annual maximum drawdown (%)</td>
<td>-18.79</td>
<td>-17.48</td>
<td>-14.24</td>
<td>-14.59</td>
</tr>
<tr>
<td>Mean annual Calmar ratio</td>
<td>0.75</td>
<td>0.87</td>
<td>0.90</td>
<td>1.08</td>
</tr>
<tr>
<td>Mean exposure (%)</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Value-at-risk 99% (%)</td>
<td>39.45</td>
<td>34.38</td>
<td>26.81</td>
<td>25.95</td>
</tr>
<tr>
<td>Expected shortfall 99% (%)</td>
<td>46.62</td>
<td>41.49</td>
<td>32.17</td>
<td>32.32</td>
</tr>
<tr>
<td>Panel B: CPPI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return p.a. (%)</td>
<td>2.73</td>
<td>4.03</td>
<td>3.88</td>
<td>6.25</td>
</tr>
<tr>
<td>Volatility p.a. (%)</td>
<td>15.72</td>
<td>15.49</td>
<td>12.95</td>
<td>14.42</td>
</tr>
<tr>
<td>Sharpe ratio</td>
<td>0.12</td>
<td>0.21</td>
<td>0.23</td>
<td>0.37</td>
</tr>
<tr>
<td>Mean annual maximum drawdown (%)</td>
<td>-14.34</td>
<td>-13.80</td>
<td>-11.69</td>
<td>-12.24</td>
</tr>
<tr>
<td>Mean annual Calmar ratio</td>
<td>0.44</td>
<td>0.57</td>
<td>0.65</td>
<td>0.83</td>
</tr>
<tr>
<td>Mean exposure (%)</td>
<td>72.41</td>
<td>74.95</td>
<td>78.97</td>
<td>80.83</td>
</tr>
<tr>
<td>Value-at-risk 99% (%)</td>
<td>17.83</td>
<td>17.60</td>
<td>16.25</td>
<td>15.98</td>
</tr>
<tr>
<td>Expected shortfall 99% (%)</td>
<td>18.14</td>
<td>17.97</td>
<td>16.97</td>
<td>16.77</td>
</tr>
<tr>
<td>Panel C: CPPI with volatility targeting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return p.a. (%)</td>
<td>3.15</td>
<td>4.25</td>
<td>3.88</td>
<td>6.17</td>
</tr>
<tr>
<td>Volatility p.a. (%)</td>
<td>13.33</td>
<td>13.34</td>
<td>12.95</td>
<td>13.44</td>
</tr>
<tr>
<td>Sharpe ratio</td>
<td>0.17</td>
<td>0.26</td>
<td>0.23</td>
<td>0.40</td>
</tr>
<tr>
<td>Mean annual maximum drawdown (%)</td>
<td>-12.50</td>
<td>-12.24</td>
<td>-11.69</td>
<td>-11.61</td>
</tr>
<tr>
<td>Mean annual Calmar ratio</td>
<td>0.60</td>
<td>0.72</td>
<td>0.65</td>
<td>0.89</td>
</tr>
<tr>
<td>Mean exposure (%)</td>
<td>63.34</td>
<td>66.66</td>
<td>78.97</td>
<td>76.70</td>
</tr>
<tr>
<td>Value-at-risk 99% (%)</td>
<td>17.64</td>
<td>17.37</td>
<td>16.25</td>
<td>15.88</td>
</tr>
<tr>
<td>Expected shortfall 99% (%)</td>
<td>17.98</td>
<td>17.84</td>
<td>16.97</td>
<td>16.68</td>
</tr>
<tr>
<td>Panel D: DPPI with volatility targeting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return p.a. (%)</td>
<td>3.22</td>
<td>4.43</td>
<td>4.17</td>
<td>5.56</td>
</tr>
<tr>
<td>Volatility p.a. (%)</td>
<td>11.95</td>
<td>12.16</td>
<td>12.75</td>
<td>13.25</td>
</tr>
<tr>
<td>Sharpe ratio</td>
<td>0.20</td>
<td>0.29</td>
<td>0.26</td>
<td>0.36</td>
</tr>
<tr>
<td>Mean annual maximum drawdown (%)</td>
<td>-11.33</td>
<td>-11.20</td>
<td>-11.45</td>
<td>-11.58</td>
</tr>
<tr>
<td>Mean annual Calmar ratio</td>
<td>0.58</td>
<td>0.72</td>
<td>0.69</td>
<td>0.84</td>
</tr>
<tr>
<td>Mean exposure (%)</td>
<td>64.43</td>
<td>68.16</td>
<td>84.95</td>
<td>78.98</td>
</tr>
<tr>
<td>Value-at-risk 99% (%)</td>
<td>15.36</td>
<td>15.23</td>
<td>15.63</td>
<td>15.65</td>
</tr>
<tr>
<td>Expected shortfall 99% (%)</td>
<td>15.82</td>
<td>15.75</td>
<td>16.11</td>
<td>16.01</td>
</tr>
</tbody>
</table>

