

Financial Markets, Insurance and Pensions

DIGITALISATION AND FINANCE



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Foreword

Technology and digitalisation are rapidly transforming the way in which the financial sector is operating. Innovative applications of digital technology for financial services, or Fintech, are being used to alter the interface between financial consumers and service providers and are helping to improve communication with consumers and increase their engagement.

This publication compiles a series of articles that focus on the impact of digitalisation and technology in the areas of financial markets, insurance, and private pensions. It also discusses the tools and policies needed to ensure that the challenges posed by digitalisation result in better outcomes and better management of the risks involved.

The first article provides a framework to help financial regulators understand the developments in financial markets being driven by digital technologies and innovation. It does so by making a clear distinction between the underlying technologies and their applications to financial services. It also addresses how these developments are affecting the various aspects of the financial landscape, and the implications this may have for financial markets.

Technology and digitalisation, and their related applications are also affecting the management and delivery of insurance and pensions. These developments are the focus of the second and third articles, which respectively cover digitalisation in pensions and the insurance sector. The second article provides an overview of how digital technology is being used to improve pension design and delivery, and how regulators are managing the changes involved. Innovation hubs and regulatory sandboxes are emerging as key components of governments' efforts to support the development of Fintech and help new businesses understand how existing regulation applies to their ideas.

The third article examines the various ways in which technology and innovation are affecting the insurance sector, and where regulation and legal developments are, in turn, having feedback effects on digitalisation. The article concludes with some insights into how these developments could affect the future of the insurance sector. The use of regulatory platforms to allow innovative technologies to enter the insurance market brings many benefits (e.g. more customised insurance coverage to more people), but digital offerings need to satisfy the requirements of insurance regulations as well as wider data protection and cyber security considerations. The implications of using big data and algorithms need to be carefully assessed.

The final two articles focus on concrete examples of the application of technology and digitalisation, and discuss the benefits, risks and challenges that digital technology and its applications bring. The fourth article provides an overview of the types of robo-advisor that are now available. The robo-advice model has emerged as one potential solution to the need to increase the accessibility and affordability of advice and support for individuals seeking to invest savings for retirement. But these models also pose risks as they challenge traditional distribution channels, and are rapidly gaining market share in

terms of assets under management. Policy makers need to ensure that existing legislation applies with respect to the applicability of duty of care requirements, avoidance of conflicts of interest, transparency of disclosure and access to redress in the case of an unfair outcome for the consumer. Moreover, regulators and supervisors may need to have processes in place to ensure that the algorithms that these platforms use are accurate and robust.

The final article focuses on another example of the application of digital technology to finance, in this case the open application programming interface (API) in banking. It looks at the creation of open API standards in banking and explores the competition problems that API standards in banking address. It argues that by fundamentally changing the way in which consumers buy and use banking services this method represents the development of a more entrepreneurial approach to remedying malfunctioning markets. The article also underlines the importance of competition authorities having the ability to investigate market failures on the demand side and to take action to resolve those failures, and notes that these remedies may have consequences for other markets where consumers lack property rights over the data that is collected about their behaviour.

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This publication contributes to the OECD Going Digital project which provides policy makers with tools to help economies and societies prosper in an increasingly digital and data-driven world. For more information, visit www.oecd.org/going-digital.

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1. Framework for digitalisation in finance

This article presents a framework to help financial regulators understand the developments in financial markets that are being driven by digital technologies and innovation. The framework makes a clear distinction between these underlying technologies and their applications to financial services. The article then discusses how these developments are impacting the various aspects of the financial landscape, and the implications this may have for financial markets.

1. Introduction

This article seeks to provide a framework to help identify the various issues that emerging technologies and digitalisation present for financial markets. The framework covers several **new and emerging digital technologies**, including distributed ledger technology, Big Data, the Internet of Things (IoT), cloud computing, artificial intelligence (AI), biometric technologies and augmented/virtual reality. In the article, these technologies are linked to such **applications** as payments, planning, lending and funding, trading and investment, insurance, security, operations, and communications. The article then notes that the new and emerging technologies and their applications to financial services have the potential to influence **numerous aspects** of the financial landscape, including new business models and product designs, competition, operational efficiencies, intermediation, accessibility, consumer engagement, speed, automation, analytics, privacy and transparency, and digital security risk.

The article incorporates material obtained from OECD work over the past several years on a range of related topics, including innovation in financial services, financial institution and market restructuring, and competition in financial services. It complements the tri-partite framework of digital technologies, applications, and aspects with additional material to separate the aspects impacted by the developments related to digitalisation of financial services from the implications of these developments.

The paper proceeds as follows: The next section seeks to describe what the Fintech revolution is all about. It does so by first taking a look at technological innovations in finance over a longer time span and at previous work assessing their impacts. This theoretical backdrop suggests relevant questions to ask in assessing the potential effects of new Fintech innovations. The paper then looks at alternative definitions of Fintech developments that have been put forward and at analytical frameworks that have been developed to examine the Fintech phenomenon.

The section following the definition of Fintech looks at the digital technologies involved in these innovations. It is followed by a consideration of the most notable applications of new technologies. Keeping with the framework developed in the previous article, the succeeding section discusses the aspects of financial services being affected by these technologies.

While the article does not seek to draw definitive conclusions, it does explore the potential structural implications of these developments. The OECD, along with other international organisations and individual governments, are fully engaged in assessing the implications of technology-driven changes in the financial landscape and determining the appropriate policy responses needed to address these changes.

2. What is 'Fintech'?

To help clarify the Fintech phenomenon this article takes a step back in time to recall that technology-driven innovation in the financial services sector is not new. Rather, developments that are now being brought together under the umbrella label “Fintech” are the most recent evolution of a process of structural development that links back to the liberalisation of entry and ownership restrictions in the financial services sector in the 1980s and 1990s. Those restrictions, along with interest-rate controls and credit allocation guidelines had succeeded in limiting competition between banking institutions and between the banking sector and other types of financial business, as a means of

preserving safety as the overarching policy objective. But they left these institutions with limited financial resilience, owing to regulation-induced distortions in the allocation and pricing of credit, and vulnerable to competitive inroads by entities not subject to the restrictions. It was in part owing to the success of the threat to regulated institutions that the reform effort was introduced. Among other developments, the reforms enlarged the set of activities and lines of business in which institutions could engage and also allowed for much broader participation in the provision of financial services.

In retrospect, it is the combined effects of deregulation and technology that helped to spur institutional change.¹ This was noted, for example, in the “Report on Consolidation in the Financial Sector”, which was published by the Group of Ten in 2001. The study cited technological change as one of the major driving forces behind the wave of consolidation (mergers, acquisitions, and strategic alliances) then taking place in the financial sector. The Group of Ten report drew the general conclusion that technological advances had altered the competitive functioning of the financial sector at both the production and the distribution levels, which among other effects had resulted in a need for service providers to find new sources of output efficiencies.²

In the Group of Ten’s overall assessment, information technology, along with deregulation of product offerings, were seen as playing a role in facilitating competition on a product-by-product basis and in enabling institutions to harness information more productively to develop tailored products that could be channelled to specially targeted customers. This process was aided by growing acceptance of electronic delivery channels on the part of financial consumers, which enabled service providers to gain access to new customers without the necessity of a physical presence. These same arguments are re-surfacing in the discussion today about some Fintech innovations.

In the years since the Group of Ten’s report was published, technological advances have continued to drive structural changes in the financial services sector, having both direct and indirect effects. The question for the current report is where Fintech developments fit in this process. The sheer pace of recent product and market innovations and the wide range of different functions being targeted at present appear to raise some causes for concern. The following section seeks to gain some insights into Fintech innovations, beginning with recent attempts to define the activity.

Fintech definitions

“Fintech” is a catchy label for the rapid developments in financial services that are largely being driven by digital technologies, but the term is not precisely defined in practice. In some references, the Fintech label has become synonymous with the companies that provide any of the underlying technologies or services, and often comes with the misleading connotation of encompassing only start-up companies. Other definitions do not distinguish between the digital technology used and the financial services to which the technology is applied.

While most definitions contain references to new technologies, to innovation, and/or to disruption, definitions that specify ‘new technologies’ tend to leave out innovations that rely on existing technologies, such as digital and mobile payments. Likewise, the focus on technology potentially ignores developments linked more to innovations in business models, such as the peer-to-peer platforms that are emerging. Also, the implicit assumption that Fintech businesses are *start-up* companies ignores the large number of well-established financial service providers using these new digital technologies or offering similar services.

Some recent examples of Fintech definitions include:

- "finance enabled by new technologies" (EU Parliament)³,
- "innovations in financial technology" (US National Economic Council)⁴,
- "digitally enabled financial innovation" (FSB)⁵,
- "newly emerging digital technologies adopted in the finance industry" (HKMA)⁶,
- "a variety of innovative business models and emerging technologies that have the potential to transform the financial services industry" (IOSCO)⁷, and
- "emerging innovation involving the use of digital technologies for the provision of financial services"

If the objective is to capture all financial innovations enabled by the use of digital technology, then most definitions will fall short. The FSB's definition and classification of 'digitally enabled financial innovation' sensibly links various innovations to their relevant economic function. But it does not differentiate between innovative technologies (e.g. wearables) and innovations in financial services (e.g. e-trading).

The definition used by IOSCO of "a variety of innovative business models and emerging technologies that have the potential to transform the financial services industry" explicitly recognises both emerging technology and the new business models, but does not recognise the linkages between the two. Their proposed categorisation puts the categories of financial applications and new technologies on equal footing, but does so without recognising, for example, the applications of data and analytics to insurance or the relevance of digital currencies powered by *blockchain* technology to payments. Nor does it recognise certain new technologies which can be used by financial service providers, including for example the use of biometric technology in security applications.

Finally, none of these definitions and classifications recognises all of the relevant applications of digital technology to financial services. Notably, the use of technology to improve the efficiency of internal processes, regulatory compliance, and communications is absent. The inclusion of such applications in the discussion about the changing financial landscape is therefore necessary.

The shortcomings regarding the definitions and categorisations of Fintech underline the need to develop a more comprehensive framework to help guide policy makers in approaching the topic of the digitalisation of financial services. While a basic understanding of the technology may be necessary, a main concern of policymakers and regulators will be the applications of digital technologies and their implications for business models, organisational processes, etc.

As long as technological innovations provide for increased efficiencies, these developments will continue to drive significant changes in the way financial service providers operate, and will have significant implications for financial consumers, including micro and small businesses relating to the cost and security of services.

All told, Fintech involves not only the application of new digital technologies to financial services but also the development of business models and products which rely on these technologies and more generally on digital platforms and processes.⁸ The framework elaborated in this article aims to overcome the limitations in the definitions and categorisations developed to this point. It distinguishes among new technologies that are emerging, the applications of these technologies and digital processing to financial services, and the most relevant aspects that are impacted by these trends. These

developments cut across a wide range of financial policy concerns and objectives relevant for the OECD Committee on Financial Markets (CMF), including market structure, market stability, consumer protection, financial education and financial inclusion to name a few. The next section looks at the technologies that are behind the Fintech wave of developments.

Digital technologies used in financial services

The ongoing advances in telecommunications and computing technology have been an important force in the transformation of finance. Technological advances have greatly improved quality and processing speed and helped to lower information costs and other costs of transacting. These developments have had implications for both providers and users of financial products and services.

The discussion that follows provides a brief overview of new and emerging technologies that are being applied to financial services. These include distributed ledger technology, Big Data, the Internet of Things (IoT), cloud computing, artificial intelligence, biometric technologies and augmented/virtual reality. While these technologies are discussed separately it should be noted that there are interdependencies among many of them. For example, AI is enabled by Big Data, cloud computing and increasingly the IoT.⁹

Distributed ledger technologies

Distributed ledger technology (DLT), also commonly referred to as *blockchain* technology, which is its most commonly used form, is a database technology that allows the creation, secure transfer (with finality) and storage of information. Contrary to other ledgers, however, distributed ledgers are not centrally controlled and administered. Rather, the responsibility for administering and verifying transactions is shared across the users of the blockchain. Box 1 provides a brief introduction to how DLT works.

DLT first emerged as the technology that underlies the cryptocurrency bitcoin. Since bitcoin was introduced, other such currencies have also been developed, perhaps most notably the Ether cryptocurrency using the Ethereum blockchain. However, numerous potential applications of DLT to financial services beyond digital currencies are becoming apparent. As such, given the link of DLT to the payments system, the technology has been receiving relatively more attention than other technologies, as regulators see the need to understand the underlying concept and its implications and to address potential shortcomings and concerns on the consumer protection front.