The table shows average performance measures based on block-bootstrapped equity style investments (panel A), and variants thereof based on CPPI (panels B and C) and DPPI (panel D). The floor for both, CPPI and DPPI, is 85%. Reported are the mean return, volatility, Sharpe ratio and expected shortfall of the simulated yearly returns, as well as the mean of the maximum drawdowns (which are computed for each simulated path) and mean exposure.

Sources: MSCI, Bloomberg, Invesco. Block-bootstrapping period: 31 October 2006 to 31 May 2018. This is simulated past performance and past performance is not a guide to future returns.
Introducing a dynamic risk forecasting element helps index and multi-factor core strategies to reduce the remaining performance wedge relative to low-volatility alternatives.

Conclusion
The choice of equity underlying is important when designing portfolio insurance strategies, especially when simple protection mechanisms are applied. We have shown that low-volatility underlyings are particularly useful for downside protection mechanisms, given their lower volatility and more favourable relative return patterns in downside markets. Using a block-bootstrap methodology to simulate the portfolio return distribution, we show that volatility targeting and dynamic risk forecasting elements can improve the portfolio insurance results for index-like alternatives. Still, investing in an active low-volatility underlying while closely managing its investment exposure with suitable dynamic risk forecasts can be the method of choice.
Bibliography


Notes
1 In “The theory and practice of portfolio insurance”, Risk & Reward #2/2017 we investigated portfolio insurance strategies ranging from static stop-loss techniques to option-based strategies and dynamic portfolio insurance techniques.
3 See Ardia, Boudt and Wauters (2016) for an overview of different CPPI studies and the choice of multipliers.
4 Throughout the article, all asset returns are in EUR. For money market investments we use EONIA. All simulations in this article are provided for illustrative purposes only and are subject to limitations. Unlike actual portfolio outcomes, the model outcomes do not reflect actual trading, liquidity constraints, fees, expenses, taxes or other factors that could impact future returns.
5 See “Factor investing: building a balanced factor portfolio”, Risk & Reward #1/2017. 6 In simulating alternative price paths, we use the stationary block-bootstrap of Politis and Romano (1994). We follow Ardia, Boudt and Wauters (2016) to the extent that block lengths are drawn from a geometric distribution with a minimum block length of one day and an average of 15 days.

The outputs of the assumptions are provided for illustration purposes only. Unlike actual portfolio outcomes, the model outcomes do not reflect actual trading, liquidity constraints, fees, expenses, taxes and other factors that could impact future return.

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Advancing the frontiers of factor investing

Invesco Quantitative Strategies constantly engages with the academic community to advance its factor investing propositions. One recent engagement involved co-hosting the Frontiers of Factor Investing Conference in Lancaster in late April 2018.

For this year’s conference, Invesco Quantitative Strategies and the Centre for Financial Econometrics, Asset Markets and Macroeconomic Policy (EMP) at Lancaster University Management School put out a call for submissions in the field of factor investing and related research, with the best paper receiving the Invesco Factor Investing Prize. Out of some 200 submissions, the organizing committee led by Professor Ingmar Nolte chose 60 of the best papers to be presented in contributed sessions.

The conference was framed by four keynote speakers discussing the current state of the art in factor investing, its academic frontiers as well as the actual implementation of factor strategies:

- Marie Brière, Head of Investor Research Center at Amundi and Affiliate Professor at Paris Dauphine University, provided a general introduction to factor investing;
- Michael Fraikin, Global Head of Research at Invesco Quantitative Strategies, shared his insights into the practical implementation of equity factor strategies;
- Raman Uppal, Professor of Finance at EDHEC Business School, explored how many factors matter jointly from a portfolio perspective;
- Daniel Giamouridis, Global Head of Scientific Implementation Group and Global Portfolio Products at Bank of America Merrill Lynch, presented novel work exploring the impact of systematic and bundled investing on equity returns, risk and liquidity.