As a ledger technology, DLT could potentially be applied to any sort of financial transaction relating to payments, including, for example, trading, post-trade settlements or insurance payouts. DLT has been used to establish smart contracts, or arrangements which automatically execute the agreed transaction when certain conditions are met.

DLT could also be used for a variety of recordkeeping tasks. Some applications have been to make compliance with Know Your Customer (KYC) requirements more efficient, or to streamline a mortgage application process where documents from numerous parties are required. The transparency of these records may also facilitate the supervision of financial institutions by authorities.

Box 1. Distributed Ledger Technology

DLT is a protocol used to build a ledger system to store records, such as those relating to ownership, transactions or contract agreements. DLT is not centrally controlled by a single party, or intermediary, however, and instead shares the responsibility of adding to and maintaining the ledger with all participants. Each participant has their own identical copy of the ledger, and any new addition to the ledger must be approved and agreed upon by all participants. The ledgers are formed through a series, or 'chain' of blocks of information. When a transaction has been approved by the participants, a new block is formed on the chain of transactions. This information is permanently recorded on the ledger, and cannot be tampered with.

Unpermissioned or permissionless ledgers are open to anyone to contribute. Unpermissioned ledgers require participants to perform "mining", which involves solving complex and computationally intensive algorithms to validate transactions. This mechanism is known as "proof of work". Given the resources required to mine, participants need to be provided some incentive to contribute to this process. This reward can be in the form of cryptocurrency, for example, as is done for bitcoin.

Distributed ledgers can also be restricted to a group of approved participants, known as a permissioned or private ledger. Permissioned ledgers are less computationally intensive as the mining process is not required, and the participants in the consortium simply check the validity of the transaction. This structure also increases the security of the ledger and reduces the risk of cyber-attacks. Furthermore, as the ledger is not available to everyone, this format is more suited to recording confidential information.

Source: ASTRI (2016), "Whitepaper on Distributed Ledger Technology", commissioned by the HKMA

Given these applications, DLT has the potential to greatly improve the efficiency of operations in the financial sector. However, the immutability of the underlying code and the subsequent irreversibility of transactions could present potential problems for financial transactions, as ultimately the accuracy of the underlying code is still exposed to human error. Mutable blockchains have been proposed as a way forward, even though such an approach may put the original purpose of the technology, or at least some important aspects of it (*e.g.* finality), in question.

Big Data analytics

The digitalisation of day-to-day activities has dramatically increased the amount of data available, creating extremely large and complex data sets commonly referred to as "Big Data". Such data are not only drawn from text or numeric forms, but also from images, video and audio clips as well as from data generated by communication and other devices (*e.g.* smartphones, Internet-connected PCs). The rapid advances in information technology are now allowing for the processing and analysis of such large data sets.

Big Data can potentially be used at every point along the value chain of financial products, from conception to sale. Analysis of Big Data could be used to improve market research and inform product design. It could also be used for more granular price

discrimination by allowing a more accurate assessment of a given individual's risk profile or willingness to pay. Profiling can also lead to targeted advertising, which in one application could tailor online promotions to an individual's characteristics inferred from their Internet use. Big Data could also potentially be used for internal risk management and outside monitoring of financial services and institutions and thus make supervision more efficient. For example, analysis of large data sets could improve fraud detection.

Three concepts closely connected to Big Data are the “Internet of Things”, cloud computing and artificial intelligence. The Internet of Things is a source of Big Data, cloud computing facilitates the processing and storage of large datasets, and finally artificial intelligence is an advanced way of analysing and using Big Data. These concepts are discussed in turn.

Internet of things

The Internet of Things (IoT) refers to the numerous connected devices that capture information regarding movement and other sensing data of objects in the physical world, and is expected to represent an increasing source of Big Data. The IoT can provide rich information regarding individuals' behaviours; thereby, the resulting data can be used for increased tailoring of products, risk profiling and pricing.

Cloud computing and storage

Cloud-based services provide cost-efficient and relatively easily scalable on-demand processing and storage capacity for data. Cloud technology has greatly increased the capacity of financial institutions to collect and analyse data, thereby facilitating the growth in data analytics and their various applications.

Artificial intelligence

The sub-fields of this science can focus on a range of different aspects of human intelligence, including recognition, understanding, learning, problem solving, reasoning and decision making.¹⁰

Artificial Intelligence (AI) is often used in reference to machine learning, whereby machines are trained with historical data to recognise patterns and classify new data. Through advanced algorithms a machine can learn patterns with new experiences to improve its performance. However, the machine is not learning entirely on its own; rather, the learning process requires a significant level of human input to make sure the data is interpreted correctly.¹¹

Deep learning is a subset of machine learning. It takes a layered approach to calculations, starting from high-level abstractions and gradually moving to more specific features. As deep learning is able to tackle unstructured data such as text and images, it has many potential applications for the analysis of Big Data.

Biometric technologies

Biometric technologies rely on the recognition of physiological or behavioural characteristics, and can be used for identity authentication by detecting characteristics unique to individuals. Techniques that are now being used for verification include fingerprint scanning, voice authentication, face recognition, iris scanning, and gait recognition.

Biometric technologies represent a great improvement in security over verification by passwords, and could be used to increase the security of financial transactions, thereby reducing the risk of fraud or data theft. Nevertheless, these technologies are still in development and security is being improved to reduce the risk that biometric information is compromised.

Augmented/virtual reality

Augmented and virtual realities provide new ways for consumers to perceive or interact with their environment. The difference between the two is that augmented reality provides an enhanced view of the actual physical world in which individuals find themselves, whereas virtual reality creates a simulated world.

3. Applications of digital technologies in financial services

As noted previously, technological advances and new innovations have had effects all along the value chain for financial products and services, in numerous applications, some of which have been introduced by new entities while others have come from incumbent financial institutions and other existing service providers.

The framework presented here classifies the applications covered into eight distinct categories: **payments, planning, lending and funding, trading and investment, insurance, cybersecurity, operations, and communications.**

Table 1 provides a mapping of the selected digital technologies to the categories of financial activities and services being affected. As shown, some digital technologies have wide ranging applications while others remain more limited, but all have the potential to significantly impact financial services/markets. These categories and the effects of Fintech developments on financial contracting in these activities and services are discussed in the following sub-sections.

Table 1. Applications of new technologies to financial services

DIGITAL TECHNOLOGY	FINANCIAL ACTIVITIES AND SERVICES							
	<i>Payment services</i>	<i>Advisory & agency services Planning</i>	<i>Investment & trading</i>	<i>Lending & funding</i>	<i>Insurance</i>	<i>Security</i>	<i>Operations</i>	<i>Communications</i>
Distributed ledger technology	x	x	x	x	x	x	x	x
Big Data		x	x	x	x	x	x	x
Internet of things					x			x
Cloud computing				x			x	
Artificial intelligence		x	x		x			x
Biometric technology					x	x		
Augmented / Virtual reality		x	x					x

Payments

Payments represent the most basic application of digital technology to financial services, one which, while not new, is evolving with emerging technologies. Although digital payments began with physical instruments (e.g. credit cards), payments have been moving more and more into the virtual domain. These innovative payment services can

broadly be classified into online payments and mobile payments, although the increased use of mobile broadband connections for mobile communications is admittedly lessening the importance of the distinction. Online payments are defined as payment orders which are placed using devices connected to the Internet, and mobile payments as those which rely upon devices connected to a mobile communication network.¹² Therefore online payments encompass online banking, electronic commerce (e.g. Amazon) and payment services (e.g. PayPal).

Mobile payments include mobile money transactions using mobile network operators (e.g. payments by SMS) and pre-paid cards linked to mobile phones. Payments are not restricted to the banking sector either; mobile payment applications also exist for insurance, where registration and insurance payments can be performed using a mobile device.¹³

In other developments, digital transactions are being used in new business models established to facilitate cross-border payments, namely through peer-to-peer currency exchange platforms, which can match currency buyers and sellers to eliminate the spread on the exchange rate.

Innovative payments applications are also making use of DLT. The first payment application made possible through this technology was the cryptocurrency bitcoin, and the technology has since been used for other cryptocurrencies like Ether. Cryptocurrencies can be used as regular currency, and can be managed with digital wallets stored on a smartphone. All transactions are permanently recorded on the blockchain, and new currency can be generated by 'miners' who succeed in solving the required algorithm.

Smart contracts are a more recent development in the use of DLT for payments, but they have not as yet raised the same types of concerns as the other DLT-related forms of payment. These agreements are self-enforcing and automatically execute a transaction when certain conditions are met. Such arrangements can be used, for example, to facilitate swap payments. They have also been used in the insurance sector to automatically pay out insurance claims when the insured event, such as a delayed flight, occurs.¹⁴ Additional applications are also being developed for insurance, such as the automatic settlement payments for natural catastrophe swaps or optimising payments for international fronting for captive insurers.¹⁵ Smart contracts could also be combined with IoT technology to automatically link connected devices with the related insurance policy.¹⁶

In more recent applications, market participants are attempting to design a solution using DLT to make post-trade payments, clearing, and settlement more rapid and efficient. However, such applications have not yet succeeded at being implemented in practice and some observers have expressed doubts as to whether blockchain would be well suited to such transactions.¹⁷

Advice and planning

The rise of digital platforms presents numerous opportunities for engaging and assisting consumers with their own financial planning. Websites and online courses can facilitate consumer access to financial information and training. Advice and planning have also been facilitated by augmented reality, which can be combined with gamification to improve the learning experience. Training can also be made more interactive through gamification, which can help to develop consumers' competencies and confidence in

managing their finances. Budget tools and retirement planning tools can help consumers to better plan their spending and savings. Other applications, such as self-commitment tools which help consumers to save, can help consumers to address their own behavioural biases. Such digital tools to support financial education have been widely developed.¹⁸

Digital platforms can also be used to help consumers to keep track of their finances. Some countries have developed pension “dashboards” which enable beneficiaries to obtain an overview of all of their sources of pension income and to take corresponding actions, such as adjusting their contribution rates.¹⁹

Digital platforms can also help consumers to compare financial products and decide on those products in which to invest. Comparison platforms have been developed to help consumers choose insurance products, mortgages, and investment/savings products. Both are being applied notably to financial education and financial planning services.

Advice and planning have also been facilitated by augmented reality, which can be used to improve the learning experience through “gamification”.²⁰ Augmented reality can help to facilitate the comprehension of complex data sets through immersive data visualisation. For consumers, augmented reality has been used to help investors visualise their investments and facilitate their investment decisions.²¹

Another application of digital technology in the advice and planning sphere takes the form of *robo-advisors*, which are beginning to use AI technology for client services and to provide investment advice based on an individual's account activity. AI is also being used for consumer support, whereby *chatbots* can interactively answer questions that consumers may have about their product or service.

Virtual reality applications similar to those of augmented reality have also been developed in applications for financial advice that provide virtual consultations with banking or insurance experts.²²

Investment and trading

Digital technologies have also been used to create new and/or more efficient ways to access and optimise trading and investment. For example, direct trading and investment platforms are facilitating access to markets for both institutional investors and retail consumers. For institutional investors, these platforms are reducing reliance on market makers for trading purposes. For retail investors, trading and investing can be done at a much lower price than going through an intermediary, and some platforms even offer ready-made professionally designed portfolios.²³ Social trading platforms are another example. They can allow investors to automatically copy the trading strategies of traders that they choose to follow.

At a basic level, the application of algorithms to trading and the speed with which transactions can be executed has enabled high-frequency trading. But algorithmic trading is now being expanded to new applications.

Robo-advice platforms offer investment and portfolio management services which can automatically trade to maintain the desired risk profiles of portfolios or to realise investment losses for tax purposes.²⁴ Robo-advice platforms can also use algorithms to recommend a certain investment strategy given an investor's profile or risk. Similar services marketed to businesses can help them to manage portfolio risk or optimise asset-liability management.

AI also has potential applications for the optimisation of investment, by recognising patterns and predicting which investments will be high future performers. The technology is already being applied for hedge funds.²⁵ Some hedge funds are already using AI in their investment models. AI is also being used to integrate ESG variables into the investment strategy.²⁶

In another application of digital technology to investment and trading, augmented reality has been tested as a means to help traders improve their ability to quickly digest financial market data and recognise trends.