Below, we have summarized the key takeaways from each speaker.

Marie Brière: What do we know about factor investing?

In her opening speech, Marie Brière highlighted how factor investing has enjoyed growing interest and become a lively field in recent years. For a long time, academics and practitioners relied solely on the market factor as the key risk factor, until 1992, when Fama and French included the size and value factors in their three-factor model. This was further complemented by Jegadeesh & Titman (1993) and Carhart (1997), who added the momentum factor. However, using factors to guide asset allocation didn’t really pick up until the 2009 study of Ang, Goetzmann and Schaefer on the Norwegian Wealth Fund, which revealed that a substantial part of active returns can be explained by exposures to additional risk factors. Since then, large investors have been shifting parts of their asset allocation to factors, and the number of documented equity factors has increased steadily.

Too many factors?

To assess whether this emerging “factor zoo” can actually deliver relevant insights, Brière stressed the importance of robustness checks. She outlined two prominent problems facing factor construction: first, high transaction costs in the microcap universe can render the anomalies, that are often driven by these stocks, more apparent than real. Second, equity factors exhibit high levels of redundancy, so that many factors are statistically insignificant when controlling for others. Apart from this, factors’ excess returns are often lower post-publication, which can be attributed to increased liquidity and trading activity.

A new paradigm?

Brière also addressed whether risk from individual factors can be diversified away through optimal allocation to factors by comparing optimal portfolios of factors and sectors to various performance measures. Her results revealed a trade-off between the risk premia associated with factors and the diversification benefits of sector allocations. According to Brière and Szafarz (2017), combining factors improves on the market and is more attractive than combining sectors for investors with low to medium risk aversion, and she went on to argue that this preference would be especially pronounced if short selling were permitted. However, in times of market distress (when diversification is needed the most), factor investing only outperformed sector investing if short selling was allowed.

Selecting stocks across multiple factors

Lastly, Brière examined the advantages of directly mixing single factors versus following an integrated
Based on academic research demonstrating that integration leads to a better risk-return trade-off, she concluded that selecting stocks across multiple characteristics is best given the ability to capture non-linear cross-sectional interaction effects between factors. The integrated approach also allows for greater style exposures because trades can “net out”, thus reducing transaction costs.

**Michael Fraikin: Factor investing – a practitioner’s perspective**

Michael Fraikin shared insights from his practical experience implementing equity factor strategies for over two decades.

**Stylized evolution of market exposure**

To set the stage, Fraikin elaborated on recent developments in the asset management industry and outlined the transition over time wherein factor investing has firmly emerged as the “third pillar of investing”. In addition to returns generated from market beta and idiosyncratic alpha, factors can be used to explain risk as well as returns. This allows for greater granularity and customization of investment products. The factor transition has been supported by decades of empirical research and will have profound impacts on the way assets are managed.

Indeed, one can already witness that traditional active investing is losing ground, whereas factor investing and passive investment products are gaining increasing market share. According to the Invesco Global Factor Investing Study conducted in 2016, the primary reasons for investors moving away from active investment are: costs and a desire for more risk diversification. The study also revealed that investors’ incentive to move toward factor investing is primarily motivated by risk diversification—as well as the need to generate alpha (figure 1).

According to Fraikin, each factor is tied to a quantitative characteristic of an asset. Empirical research shows that some factors are reliable predictors of price movements. In this sense, factor investing is the distillation of potential characteristics to reliable factors that can be managed cost-effectively in diversified portfolios to pursue excess returns, control risk—or both. Theoretically, investors must choose whether to invest in macro or style factors. However, given the limited investability of macro risk factors, the prevailing paradigm is to diversify across style factors. Style factor investing has proved to be more robust across different macro environments than traditional asset class allocations.

At Invesco Quantitative Strategies, Fraikin’s research team currently employs three factor groupings seeking to generate above-benchmark returns: momentum, quality and value. Valid rationales are required as the basis for persistence of returns, and these rationales can be rooted in risk premia, behavioral aspects or market structure.

**Is it a factor and – if so – how many?**

Fraikin posed the question as to whether the 19 individual factors in his team's multi-factor model should be grouped into the four factor families: price momentum, earnings momentum, quality and value, or whether the parsimony of the model could be improved by merging price and earnings momentum to a single momentum factor. Indeed, both factors seem to capture the same economic phenomenon and Fraikin presented strong empirical evidence that they are exposed to similar latent properties. While earnings momentum posted stronger returns than price momentum, Fraikin said, it also came at the cost of a much higher turnover rate. Thus, combining both factors resulted merely in a marginal loss of information.