Lending and funding

Applications of digital technology to lending and funding operations are helping to make credit accessible to individuals or businesses that previously may have had difficulty accessing the traditional credit market.

New business models for lending and funding are emerging, notably peer-to-peer platforms. These peer-to-peer platforms can take on one of several different models. With donation and reward-based platforms, the individuals funding the counterparty donate funds outright, e.g. for a social cause or in exchange for a future reward (typically a product or service generated by the funded project). With loan-based platforms, individuals expect to be repaid their investment with a return. With equity-based platforms, individuals receive a stake in the company raising funds.

Big Data is also providing an opportunity to better assess the risks related to lending. New methods for calculating credit scores based on non-traditional variables such as social networks are emerging in practice, refining these scores to better represent an individual's risk characteristics.

In another application of Big Data, payment processor Worldpay began extending loans to SMEs in partnership with Liberis, a London-based nonbank business-to-business lender, offering unsecured cash advances based on projected card sales. Worldpay is able to analyse the sales data going through its system to determine in advance what amount customers are able to repay and over what time period and, thus, is able to advance only amounts of capital that are within those limits.

Insurance²⁷

Applications of digital platforms and new technologies are also transforming insurance. First, they are changing the way insurance is accessed and distributed. Providers are now offering access to insurance through mobile devices, for example. Peer-to-peer insurance platforms are also emerging, whereby individuals can form their own group of individuals with whom to pool risk.²⁸

The biggest impact to insurance, however, may be the uses of technology to improve underwriting and the pricing of risk. Big Data and improved data analytics, including AI, are increasing the number of variables which can be taken into account for the pricing of a policy. However, while this may increase precision, it also may push the boundaries of the goal of insurance to pool risks and lead to exclusion from insurance for risks deemed to be “bad risks”.

This increased precision and efficiency in underwriting also enables new types of products to be offered. Insurance contracts can be issued for very short periods of time, for example, for specific car trips or for short-term home rentals.

Digital technology is also changing how policies can be underwritten. For example, facial recognition technology can be used to estimate the health and age of an individual for the underwriting of life insurance. Sensors and cameras in cars can detect the driver's behaviour on the road, and this information can be used to determine the premiums for auto insurance.

In the health arena, AI can also be used to analyse photos to identify certain medical conditions or the health of individuals. It has successfully been implemented, for example, to detect skin cancer from a photo on par with the performance of dermatologists.²⁹

Cybersecurity³⁰

While the increased reliance on digital technology may increase the risk of cybersecurity being compromised, digital technology also presents numerous opportunities to improve the security of digital financial services.³¹ Data encryption to protect digitally stored data is improving with technology. Biometric technology can be used to improve identity verification and authentication to reduce the risk of stolen passwords or falsified transactions. Data analytics can be used to detect irregular patterns and pinpoint if fraud has occurred. DLT could increase the transparency of transactions, making them easier to track and control, and also reduce the risk of falsified transactions.

Operations

For all types of financial institutions, technology has the potential to greatly improve the effectiveness of processes and efficiencies with which they operate and reduce overall overhead costs. Day-to-day processes can be streamlined through increased automation. Compliance functions can be more efficient, and applications of technology are being devoted to facilitating regulatory compliance, which are often referred to as “RegTech”. Such applications can facilitate regulatory reporting requirements or other compliance processes, for example through the use of DLT or another digital database to facilitate Know Your Customer (KYC) requirements. Applications are also being developed to facilitate risk management functions.

Communications

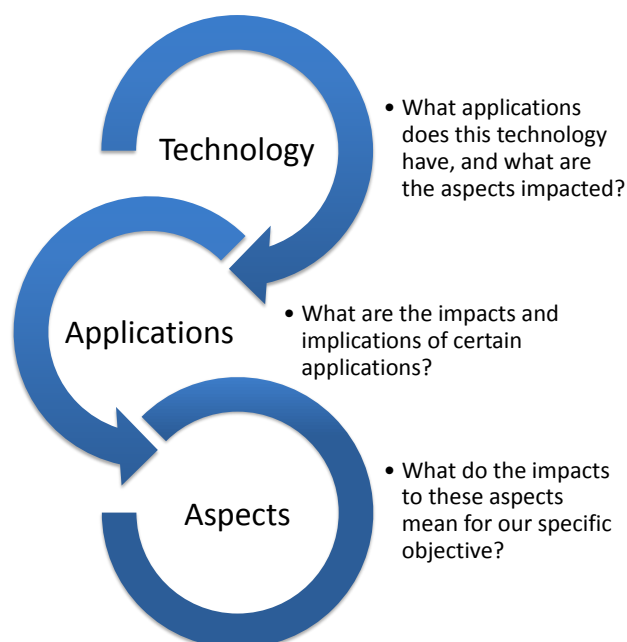
New technologies are also changing the way financial services providers communicate with their clients. They are changing the way financial products are marketed. Online ads are often targeted to the profile of their viewers, which is inferred from their online behaviour and browsing habits. Once consumers are engaged with a product or service, regular communications can be tailored to them individually, for example, via text message reminders to contribute to a savings plan or pension fund or to pay bills. Consumer support functions can also be transformed with technology, such as the use of *chat bots* or virtual reality sessions with an advisor.

4. Aspects of financial activities and services affected by Fintech developments

Generally speaking, understanding the impacts and implications of Fintech developments can be approached in one of **three ways**. The first way is to start with the technology, such as DLT, and then look at the applications of this technology to financial services and the potential implications that it can have. The second is to look at a specific application, such as crowdfunding, and consider the implications specific to this application. The third

way is to start with a focus on the impacts that these changes are having, such as increased cyber-risk, and what these changes imply for specific policy objectives.

Figure 1. **Dimensions from which to assess the digitalisation of financial services**



The applications of these new digital technologies are having a major effect on key aspects of financial activities and services. To understand it helps to start with the basics of financial contracting. Financial transactions can be executed on a bilateral or multilateral basis, either directly between counterparties or through markets or indirectly through financial intermediaries. A core objective of the financial system is to help facilitate these interactions. The pooling and allocation of scarce and dispersed capital to facilitate the exchange of goods, services, and ideas is one of the core intermediation functions. Other main functions of the financial system and the intermediaries operating therein include:

- Facilitating an efficient storage of wealth
- Facilitating maturity transformation
- Facilitating the exchange of domestic payments
- Facilitating the exchange of currencies between countries; and
- Providing a means by which financial and other risks can be managed

Technological progress, broadly construed to include technical aspects of digitalisation along with Fintech innovations, is affecting many aspects of the financial intermediation process, ranging from upstream activities associated with the creation/origination of products and services all along the value chain to activities associated with their distribution to end-consumers. The evolving digital production functions, embodying digital products transmitted over digital channels, are changing the economics of the financial intermediation process.

Growing acceptance and trust on the part of consumers, at least for some aspects of digital life, is a big part of this development. As financial consumers have become more knowledgeable about financial products and services, and as their comfort level with

technology (e.g. online delivery channels) has grown, the number and type of activities they require to be carried out in direct physical proximity to the service provider have declined. This trend has been longstanding for many services at the wholesale end of financial services, but it has also firmed for many retail financial services, as the Internet and other electronic delivery channels have grown in popularity. Financial education plays a role in this process by helping consumers better understand financial markets, products and services, but technology has played a major role. By lowering search costs, ICT has enabled financial consumers to more easily acquire information, not only about alternative products and services but also about the providers of these services, including about the quality of the customer experience they offer.

For the financial services sector as a whole, these factors have given rise to multidimensional effects on competition. New competitors have entered, including various types of non-traditional competitors, offering more flexible terms and improved quality. Examples of the aspects of financial intermediation that have been affected are described in the following sub-sections.³²

Operational efficiencies

In the merger wave period in the wake of financial liberalisation, competition for savings was increasing both within financial service sectors and among intermediaries from different financial services sectors. This phase was mainly about consolidation and integration of financial services, both vertically and horizontally, across products and geography, in the quest for scale and scope economies.

While scale and concentration pose potential risks for stability, these risks are fairly well understood by the policy making community, so apart from the occasional intervention by competition authorities, the process of consolidation was allowed more or less to continue for some time, as long as managerial expertise and capital kept pace with the expansion in size and scope of operations. Among other benefits, new ICT technology brought lower infrastructure costs, which helped to increase the feasible scale of providing certain types of financial products and services (e.g. custody, risk management and asset management). Lower infrastructure costs also facilitate increased distribution capacity, even globally, given the ubiquitous nature of the Internet.

Scale economies can still exist in the Fintech world, but in contrast to the physical size of an enterprise, in this case it relates to access to data. Customer data becomes the principal source of comparative advantage and a potential barrier to entry. There can be data scope effects as well. This is certainly the case for many Internet firms, with business models that involve the collection and analysis of large streams of data collected from the Internet.³³ By collecting and analysing “Big Data”, Internet companies are able to automate their processes and to experiment with, and foster, new products and business models at much a faster rate than non-Internet based competitors. In particular, the advanced use of data and analytics enables Internet firms to scale their businesses at much lower costs than other ICT firms.

In the financial sphere, the increased efficiency that technological innovation allows in terms of processes and operations can also result in lower operational and regulatory compliance costs. While new entrants tend to be more nimble and flexible in adapting to changing markets, mainly on account of not being burdened by legacy systems, securing these benefits can prove challenging for incumbent players, which are required to update their IT systems and administration, especially those entities formed via mergers of

various separate institutions, each with their own systems, which can present compatibility problems.

Intermediation

The disintermediation of financial services providers is often the focus of discussions relating to the digitalisation of financial services, but these trends also result in changes in intermediation or even new intermediaries being created. The use of cryptocurrencies as a means of exchanging payments is a prime example of a technological innovation challenging the business model of incumbent providers, as electronic payments no longer have to go through banks. Peer-to-peer platforms change the intermediary structure, with the digital platforms, which match both sides of the transaction, replacing the traditional bank as counterparty.

Robo-advisors also remove a level of intermediation, giving consumers direct access to the types of tools that financial advisors have been using for years. Mobile distribution agents who sell mobile insurance or provide mobile payment services in emerging countries are another new form of intermediary.

Speed

Speed has two meanings in the context of the digitalisation of financial services; it refers both to the speed of operations and the speed of change. On the one hand, digital transactions can be executed much more quickly than could be done previously. This may also imply that consumers may take less time to reflect on their transactions. The speed of trading in the market also may impact market movements and stability. On the other hand, the speed of change means that technologies and services are evolving rapidly, and both regulators and consumers alike will need to stay on top of these changes to ensure that these services can be used safely and effectively.

Accessibility

The digitalisation of financial services has generally increased the accessibility of various financial products and services to consumers and has great potential to help attenuate financial exclusion of more vulnerable groups. New models have targeted previously underserved market segments, and mobile banking in particular has brought banking services to these market segments in developing economies. Nevertheless the trend towards digital and online-only services may inadvertently contribute to the financial exclusion of groups who lack the connectivity and/or the technical skills or knowledge to use them, such as the elderly.

As financial services are also becoming accessible from a large variety of devices this may have implications for how consumers perceive the products and services in which they are engaging and how these services are adapted to a given device.

Consumers and small businesses may need new technical skills to use digital financial services that also expose them to new risks. These trends have implications for the educational and legal protection needs of the population, and the question for policy makers is how financial education and financial consumer protection can be made more effective in this environment³⁴.

Consumer engagement

New customer interfaces and the ease of use of digital financial services have the potential to increase the degree to which consumers are active in managing their finances, and offer new opportunities to engage consumers with technology such as text messages and videos. Nevertheless these trends may also lead to consumer disengagement, as the ease of transacting may require less follow-through on the part of the consumer. The reliance of some services on automation may also lead to a lack of attention by consumers, as no real action is required on their part to manage their investment. Such ease of use may also create new risks for the consumer, and may lead to overuse and cost increases on the side of the provider

Automation

Along with the use of digital technology in financial services comes the increased reliance on algorithms and the automation of processes. While in some respects reduced human involvement also reduces the chances for human error, the algorithms themselves rely initially on human input; therefore, this exposure is not fully eliminated. Furthermore, with automation any potential errors may be more difficult to detect before a problem occurs and may spread faster and more widely before being remedied. Automation, particularly with respect to investments, could also lead to herding behaviour, potentially affecting market valuations and stability.

Product delivery

Technological improvements have transformed the way financial institutions develop and distribute their products and services. Quite simply, face-to-face interaction has given way to online delivery for most standardised products, and products and services that were once thought necessary to be tailored to the specificities of particular customers can also now be developed, contracted, and delivered remotely.

The global nature of the Internet, as a basis for delivery, makes a global scale feasible, even for smaller entities, providing for cross-border access without the necessity of a physical presence. The upfront fixed costs can be sizable, but once in place the marginal costs are much more trivial.

Digital security risks

The increased reliance on digital technology and digital financial services clearly goes hand in hand with higher digital security risk. While cybersecurity risk is not unique to Fintech, greater connectivity from digital solutions expands the number of entry points for cyber hackers in search of a weak link in the network.³⁵ This may be particularly relevant for client-facing applications using customer data, and new devices, including those connected to the “Internet of Things.” Indeed, a number of recent incidents have involved fraud and theft through mobile banking apps, and there have been breaches of personally identifiable information, particularly as a large number of mobile devices lack anti-virus software.

The OECD report on the *Next Production Revolution* notes that cybersecurity risks and lack of trust are often indicated as the most common reasons that financial consumers with access to the Internet do not use some digital technologies and applications and refrain from engaging in online or mobile transactions.³⁶ Among the concerns commonly expressed are the growing risk of online fraud and the misuse of personal data as well as

the rising complexity of online transactions and related terms and conditions. Uncertainties about the existence and effectiveness of redress mechanisms in the event of a problem with an online purchase add to their reluctance. The following sub-section discusses these issues in more detail.

Data analytics, privacy and transparency

Information technology influences the gathering of information, its analysis, and its transmission. Digital technological progress has greatly increased the ability for advanced analytics to be used in financial services. While this development can lead to better-suited products and services, it also raises the issue as to whether there should be a limit to individual profiling. This issue has particular implications for consumer protection and privacy relating to targeted marketing as well as the pricing of insurance and access to the insurance market. It also creates policy issues related to exclusion of disadvantaged individuals from lending and other financial services more generally.

The use of AI, in particular, requires consideration as to how such algorithms should be audited and monitored, and what sort of impact implementing investment models that use AI could have on market valuations and stability.

The increased availability and use of consumer data raises issues relating to the ownership and use of this data and the implications this could have for consumer privacy. It also raises questions about the extent to which available data should be shared to enhance regulatory and consumer protections. There will need to be a balance found between these two objectives of protecting consumers' privacy and ensuring transparency of transactions.

5. Structural implications of Fintech innovations

As the discussion in the previous section suggests, many key aspects of the production and distribution of financial products and services are being affected by developments linked to new digital technologies. All of these developments affect the way that investors and financial consumers interact with providers of financial products. But underlying these developments are some basic needs that haven't changed, and it is important in the attempt to assess the potential implications of Fintech innovations to have a clear idea of the "big picture".

Financial service providers can certainly structure new products and call on their sales and marketing teams to try to convince clients that they really 'need' the products in question, but most successful products satisfy an existing need. In this context, retail clients still have a need for some type of current account, for loans to finance large purchases and investments, for financial advice, and for remittance capabilities and money transfers. Corporate clients still have a need for equity, debt, M&As, advice, cash management, foreign exchange operations, etc. These basic needs remain more or less the same. What is changing, from the viewpoint of the end-users, is how the needs are met.

In effect, the traditional relationship between consumers and financial service providers is being altered by the new digital technologies and related services. The channels through which funds flow from sources of funds to users, are changing.

The various components of the financial system – the institutions, markets, and infrastructures – help to support sustainable long-term growth of the economy by helping to ensure that scarce savings are allocated optimally among competing investment

opportunities. The functions that support the attainment of this objective include credit allocation, price discovery, and facilitation of payments. These financial intermediation functions help to link providers and users of funds and allow consumption decisions to be smoothed over time and across geographic space.

Digital technologies and their applications are resulting in much lower costs of interaction and less importance of geographical proximity. The importance of physical locations for providing these functions, such as bank branches, has dropped considerably for many types of financial transactions (e.g. payments) as has their importance as primary sources of information about the consumer (especially at the retail level). This shift in information and some basic banking services hits traditional intermediation at its core and, at a minimum, threatens the revenues incumbent service providers have derived from providing these relatively standardised products and services. In some conceivable future scenarios, the economic viability of traditional business models linked to these services becomes highly questionable.

Competitive challenges to incumbent service providers

Theoretical arguments have long held that the process of financial intermediation is mainly about processing information of one form or another. In the strictest interpretation,³⁷ intermediaries owe their very existence to the information asymmetry between would-be users and sources of funds and to other market imperfections that make it costly for users to find sources (search costs) and negotiate directly.³⁸

A few decades ago, as the digital revolution was picking up in earnest, and as regulatory barriers to entry were coming down, researchers began to hypothesise that this particular function of intermediaries would cease to add value (i.e. warrant remuneration) if relevant information about prospective users of funds were readily available. The particulars of the hypothesis put forward was that, as costs of interaction fell, more sources of funds would go directly to prospective users and serve as new points of interface, and that new forms of intermediaries would emerge to provide online markets and to assist in solving the matching problem between the supply of funds and demand.

Researchers further hypothesised that this process would result in the eventual complete deconstruction of the value chain for financial services, whereby product creation would be completely unbundled from distribution: upstream would be institutions that supply products linked to specific, stand-alone businesses, and downstream would be specialised entities that use their distribution networks to market products of institutions from whatever service segment.

Many arguments put forward in this context stopped short of full ‘open architecture’ but nonetheless identified a number of alternative competitive scenarios, which collectively contained the following key characteristics:

- unbundling of production from distribution
- less value to vertical integration
- decline in the role of traditional intermediaries
- increase in disaggregation, including outsourcing
- increased specialisation (e.g. product specialists, channel specialists, relationship specialists)
- new forms of intermediaries

A couple of decades ago when these scenarios were formulated, the likelihood of their becoming reality seemed remote. But as data capture and analytics have grown and as digital technologies have further developed, costs of interaction have indeed declined and numerous market segments (e.g. credit extension, provision of risk capital, insurance, advisory services, wealth management) have been challenged by new digital-based firms, including entities from outside the traditional types of service providers.

These new companies have a number of advantages over incumbents, including importantly, their adaptability to individual client needs. Unencumbered by legacy infrastructures and focused on only a few core services, these new companies are able to offer users a more tailored, faster, and more cost-effective service.

As the discussion on applications indicates, digital-based financial services are being targeted at various market segments, lending being a prominent example, and transactions are increasingly being executed across more than one jurisdiction (subject to local restrictions), which again points to the waning importance of location as a determinant of how consumers access financial products and services.

The decline in the importance of geography is certainly at odds with historical arrangements established to service the retail market segment. The importance of the face-to-face relationship led services providers to devote considerable attention and investment on developing or gaining access to such distribution channels. The classic examples include the branch-based distribution network of commercial banks and the local agent/broker network of insurance companies. The problem with these infrastructures, especially the physical branch networks of commercial banks, is that they are very costly to establish and maintain. Given the high fixed costs, to make them more cost-effective and efficient requires increasing the volume of products and services that are distributed through them. But these strategies are not without limits and the existence of more efficient specialised (online) providers will continue to put pressure on margins derived from physical interface points.

It is difficult to pass a high enough volume of products through physical distribution channels to spread the fixed costs to levels that achieve competitive pricing against digital delivery methods. And digital delivery has other advantages: it makes it feasible to reach dispersed clients who are geographically remote or even across borders, provided they are connected to the Internet; digital delivery also facilitates adding to the services that are on offer; in the process potentially creating products that are better tailored to the end user; and, digital technology makes it feasible to provide the same product or service in several languages and deliver it via multiple platforms to reach different population segments, including vulnerable groups such as migrants and those with disabilities. Given these advantages, it seems clear that physical distribution channels face a serious competitive threat if clients no longer require a face-to-face interface. Incumbent institutions face the difficult challenge of finding ways to rationalise their existing physical distribution points or to close them.

New business models and product design

While it is far from clear that the point of complete deconstruction of the value chain for financial products and services is near, evidence is emerging in favour of most of the components of the future scenarios hypothesised some years back. Digital technology is becoming a means of offering faster, more convenient, and more cost-effective service, which is proving to be a major competitive advantage.

On the consumer side, new payments technologies and digital financial services are altering the relationship between consumers and financial service providers and could prove disruptive for bank business models. New types of marketplace lenders, such as peer-to-peer lending and crowdfunding platforms, have emerged to support the financing of SMEs. These new players are also targeting previously excluded or underserved market segments, including in particular mass market and more vulnerable groups, while offering higher returns or diversified investment opportunities to institutional investors.

Financial innovations and digital technologies are also emerging in the asset management and wealth management industries, through the emergence of online automated and algorithm-based portfolio managers (robo-advisors).

The emergence of peer-to-peer platforms, which match consumers and borrowers/lenders with one another, is one of the key innovations in terms of business models that have been driven by the digitalisation of finance.

These digital innovations drive costs down and in serving borrowers who might be overlooked by traditional banks have the potential to increase consumer welfare and support increased growth of the economy. As the competitive pressure on incumbent service providers has increased, so, too, have the prospects for new forms of industry configuration. Digital technologies make it feasible for institutions to specialise either in production (where they bear the risks of the products and services) or in distribution (where they manage the customer interface). Banks, in contrast, tend to offer a range of products and services, without necessarily being optimised for any of them.

Hence, the potential is certainly there for these innovative models to take substantial market share from pre-existing products and firms. The threat of disintermediation is apparent. But is it an existential one? There are arguments in favour of increased specialisation as a means of providing more tailored and cost-effective service, but do they imply that all multi-product financial services organisations will become financially non-viable and need to be unwound?

The outcome will depend in part on three factors. The first is the extent to which consumers perceive the products from digital financial service providers to be close substitutes for those from traditional intermediaries and the market configurations that enable consumers to easily switch from one service provider to another (*e.g.* flexible types of distribution channels, low entry barriers, low switching costs), the second is on consumers' loyalty to specific products, and finally on the perceived quality of the existing product relative to alternatives.

Temporal issues related to financial innovations

In some market segments, digital provision may appear to be safer (*e.g.* avoiding human error or human biases), but that is not the case in all contexts (*i.e.* cybersecurity issues),³⁹ and that latter risk may constitute an important limiting factor of digitalisation, as it bumps into the underlying need for trust in all financial transactions. There is a temporal aspect to this question.

New products and services may appear to be successful when first introduced, but properly functioning markets for the products can take longer to develop, part of a less rapid process of learning and strategic adjustment. Many episodes of financial instability have occurred in the wake of a change in the structural regime that often reflected some form of market innovation that altered the nature of competition and had unintended consequences. Given this history, it is rational to exercise some caution to ensure that the

new innovations do not have negative externalities or, worse, constitute new sources of systemic risk.

In this sense, the new business models that have been introduced have not been around long enough to prove their long-term viability, such as through the financial and economic cycle. For example, one might ask whether Fintech credit is a source of long-term funding that can survive a crisis. Clients will be more likely to accept Fintech credit as a direct or even improved substitute for bank credit if it remains available through an economic downturn.

There is a second temporal aspect of financial innovation. It relates to the fact that innovations can have many potential applications, and the application that proves to have the greatest impact may not be the one initially adopted.

The competitive response of incumbents

A second factor to consider is the competitive response of incumbents. Traditionally, or at least since the early 1980s when regulatory barriers between different segments of financial services began to be removed, many large financial services institutions have engaged in the joint production and distribution of a range of financial products and services, including all sub-components, through integrated operating structures. But the use and spread of digital technologies has begun to challenge the economic rationale underlying the value of integration, in lieu of what some call the superior economies of specialised providers (e.g. back-office operations, accounting processes, provision of ATMs, etc.)

But institutions have begun to respond to the challenges from the digital sphere. Digital technologies also make it possible for existing providers to reduce their costs and possibly retain or recoup some of the customers they've lost to more nimble online competitors. Digital technology has become an intrinsic part of the financial services industry, influencing how financial institutions conduct their business and the products they offer, although progress in this capacity is uneven.