**The case for active multi-factor investing**

Finally, he presented general evidence of factor strategies displaying more favourable return patterns than a broad market portfolio. However, some may...
underperform in the short to medium term or revert to more volatile regimes, demonstrating the need for diversification among factors. Thus, a diversified active multi-factor model is expected to generate more stable relative returns. Yet, Fraikin also pointed out that markets react and adapt to the efforts of their participants, so that a constant evolution of multi-factor investment processes is key.

Raman Uppal: A portfolio perspective on the multitude of firm characteristics

On a related topic, the third keynote speaker Raman Uppal explored how many factors matter jointly for an investor focused on out-of-sample returns with an eye to portfolio risk and transaction costs. In particular, he examined the effect of transaction costs on the number of jointly significant company characteristics in the overall multi-factor portfolio.

In their paper, Uppal and his co-authors analyzed data of around 3,000 listed US firms from 1980 to the end of 2014 and applied 51 company-specific characteristics. Only a small number proved jointly significant in the absence of transaction costs. Five characteristics, namely: unexpected quarterly earnings, low volatility, asset growth, short-term reversal and profitability, help to increase the mean return while simultaneously reducing risks. While the beta characteristic's factor posted a mean return of approximately zero, Uppal said, it still reduced risk and, thus, diversified the portfolio. Furthermore, Uppal and his co-authors found that return volatility and beta are highly positively correlated, hence providing a nearly perfect hedge.

Perhaps counterintuitively, the number of significant factors increases to 15 in the presence of transaction costs. Uppal argues that this outcome is plausible because combining factors helps to reduce transaction costs given that the trades required for rebalancing different factor characteristics “net out”. This trading diversification reduced in-sample transaction costs by 65%.

Lastly, Uppal answered the question as to whether investors can exploit larger sets of characteristics to improve performance net of transaction costs. Applying the model showed that out-of-sample performance net of costs is significantly better than with a smaller number of characteristics from other prominent asset pricing models. Ultimately, Professor Uppal's work demonstrates that transaction costs provide a rationale for investors to consider larger numbers of stock characteristics for equity factor portfolio construction.

The Invesco Factor Investing Prize

The first day of the conference was rounded off by awarding the best paper with the Invesco Factor Investing Prize, which came with a cash award of GBP 2,000. After careful consideration, the jury awarded Andrea Tamoni (London School of Economics) and his co-authors Fahiz Baba Yara and Martijn Boons from Nova SBE for their academically rigorous but accessible work on “Value Timing: Risk and Return Across Asset Classes”. As part of the ceremony, Dr Harald Lohre from Invesco Quantitative Strategies cited from the scientific committee's appraisal that the “paper is simple but interesting to both academics and practitioners. Moreover, it is very well written and has an extensive analysis.” The authors demonstrate that value strategies in equities, bonds, commodities and currencies are predictable via value spreads. Returns to value strategies are found to be substantial in all asset classes when the value spread is comparably wide, and this predictability is economically and statistically significant.
In addition, the presenter provided evidence in favour of strong commonality and persistence in volatilities within pre-specified market segments such as sectors and styles. Commonalities in volatilities, volume, and liquidity give rise to cross-market impact. This observation calls for estimation models that do not focus solely on individual stocks, but rather also take into account their environments.

**Liquidity in a bundled investing world**

Giamouridis extended this analysis to day-to-day changes of stock volumes, observing that commonalities within certain market segments also exist in trading volume. This effect is equally observable across sectors, as well as across factors (investment styles) and is particularly pronounced around the market open and close. These results have implications for liquidity models and strategy execution. For example, simple trading volume forecasting models could exploit not only the respective stocks’ volume, but also sector and market volumes. Consequently, commonalities in volumes may be used to build more accurate volume and volatility forecasting models.

**Conclusion**

This year’s Frontiers of Factor Investing Conference in Lancaster showed that factor investing is a highly active and fruitful area of academic research. The two days brought together a select group of researchers to discuss the most recent advances in the theory and practice of factor investing. Given the increased interest among investors in this new paradigm, which stipulates allocating across factors rather than single securities, it is imperative for quantitative investment managers to take these advancements into account. While an integrated multi-factor approach emerges as the method of choice, the underlying processes must constantly evolve given the adaptive nature of capital markets.
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