Nonetheless, squeezed margins in some core product areas and higher compliance costs associated with Know your customer (KYC) and Anti-Money Laundering (AML) rules are forcing institutions to rationalise their cost structures. Institutions have become more strategic. The days of the one-stop shop offering all products to all comers appear to be receding in favour of concentrating on areas of perceived comparative advantages in order to realise scale and (where they exist) scope economies, while disintegrating other parts of the value chain and relying on the marketplace or strategic partnerships to carry out the other functions. Some of these partnerships are with Fintech entities; after all, "if you can't beat it, buy it".

While some institutions have been reluctant to entrust "core" aspects of their business to third-parties, outsourcing has more generally become more widespread and some institutions distribute non-proprietary products through their networks in addition to their own. In the future, they may become distributors only. Technology makes it feasible for institutions to specialise either in production or distribution, customers demand the benefits of better service and better pricing, and there do not appear to be any specific rules to prohibit it.

Business models are also changing in terms of pricing structures, with many moving towards more transparent structures than the traditional banking models provided and with lower fees.

Concerns about the regulatory perimeter

Some institutions are also raising concerns about the constraints imposed on them by the regulatory framework, which impedes their ability to compete. The effects of prudential regulation have a direct bearing on competitive level playing field issues. In this context, the third factor affecting the structural response to new Fintech innovations relates to the contours of the regulatory perimeter. Existing regulation may not adequately cover these new models, may present impediments for these models to operate efficiently and effectively, or alternatively prohibit them from operating at all.

Technically, the system is functioning as it should. In the absence of market imperfections and with competitive market structures, the market mechanism works by encouraging new players to enter profitable market segments, and in the process drive out excess returns, while the market for corporate control weeds out firms that are operationally inefficient or unable to innovate. This appears to be happening.

There are advantages to having risks being spread more widely throughout the economy, a result of the entry and broader participation of new entities in the financial system. For example, compared with banks, new lenders tend to have different risk management and investment objectives, which may result in less cyclical provision of credit. But the opposite may also be true and there are growing concerns that some new activities and participants may constitute sources of instability.

The challenge is to find ways to secure the benefits of new innovations while avoiding the hazards. Guidelines on how to do so were put forward some years ago by former Federal Reserve Board Chairman, Alan Greenspan, who suggested that policy makers should: “Proceed cautiously, facilitate and participate in prudent innovation, allow markets to signal the winners and losers among competing technologies and market structures, and overall – as the medical profession has advised – do no harm”.

To operationalise these guidelines requires linking them with the three longstanding principal objectives of financial policymaking: ensuring financial stability, ensuring adequate protection for investors, and ensuring market integrity.

Financial innovations raise issues concerning the regulatory perimeter.⁴⁰ One difficulty arises, for example, in situations in which financial arrangements having the same intrinsic characteristics can fall outside regulatory coverage if they are offered by an institution beyond the regulatory perimeter. An example would be a nonbank provider of payment services, which would avoid regulations applied to bank providers of the same services. Customers clearly derive benefits from having more flexible, mobile payment options, so the solution is not to impose capital requirements on the providers. Capital requirements exist in part to ensure the integrity of the deposit insurance system and its ability to protect depositors, as well as ensuring an adequate buffer against losses and avoiding any messy failure that becomes contagious. The new payment providers do not take deposits. But how does one ensure the systemic integrity of the payments system, which has been based largely on the protections inherent in the interbank system?

The special nature of banking, which derives in part from the contagion effect, tends to result in the special application of competition and antitrust policies in the banking sector. For stability reasons as noted before, entry and exit conditions in banking are not free and open. Deposit taking remains the preserve of depository institutions. But entry into some of the other core product areas of commercial banking, like lending, is open.

Entry is also not free and open in the provision of some types of insurance, but in this case on grounds of the need to ensure that financial consumers (including SMEs) and investors are adequately informed and protected.⁴¹ As a consequence, when an entity wants to become licensed as an insurer or as an insurance agent/broker, it faces potentially prohibitive capital and/or fit-and-proper requirements that must be met before it receives an authorisation to operate. This requirement is perhaps partly why very few InsurTech start-ups have gained insurance underwriting licenses and are limited mainly to broker licenses.⁴²

These prudential requirements are a core component of the policy framework to ensure adequate protection of insurance policyholders. But they can also constitute a barrier to new market entry, where applicable.

Another relevant consideration, similar to the mobile-payment issues in banking services, is whether the insurance regulatory framework should allow for new insurance products that target specific limited risks that are low in value. This is particularly the case in emerging economies which can benefit from greater penetration of insurance policies while having a limited policyholder impact. But *microinsurance* can also be beneficial in OECD countries, by providing for increased flexibility and lower transaction costs via mobile apps.

While InsurTech innovations can provide a number of benefits, there are nonetheless a number of areas in which greater regulatory discussion may be required, in particular where the transparency of the technology and the impact on a policyholder's choice and rights is unclear. The same types of data protection issues also arise, along with the potential for exclusion of certain segments of the population based on data aggregation. This is an area that will require closer examination by regulators, as the volume of personal data handled by insurers increases and the consensus on its use becomes blurred. Ensuring that policyholders are appropriately protected when the implications of certain innovations and technologies are uncertain will be important for regulators.

These comments imply that structural issues that are not adapted to a digital world, such as local ownership requirements, bank-focused or insurance-focused regulation, and non-electronic requirements to comply with "Know-Your-Customer" rules, will tend to impede innovation. Consistency of regulatory treatment and interpretation so that businesses know how they will be treated and can scale-up is a second challenge. Even where rules are technically the same, interpretations of their application may differ not only across jurisdictions but even within the same jurisdiction.

The OECD considers that two sets of measures are needed to make the financial system more resilient and capable of withstanding disruptive financial innovations.⁴³ One set of measures relates to improvements in the infrastructure for financial services. Other necessary measures are directed at various types of innovations. In the end, the Committee agreed on the following recommended steps:

- Step 1: ensure that the necessary framework conditions for markets to function properly are in place
- Step 2: Acknowledge that there is no one policy measure that can be considered optimal in all circumstances
- Step 3: Ensure that the policy instruments needed to achieve incentive-compatible objectives are in the toolkit
 - clarify what is meant by maintaining systemic stability
 - properly address exit problems for large institutions

- establish a proper macro-prudential framework
- establish a proper framework to ensure adequate protection for consumers
- Step 4: Ensure regulators and supervisors have the requisite skills and experience
- Step 5: Ensure a proper balance between regulation and governance
- Step 6: Ensure there is appropriate monitoring of new products, markets, and processes
- Step 7: Adapt the regulatory system as necessary to the market environment it is intended to regulate

Many of these components are found in the methods being undertaken in practice, which include, for example, sandboxes,⁴⁴ accelerators and innovation hubs to facilitate monitoring (Step 6) and calls to assess the regulatory perimeter and update it on a timely basis (Step 7).

6. Concluding remarks

OECD work in the financial area has tended over the years to focus on questions that have structural or longer-term implications⁴⁵, such as changes in the topography of the financial system (e.g. the types and sizes of participants, the products and services they offer, to which categories of customers, via what types of channels). Examining changes in institutional restructuring of markets, as in changes in institutions' business models, has been a core part of this body of work.

Financial intermediaries, like many firms, are not static entities, but instead evolve in response to changes in various factors, some of which are internal to the firm, while others, such as changes in the competitive environment and overall economy are external. Firms may lose their comparative advantage in the provision of some products and be forced to shed particular lines of business, which in some cases may have been a core part of their previous business model. Previously unbundled activities may be rebundled or vice-versa, which could result in changes in the size variation of providers.

International organisations and governments are fully engaged in assessing the technology-driven changes in the financial services landscape and determining the appropriate policy responses needed to address these changes. Given the complexity of these changes and the numerous interrelated factors involved, the angle with which to approach this topic is not necessarily obvious.

Notes

1. The regulatory framework can either accommodate innovations or endeavour to block them.
2. This argument is in line with the OECD (2016) report "Stimulating Digital Innovation for Growth and Well-Being" which highlights that "There is evidence that the adoption of ICTs have been largely driven via heightened competitive pressure in ICT using sectors (see Conway et al., 2006; Aghion et al., 2008). When comparing Japan and the United States, for example, Kushida and Zysman (2013) observe that ICT adoption rates remained lower in ICT intensive sectors such as finance, retail, and healthcare in Japan, despite higher broadband penetration rate. The authors argue that the ICT revolution developed largely in the United States instead thanks to "lead users of ICT tools [that] faced newly liberalized environments, pressuring them into intense competition".

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8. This focus on the use of digital technologies is consistent with the concept of digital innovation found in the OECD report on digital innovation, “Digital Economy Outlook 2017”.
9. For a more complete discussion, see Chapter 2 on digitalisation in OECD (2017), *The Next Production Revolution: Implications for Governments and Business*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264271036-en>.
10. Rao (2016), “Five Myths and Facts about Artificial Intelligence”, *Predictive Analytics and Futurism*, Issue 14.
11. This is the case for now at least; in AI circles there is futuristic talk of a (so far hypothetical) moment called “singularity” when AI in combination with the web, IoT, and Big Data will be independent of and escape human control and understanding.
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26. <https://globenewswire.com/news-release/2016/12/14/897471/0/en/Sustainalytics-Launches-ESG-Signals.html>
27. See the discussion in www.oecd.org/finance/Technology-and-innovation-in-the-insurance-sector.pdf
28. See OECD (2017), *Enhancing the Role of Insurance in Cyber Risk Management*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264282148-en>.
29. www.nature.com/nature/journal/v542/n7639/full/nature21056.html
30. See “Supporting an effective cyber insurance market” OECD Report for the G7 presidency
31. In terms of digital security, the OECD Council approved in 2015 the Recommendation on Digital Security Risk Management for Economic and Social Prosperity which recommends that national strategies could include incentives for businesses to measure and manage their exposure to cyber risk. In particular, corporate governance practices can provide an avenue to foster the integration of cyber risk into the broader enterprise risk management framework. See also the 2016 Ministerial Declaration on the Digital Economy, which promotes digital security risk management and the protection of privacy.
32. Ongoing work at the OECD is investigating the vectors of change brought about by the different forms of digitalisation as part of the Going Digital horizontal work. A draft report on the Vectors of Digital Transformation classifies them under three major headings: a) Scale, Scope and Speed; b) Ownership, Assets and Economic Value; and c) Relationships, Markets and Ecosystems. There is some overlap between the specific aspects identified in the going Digital work with that presented herein, but there are differences, owing mainly to the focus in this report on financial services.
33. See OECD (2012), *OECD Internet Economy Outlook 2012*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264086463-en>.
34. OECD (2017), *G20/OECD INFE Report on ensuring financial education and consumer protection for all in the digital age* www.oecd.org/daf/fin/financial-education/G20-OECD-INFE-Report-Financial-Education-Consumer-Protection-Digital-Age.pdf
35. See OECD (2017), *Enhancing the Role of Insurance in Cyber Risk Management*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264282148-en>.
36. *The Next Production Revolution: Implications for Governments and Business*, OECD Publishing, Paris.
37. See the discussion by Bert Scholtens and Dick van Wesveen in “A critique on the theory of financial intermediation,” *Journal of Banking & Finance* 24 (2000) 123-1251.
38. Allen and Santomero [F. Allen and A.M. Santomero, “The theory of financial intermediation,” *Journal of Banking & Finance*, 21 (1997) 1461-1485] contend that the traditional theory of financial intermediation focuses too heavily on functions of financial institutions that are no longer crucial in mature financial systems. They suggest instead that the emphasis should be placed on the role of intermediaries as facilitators of risk transfer and risk management.
39. Big data analytics might have the potential to affect the availability and pricing of financial services, but may also raise privacy issues and have potential adverse effects such as customer red-lining.

40. There are many examples of the challenges posed by innovative products. An example from the early 1980s relates to US regulations controlling the payment of interest on various deposits. The restrictions applied to institutions formally licensed as “depository institutions”. That meant that banks and savings and loan associations were subject to the restrictions, but the rules did not apply to securities firms, as the latter were not formally licensed depository institutions. By the same token, securities firms, not being banks or thrifts, could not technically offer checking accounts, but a number of securities firms took advantage of the loophole in the formal definition to create money market mutual funds with check-writing privileges, using contractual agreements with partner commercial banks to gain legal access to check clearing systems. The products were functionally equivalent to bank checking deposits, but were not subject to the same regulatory controls on payment of interest and proved to be extremely popular among retail investors, prompting a considerable outflow of deposits from banks and thrifts, which lacked equivalent products to offer.
41. For a more complete treatment, see www.oecd.org/finance/Technology-and-innovation-in-the-insurance-sector.pdf.
42. Chapter 3 of this publication on Digitalisation in the Insurance Sector provides more information.
43. These are the results of discussions of the implications of financial innovations for regulators back in 2009 at the OECD Committee on Financial Markets.
44. Chapter 2 of this publication on Digitalisation and Pensions provides an analysis of sandboxes.
45. The OECD has a long-standing commitment to making financial markets more efficient, more deeply integrated and better regulated, in order to support the real economy. The OECD has also been contributing to the design of the post-crisis regulatory landscape with the aim of ensuring a proper balance between financial stability and growth. This work includes promoting long-term investment finance, especially by institutional investors, as well as financing SMEs. It also covers issues of financial education (with a large OECD International Network on Financial Education (INFE)), complemented by work on financial consumer protection. Ever more interconnected, complex and global financial markets and institutions require enhanced international co-operation – in terms of monitoring, supervision and regulation as well as policy responses to crises. In monitoring financial market developments and providing a platform to discuss, analyse and design financial policies, the OECD is well placed to contribute to making financial systems not only safer and more resilient, but also improve their efficiency and thus their role in fostering economic growth.

2. Digitalisation and pensions

Technology is rapidly transforming the way that the financial sector is operating, and the management and delivery of pensions is no exception. Innovative applications of technology for financial services, or Fintech, are already being used to improve communication with consumers and their engagement with their pension plans. While regulators are keen to promote innovative ideas that can lead to consumer benefit, they also have to proceed with caution to ensure that consumer protection is not overlooked. Many jurisdictions are dedicating significant resources to keep up with the rapid technologically-driven changes so that the regulation can strike a balance that is both adequate and appropriate in this new environment. This article provides an overview of how technology is being used to improve pension design and delivery and what regulators are doing to encourage innovation that will benefit consumers.

1. Introduction

This article explores the early regulatory implications of the growing role of technology in pension provision, and look at what governments are doing more generally to support its development for the benefit of consumers.

Financial innovation enabled by digital technologies ("Fintech") and related technological developments such as RegTech (using technology to facilitate regulatory compliance) have the potential to re-shape private pension design and delivery. Individuals are increasingly required to make complex choices about their pension finances, and consumer engagement with financial services in general is becoming more digital. Fintech can improve the ways in which pension providers interact with individual members: enhanced communication techniques can encourage greater engagement; digital disclosure can reduce compliance costs; robo-advice can make financial planning more accessible. New technologies are also relevant to pension providers' internal processes, including product design, transaction processing, risk management and compliance. The improvements in efficiency that technology allows can also translate into lower costs both for pension providers and for members.

Reliance on technology can also create new risks. Less educated and less well-paid workers might be excluded from technological progress because they cannot or will not engage with new methods of communicating. Non-regulated entities from other sectors might cherry-pick some aspects of pension provision, leaving traditional players with less profitable businesses and creating regulatory risks. There are also concerns over data protection and data security as well as consumer protection issues relating to the suitability of the services and products offered.

Regulation must therefore achieve a balance between the objective of encouraging the development of Fintech-enabled solutions to benefit consumers and that of ensuring adequate protection against the potential risks to consumers. Several jurisdictions have been addressing this balance through programmes that intend to work directly with providers to foster and encourage the development of Fintech-enabled services, while at the same time closely monitoring and mitigating the potential risks that emerge in the process. These types of programmes go by several names, but typically include those referred to as innovation hubs, Fintech accelerators or incubators, and regulatory sandboxes. Such programmes can be useful tools to ensure that the financial consumer risks presented by technological innovations are mitigated while also ensuring that protections in place do not inadvertently stifle innovation, thereby maximising the ultimate benefit for consumers.

The key findings of this article are:

- Fintech applications are increasing the accessibility of investing in pensions to a broader consumer base and making communications with pension savers more effective.
- Fintech is increasing the efficiency of the operation of pension schemes through risk management applications, the automation of investment processes and the facilitation of regulatory compliance.
- Governments are making substantial efforts to support the development of Fintech.
- Innovation Hubs are becoming a key component in regulatory support to help new businesses understand how existing regulation applies to their ideas.

- Regulatory sandboxes are emerging as a way to offer flexibility in how regulation applies for new business models and ideas.
- Effective engagement with all stakeholders will be a key factor in successfully supporting innovation in financial services.
- Engagement with international regulatory counterparts will be necessary to try to ensure a certain level of consistency in the regulations and their interpretation and application.

The structure of this article is as follows:

Section 1 presents the introduction and key findings.

Section 2 discusses how technology is being used to improve communication with pensioners.

Section 3 looks at the impact that technology is having on the internal processes of pension providers.

Section 4 highlights the potential impacts to pension business models.

Section 5 underlines some of the potential risks associated with the greater use of technology.

Section 6 looks in detail at the approaches that regulators are taking to support the development of Fintech that has the potential to benefit consumers.

Section 7 discusses some of the challenges that regulators are facing.

Section 8 concludes with some key takeaways from the discussion.

2. Using technology to enhance interactions with pension members

Fintech is being deployed across a range of financial services to enhance interactions with consumers. Fintech can help to increase trust in financial products, by making them more accessible, transparent and comprehensible. It can improve data collection and analysis, aiding product design and personalisation. It can encourage participation in financial decisions through gamification and education. These developments are likely to be especially valuable in interactions with millennials, who expect to use technology to access financial services and who are now entering the workforce.

Financial advice is the area where the impact of Fintech is most evident. Although its primary application is currently in wealth management, insurance companies are also adopting the technology. Robo-advice is generally cheaper and more accessible than “human” advice and so could be especially useful for DC plans where members are faced with a number of financial choices and where accumulated savings may be relatively small. According to the UK Government’s Chief Scientific Adviser, Fintech companies can increase the availability of financial advice to previously under-served populations, thanks to their “lower cost structures, greater customer reach or superior ability to monitor or score risk”.

Digital communications

Fintech can help to generate member engagement through the use of digital technologies in communications, including periodic reporting, marketing communications and other information. Digital communications can involve simply the storage and delivery of documents electronically, or it can involve “smart” communications, which use of other media, gamification, personalisation, or interactivity to attract readers.

The trend away from paper documentation and towards electronic communications is being recognised by regulators, who increasingly permit financial service providers to use electronic communications as the default option for regulatory disclosure. For example, the SEC allows mutual funds to post their prospectus on line, and ASIC (Australia) has a “publish and notify” regime. Electronic communications are cheaper than printed communications and it is easier to track who has received and read them. However, digital disclosure poses certain risks in terms of disclosure standards: framing of the information is important so that readers are not distracted from the most relevant information by additional features. Providers could face liability risks if there is a discrepancy between the framing of the printed information and the electronic information. Regulators may therefore need to provide best-practice guides for digital disclosure to help make sure that consumers will read and understand the most relevant information.

Overall, digital technologies are likely to enhance the quality and effectiveness of interactions between pension providers and their members. Smart communications can take advantage of behavioural insights; for example, by using push notifications to nudge people into checking their balances or increasing contributions. The UK Competition and Market Authority’s inquiry on personal current accounts found that “annual interest statements have virtually no effect on consumer actions, but given immediately actionable information – text alerts and internet banking – overdraft charges can be reduced by consumers by almost 25%.” Fintech enables on-demand interaction between pension providers and their members outside the regulatory reporting periods. In Australia, members of superannuation schemes can access their accounts through a mobile phone app; in the UK, Aviva’s Shape My Future app provides online tools and calculators to help members visualise their lifestyle in retirement.

Platforms and dashboards

Digital technologies could also encourage greater transparency and allow people to manage their own data more efficiently, ultimately increasing their bargaining power and lowering the cost of private pensions (especially personal pensions). E-aggregators facilitate comparison sites or allow people to aggregate and analyse their own data. Ultimately, individuals might be able to manage all their finances from a single platform.

A number of countries have created “pensions dashboards” to give members and beneficiaries an easy-to-use overview of their likely pension finances (see Box 1). These dashboards vary in terms of the depth of the data they contain and the functionality they offer, but research indicates that they can be a powerful tool for transmitting information, encouraging people to take action, and in particular for keeping track of multiple pension pots as individuals move between several different employers. There are considerable technical challenges and costs in building a dashboard, however, and policy considerations include both funding and governance in addition to functionality. For example, whether the dashboard should be funded by the private sector or whether advertising should be allowed need to be considered.

As for digital disclosure, it is important to ensure that such platforms do not lead to less engagement or encourage members to skip important information. For example, plans to launch an auto-consolidation of small DC pots on Australia’s pensions dashboard were postponed because inactive accounts in some cases offered better protection than active accounts; users of pension dashboards should be given all the relevant information as well as a simple “one click” option to take action.

Box 1. Pensions Dashboards

A pensions dashboard provides a one-stop shop for individuals to see their pension situation. Depending on the functionality of the dashboard, they can see their public and private pension entitlements, compare different private schemes, enter personal information (such as a change of address) just once for transmission to multiple providers, receive regulatory and marketing communications, compare different payout options, and consolidate small pots.

While dashboards can provide considerable utility to both pension providers and pension members, and bring transparency, a number of questions need to be addressed in setting them up:

- *Cost*: upfront costs may be paid by the government or private providers; ongoing costs will ultimately be borne by members unless private sponsorship or advertising is permitted, which raises consumer protection and competition issues.
- *Technical challenges*: individual records will need to be cleaned, standardised and digitised.
- *Quality and scope of information*: the content and display of information needs to be controlled so that individuals are not tempted into making a decision such as consolidation on the basis of attractively-displayed but incomplete information.

AUSTRALIA

The Australian Tax Office portal provides up-to-date valuations of all an individual's super accounts and of any unclaimed money in "lost" accounts. Individuals can trigger the process of consolidation on the portal. It is estimated that streamlining processes and consolidating smaller pots could save AUD 1 billion per year in running costs.

THE NETHERLANDS

The government set up a website in 2011 to increase engagement and awareness of pension entitlements. It includes information on state and occupational pension rights on both a gross and net of tax basis. Occupational schemes are legally required to provide data, but information and functionality are relatively limited, though a pension simulator may be included in the future. Work is also being conducted to look at the feasibility of including personal pensions.

SWEDEN

The minpension site was established in 2004 and has evolved to provide real-time information about state and DB pensions, the current value of pension entitlements, a projection of retirement income and a simulator to model changes in the projection at different retirement ages. Around half of eligible users are registered with the site and data suggests that people are most likely to use the site as they get close to retirement age.

UNITED KINGDOM

The government has set a goal of establishing a pensions dashboard by 2019 where individuals would be able to view all of their pension pots, including state pensions, in one place. As a preliminary step, the government has launched a pension finding service to help individuals easily locate unclaimed pensions. An initial prototype of what the dashboard could look like has also been developed in collaboration with the industry. Participation by the industry has not yet been mandated, however, and it is not clear how the project will be funded.

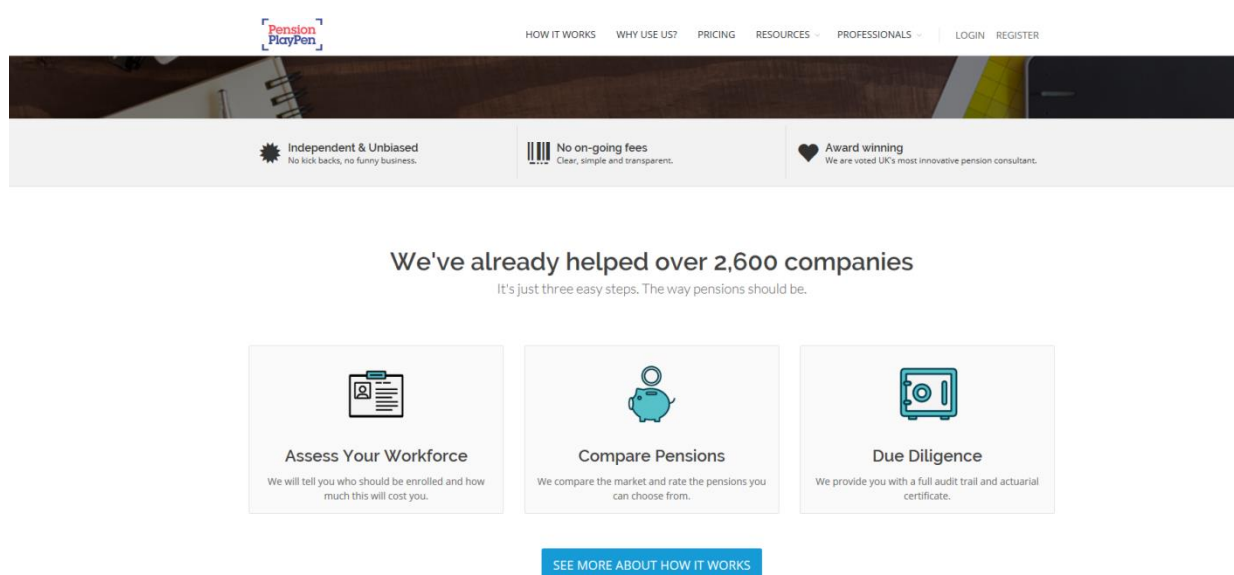
Source: (Johnson, 2016^[1]), (Royal London, 2016^[2])

3. Impact of technology on internal processes

Scheme management

Fintech can also help to facilitate pension scheme administration and risk management, particularly for smaller plan sponsors who may have fewer resources and could benefit the most from lower costs and improved efficiency. For example, Fintech has been used to create platforms to facilitate the management of pension schemes for employers by providing a digital auto-enrolment platform (see Figure 1). These are especially useful for small employers who may not have the resources or expertise to select a scheme or connect it with their payroll systems.

Figure 1. Digital Auto-Enrolment Platform Example



Fintech can also facilitate risk management for pension providers. Financial software such as RiskFirst gives smaller pension schemes access to the same risk management and reporting tools as larger schemes. Improved risk estimates and forecasting could be particularly powerful in avoiding large downward swings in DC pots, for example.

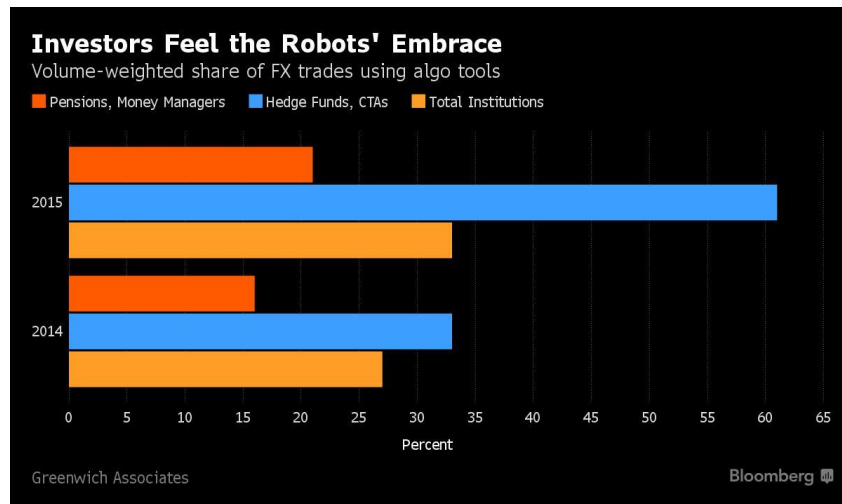
New analytical techniques and big data could lead to the creation of more efficient and more personalised retirement solutions, in particular for the pay-out phase. Financial data and analytics improve our understanding of consumers and their savings and spending habits, therefore solutions for financing retirement could be better tailored to individuals' specific circumstances.

Investment management

Lowering investment costs is recognised as an important contributor to increased portfolio returns. Fintech is helping to reduce the cost of portfolio management, through low-cost investment products such as bespoke tracker funds and automatic portfolio rebalancing and algorithmic trading. Several robo-advice firms are positioning themselves as business-to-business operations, offering automated portfolio management services to businesses providing pensions for their employees. Direct trading between

players on the buy side, especially in the corporate bond market, are helping to offset the decline in market making as investment banks withdraw liquidity, but in doing so they transfer trading risks to investors and make markets less transparent, so may need additional supervision. Fintech is also enabling the emergence of entirely new asset classes, such as peer-to-peer lending.

Figure 2. Volume-weighted Share of FX Trades Using Algo Tools



Source: Bloomberg

Regulatory compliance

Technological applications can support risk management and compliance through making Management Information Systems, compliance monitoring and risk training more efficient and transparent. Technology can support labour-intensive regulatory and compliance processes such as real-time transaction analysis, online registration, risk-weighted asset calculations, data analytics and aggregation; modelling, scenario analysis and forecasting; monitoring internal culture and behaviour and complying with customer protection processes. Data-mining algorithms can organise and analyse large sets of data, including qualitative data such as e-mails and recordings.

Technology could also facilitate data sharing between regulators within or across jurisdictions, or the creation of open-source compliance tools, although this would require harmonisation of data. As financial regulation requires more and more data, new technologies might help to streamline both data capture and data analysis. New mathematical tools could lead to more powerful risk models; emerging techniques such as agent-based modelling to simulate the likely impact of new policies such as MiFID II before they are introduced; while smart contracts (computer protocols that can self-execute, self-verify and self-constrain the performance of a contract) could reduce the need for some areas of supervision.

Blockchain

Many of the technologies described above rely on blockchain, or distributed ledger, technology (Box 1.2). Although the application of blockchain to pensions is so far limited, it has potential use in dashboards, trading and many Regtech solutions.

Box 2. Blockchain Technology

Blockchain – or distributed ledger – technology makes it possible to connect multiple parties to each other without passing through intermediaries. These multiple parties all have access to identical copies of a digital record (for example, a contract or transaction data), they can update these records to register a transaction that has taken place and have their amendments validated by the other parties in close to real time.

This makes transactions cheaper and in some ways safer. For example, company shares can be traded by investors without passing through multiple custodians, as the shareholder register can be updated directly once an exchange takes place between buyer and seller. The existence of multiple copies of the transaction means that there is less risk of a single systems failure reversing the transaction. Once validated, transactions cannot be reversed.

Distributed ledger technology is potentially applicable to a number of aspects of pensions:

PORTFOLIO MANAGEMENT - Trading (including bespoke derivatives contracts), reconciliations, foreign exchange management, portfolio rebalancing and proxy voting could all be made more efficient through the use of dedicated blockchains.

COMPLIANCE - Blockchain would facilitate many aspects of pensions administration, such as automated identification solutions (KYC) and data recording and transfers. By giving sponsors, trustees and tax authorities access to a unified, tamper-proof database, the need for reconciliation of transfers/contributions would be sharply reduced.

DASHBOARDS - Dashboards that allow transactions, such as consolidating multiple pots, could use this technology.

Source : (UK Government Office for Science, 2015^[3])

3. The impact of technology on business models

Technology is changing business models in financial organisations in two main ways. Within internal operations, it is leading to disintermediation between front, middle and back offices. Within commercial operations, it is changing consumer behaviour and so forcing adaptation by providers. These trends are already evident in other financial institutions but they are likely to affect pension providers in the future. De Nederlandsche Bank suggests how insurers might be faced with new types of competition for certain parts of their business, making them less able to bear the cost of their legacy books (DNB, 2016^[4]).

Incumbent pension providers may be at a disadvantage to newer players in exploiting new technologies, because they are constrained by existing IT infrastructure that is expensive to change or replace. This could enable new entrants with lower costs to enter some areas of pension provision, as has already been seen in the area of advice. As an example of the potential costs of upgrading legacy systems, UBS is reported to have invested USD 1 billion in redesigning processes across its wealth management operations to introduce robo-advice in the UK.

Fintech is bringing increased transparency and a greater use of comparison sites. This trend could lead to pressure on pension providers to provide more granular reporting on their cost structures and the fees they charge, ultimately leading to a drop in pricing.

4. Risks associated with the greater use of technology

Each of the potential advantages of Fintech carries corresponding risks. Some of these risks are not new, although they may be more acute because of the applications of new technologies, for example data security and privacy risks. Fintech also has the potential to create new types of risk, such as structural changes in the financial services industry and the entry of non-regulated players. Regulators may wish to impose new training requirements on pension providers, sponsors and trustees to address Fintech risks as well as build their own internal capacities to supervise these risks.

In the area of interaction with members, there are a number of potential risks. Fintech could aggravate financial exclusion for those who do not engage with digital communications; conversely, there is some concern that consumers will place too much trust in technological solutions and so the fall-out from any problems with Fintech will be particularly damaging. One example of this is crowd funding, where small investors might take more risk than with traditional investment products.

Data privacy and security risks are heightened with the introduction of technologies that rely on the capture, storage and analysis of large quantities of data in order to provide improved services. Fintech providers that use cloud-based IT services may put data beyond the reach of regulators.

Technological advances may lead to a greater degree of advice from and outsourcing to specialised providers, for example enhanced analytics companies. These companies may fall outside the scope of pensions regulators, but a failure by them could have negative consequences for confidence in private pensions.

5. Regulatory approaches to Fintech

Regulation of Fintech has to strike a balance between encouraging innovation in order to reap the potential benefits of lower costs, improved transparency and higher consumer engagement, providing space for the evolution of business models, and ensuring that consumers are protected and incumbents are not faced with unfair competition from non-regulated entities. It also needs to be adaptive in order to accommodate the impacts of future, unanticipated technological developments and encourage knowledge-sharing between regulators, supervisors, incumbents and potential new entrants to the pensions industry.

Regulators also need to be vigilant that the benefits of technology are indeed passed on to pension members and beneficiaries. Philippon argues that the financial services industry has so far kept IT efficiency gains for itself, and that the role of the Regulator is to ensure that disruption is allowed to take place (Philippon, 2017^[5]). The regulatory framework needs to accommodate such disruption and ensure that the same rules are applicable for both new entrants and incumbents.

Government sponsored programmes to support innovations in the provision of financial services have been implemented in numerous jurisdictions. The ultimate objective of these programmes is to ensure that innovation is encouraged, that these developments are in consumers' interests, and finally that any consumer risks resulting from these innovations are adequately mitigated and financial consumer protection ensured.

These programmes can intervene in various stages of an idea's development, from the initial brainstorming phase to the implementation or even expansion of the resulting product or service:

- **Idea stage:** to promote the generation of ideas to improve the provision of financial services and benefit consumers
- **Compliance stage:** to facilitate the identification of applicable regulations and the process of compliance
- **Financing stage:** to facilitate the raising of capital to fund the implementation of the project
- **Implementation stage:** to provide a controlled and safe environment for testing the idea in the market and to use the feedback and information learned to adapt product offering or regulation which may be inadequate or inappropriately constrictive
- **Expansion stage:** to facilitate the exportation of the idea to other markets and allow consumers to benefit more rapidly

These stages of development are not necessarily chronological and the programmes offered may span several stages of development, which is often the case for incubator-type programmes which offer end-to-end services. Programmes may also target specific stages, such as an agreement between two jurisdictions to facilitate cross-border expansion.

While the criteria for a Fintech candidate to participate in these types of programmes generally includes having an innovative idea that will improve financial services for consumers and result in a tangible consumer benefit, the types of participants targeted may vary across jurisdictions. Some programmes explicitly target start-ups, such as the 10,000 Start-up programme in India, while others favour developments by incumbents such as banks, as is the case in Hong Kong, China. Many programmes, however, are open to any market participant having an innovative idea to benefit consumers and improve financial services with technology.

The sections below provide some details on the specific types of support that various programmes can offer in each stage of the Fintech's development.

Idea stage

Several jurisdictions have developed programmes or incentives to engage with the industry and to encourage ideas to be put forward for the application of technology to solve certain challenges observed in the market and to benefit consumers. These initiatives typically take the form of a network or community which facilitates the exchange of ideas, support to vet ideas for specific applications in financial services, or organised competitions to develop concrete Fintech solutions to specific challenges.

A few governments have established or funded efforts to facilitate idea generation and communication to capture the potential benefits that technology can offer to financial consumers and engage in discussions with the industry. The Hong Kong Monetary Authority has created a Fintech Facilitation Office, which includes a dedicated platform to liaise with the Fintech sector. This platform facilitates the exchange of ideas among stakeholders to find applications of technology for financial services. It also initiates research with the industry on specific applications of Fintech, for example the application of blockchain technology to financial services. The Belgium government sponsors the “B-hive”, a platform intended to facilitate innovation and the liaison between traditional

financial service providers and Fintech start-ups. Australia has established a digital advisory committee made up of industry representatives, academics and consumer representatives to provide feedback on how the regulators/supervisors are engaging with the sector and to identify which issues are the most important to address. Canada has a similar committee, and also invites venture capitalist and tech experts to the table to understand the challenges they face with particular regulations.

Other governments have established dedicated support for businesses to bring solutions to solve particular market challenges and benefit consumers. The Advice Unit established by the Financial Conduct Authority in the United Kingdom is one such an initiative. The Advice Unit provides regulatory feedback and published resources for businesses developing models to provide automated advice, either in the form of a personalised recommendation or through automated investment management services. Businesses wishing to benefit from the service must meet a number of criteria, including the potential for lower cost services, consumer benefit and a clear and well thought-out proposal.

Another emerging trend is to host Fintech competitions, commonly referred to as “hackathons”, to generate ideas for solving specific challenges presented in financial markets, including those related to financial consumer protection. While more common in the private sector, one of the first government sponsored events was the TechSprint sponsored by the Financial Conduct Authority in the UK, a two-day event where market players came together to develop ideas to use technology to improve the efficiency and effectiveness of financial regulation. More recently, the Canadian securities regulator sponsored a hackathon for Fintech applications for regulatory compliance, Know-Your-Customer requirements and improving financial literacy. The United Arab Emirates has sponsored a virtual hackathon for applications of blockchain technology, with one objective being the reduction of financial fraud and cybercrimes.

Compliance stage

Assisting businesses in understanding the regulatory requirements applicable to their business idea is the most common approach governments have used to encourage innovation in financial services and ensure that appropriate consumer protections are in place. Such services or programmes are commonly called “innovation hubs”, Fintech incubators or Fintech accelerators, though there is no universally agreed definition across jurisdictions. The goal of these services is to help Fintech companies understand how the regulation applies to their ideas and to facilitate the registration or licensing process, which can significantly reduce start-up costs and time-to-market. These services often operate based on a ‘hub and spoke’ model (e.g. Australia, Canada, United Kingdom), with a dedicated team being the central point of contact who can refer specific issues to relevant contacts in other departments as need be.

This approach helps to ensure that the business models are compliant with requirements put in place to protect consumers. Often, the regulators/supervisors will also try to reach out to and engage with market participants who may not realise that the activity they are engaging in is subject to regulation. The OSC in Canada, for example, provides a website that uses plain language (no legalese) and provides plain examples of how securities law may apply, and issues media releases to make participants aware of required regulation where a lack of awareness has been observed for a specific type of situation.

An example of a dedicated team is the Innovation Hub in the United Kingdom, which is dedicated to working on innovation and supporting the growth of Fintechs. The Innovation Hub provides qualified applicants with a dedicated advisor who sees them

through the compliance process, identifying the relevant aspects of the regulatory regime, facilitating the application for authorisation, and providing support for up to a year following authorisation.

Short of having a dedicated advisor, most jurisdictions with a programme in place to support innovation in financial services will at least provide a service to help aspiring innovators to understand the applicable regulations. This is true in Abu Dhabi, Australia, Brazil, Canada, France, Hong Kong, China, Indonesia, and the Netherlands, for example.

Financing stage

While not as common, governments may also provide assistance for innovators to raise capital or cover the costs for the development of their projects, with the end-goal that these projects will ultimately benefit consumers. The B-hive platform in Belgium, for example, facilitates the creation of partnerships between start-ups and traditional market players to help the business concepts scale-up their idea. The programme 10,000 Start-ups in India, supported by the government, helps innovators by providing direct access to venture capital and angel investors. In France, innovators can have access to government grants or contracts which will help to ensure future revenues. The French government may also help with operational costs by providing office space, for example. The Abu Dhabi Global Market assists start-ups connect with potential investors and helps them with logistical resources.

Implementation stage

Programmes which offer support for the implementation of the innovative idea are most often in the form of what has become commonly known as a regulatory sandbox. The principle of the sandbox is to provide a controlled environment in which the business idea can be tested in real time and where some licensing and/or regulatory requirements may be relaxed. It also provides a safe environment for the idea to be tested where risks to consumers are controlled. This not only speeds up the time-to-market, but provides valuable feedback both to the participant and to the regulator as to how the regulation does and should apply, including rules relating to consumer protection. This feedback can then be used to either adapt the product or service offering, or to adapt the regulation itself. As such, these services are typically reserved for innovative business models for which there is no direct precedent as to how the regulation should apply, as these types of ideas require more interactive support. The participating businesses also need to have considered potential risks to consumers and how to mitigate them.

Jurisdictions which have implemented a sandbox-type approach (date of launch in parentheses) include Australia (Dec. 2016), Bahrain (June 2017), Canada (Oct. 2016), Hong Kong, China (Sept. 2016), Indonesia (Nov. 2016), Iran (Dec. 2016), Malaysia (Oct. 2016), the Netherlands (Jan. 2017), Thailand (Oct. 2016), Singapore (Nov. 2016), United Arab Emirates (Nov. 2016) and the United Kingdom (May 2016). China has also announced that it will launch a regulatory sandbox.

One type of flexibility that sandboxes may offer is relaxed registration or licensing requirements. The sandbox in the United Kingdom allows participants a temporary form of authorisation which allows them to try their idea within a defined period of time, after which they may apply for full authorisation. In Abu Dhabi, firms are allowed to operate in the 'RegLab' for up to two years without a traditional license, but may be subject to limitations such as the number of products, types of consumers, size of transactions and the geographies where products and services are offered. The Netherlands allows for

'light' licensing requirements, granting temporary licensees to test-run ideas. Australia has issued a licensing exemption for businesses offering products to a small number of clients or for small amounts, and also offers modular licensing, where participants can be licenced to provide specific services and/or products.

Sandboxes may also have the power to relax certain regulatory and compliance requirements. In the United Kingdom, certain rules can be 'switched off', allowing the business to freely test their ideas, albeit within an agreed set of parameters. A 'no enforcement' action may also be offered, so that in the event the product does not work the supervisor will not take enforcement action against the company. While not officially a 'sandbox', the US Consumer Financial Protection Bureau issued its policy on innovation in February 2016, which establishes a process for Fintech companies to proactively seek 'No Action' letters so that regulatory uncertainty does not hinder innovation.

The OSC Launchpad in Canada and the RegLab of the Abu Dhabi Global Market have the power to tailor regulations for individual companies. In Hong Kong, China, compliance requirements can be relaxed to allow banks to experiment with new ideas, and Singapore allows new products to be offered to consumers that are subject to relaxed compliance rules for a limited amount of time. In Iran, regulation and tax rules can be relaxed for start-ups. The Astana International Finance Centre planned in Kazakhstan will offer flexible regulations for start-ups. Where principles-based regulations apply, providing another interpretation as to how the regulation should apply may be sufficient and a modification of the rule may not be necessary.

As relaxing licensing and compliance requirements can potentially expose consumers to additional risks, other measures can be taken or controls put in place to ensure that adequate consumer protections are in place. In the United Kingdom, applicants must first be qualified to offer the product or service. The process also requires that the innovators have a dedicated advisor to follow the process and check the outcomes. In the event that consumers are harmed from a product or service being tested, the company is required to provide redress to the consumer to avoid enforcement action. Also, certain rules, such as suitability requirements, may not be allowed to be relaxed. In Australia companies must maintain basic requirements such as having professional indemnity insurance, joining an approved external dispute resolution service and meet conduct and disclosure obligations such as best interest standards for advice and responsible lending obligations for credit. Senior executives may also be required to have previous financial services experience. In Malaysia, requirements relating to confidentiality, appropriate handling of assets and anti-money laundering must be adhered to.

Following the observations during the testing of the product or service, lessons learned may be used to adapt existing regulation to ensure that appropriately accommodates the new business model or product while maintaining adequate levels of consumer protection. The OSC Launchpad in Canada, for example, uses this feedback to modernise regulations and remove the pain points for these businesses.

Expansion stage

Governments are increasingly putting agreements in place which facilitate the expansion of innovative and successful ideas that benefit consumers into new markets. These may take the form of agreements to fast-track the application process to participate in the innovation hubs of other jurisdictions or platforms to facilitate the exchange of information or ideas across jurisdictions.

Some jurisdictions have entered into agreements which directly facilitate businesses from one market to enter into another. The Financial Conduct Authority in the United Kingdom has made bilateral agreements with Australia, Canada, Hong Kong, China and Singapore which allows each jurisdiction to refer Fintech firms to the other, which enables the firms to more quickly test their ideas in the new market. A French initiative in Korea has launched the "French Tech Seoul", which facilitates the entry of Fintech entrepreneurs from one market into the other. In the same vein, the B-hive of Belgium has signed a Memorandum of Understanding with Innovative Finance, the trade body for Britain's Fintech sector, facilitating collaboration between the two bodies. The Abu Dhabi Global Market has established a Fintech bridge with the Monetary Authority of Singapore to establish a strategic framework to assist innovators to understand the respective regimes and provide support in the authorisation process and facilitate joint innovation projects.

Agreements facilitating more general collaboration and the exchange of information relating to Fintech innovations are also becoming more common. An agreement between the United Kingdom and Korea allows the regulators of the two jurisdictions to more easily share information regarding emerging trends, innovative ideas and regulatory issues. Such agreements can also help to identify and share any emerging risks to consumers which may result. Australia has signed a similar agreement with Kenya, Indonesia and Singapore.

6. Challenges to implementing successful programmes to support the development of Fintech

There are numerous challenges to successfully implementing programmes to support the development of Fintech. These challenges relate to the motivation for developing such programmes and their focus, and having appropriate rules in place and ensuring the effective functioning of such programmes.

The first challenge that oversight bodies may have to address before establishing a programme to support the development of Fintech is the need to ensure there is sufficient scope within their existing mandate to do so. The Financial Conduct Authority in the United Kingdom is unique in having a mandate to promote competition in the financial markets, and it uses this mandate to support its regulatory sandbox programme as a way to encourage innovative new entrants into the market. A more common mandate for oversight bodies is to promote market efficiency, which many jurisdictions felt was sufficient to allow them to take measures to support businesses with innovative ideas using technology in a way which would reduce the firms' operating costs and in turn the costs for consumers. Nevertheless, even just having a mandate for consumer protection should be sufficient in many cases to support those businesses which are rendering costs that are typically very opaque for consumers, such as the spreads charged on currency exchange rates, more transparent.

The culture of the organisation also plays a role in the extent to which programmes will be able to successfully interact with Fintech businesses. Many programmes are centred on a hub which offers direct support to the businesses. However, while these hubs will certainly be geared towards technology and innovation, new businesses will ultimately still have to interact with other areas of the organisation to ensure their ideas are implemented and become operational. The hub therefore also needs to engage with other areas of the organisation to help spread the type of culture which embraces change and innovation and get the buy-in from senior executives in all areas of the organisation.

Having this buy-in may also help to overcome the functional and practical constraints that come with the necessity of having many different types of knowledge and functions involved in the process. Professional biases may contribute to the difficulty in cultural adaptation, so additional human resources may need to be called upon, ones who not only have experience in technology but also have a better understanding of the potential risks involved. The language used to communicate with companies may also need to be adapted to facilitate understanding. In this context, several jurisdictions are making an effort to simplify the language used on websites to avoid “legalese” and make the application of the regulations clearer.

Another challenge is finding the right balance to allow regulatory barriers to be lowered without compromising on the core principles of the regulatory framework. Given the speed of the evolution in this area, the framework in place needs to be nimble enough to facilitate growth while ensuring that the risks are mitigated effectively. Technology and innovations are also being directed at reducing frictions in transactions. However, eliminating all frictions may not be desirable as this could result in reduced consumer engagement and attention with respect to the transactions that they are executing and which they may not fully understand.

Clarity in regulation is clearly desirable but not always so easy to achieve. Many unanswered questions remain about how certain innovations should be regulated, such as the legal issues around the use of distributed ledger technology or settlement finality. Yet it is very difficult to keep pace with the changes arising from innovation to make sure that this clarity can be provided effectively without unnecessarily slowing down the pace of innovation.

Numerous challenges also present themselves for the effective functioning of these programmes. First is whether the necessary structures and rules are in place. Structural issues which are not adapted to a digital world such as local ownership requirements, bank-focused regulation, and non-electronic requirements to comply with “Know-Your-Customer” rules will impede innovation. Consistency of regulatory treatment and interpretation so that businesses know how they will be treated and can scale-up is a second challenge. Even where rules are technically the same, interpretations of their application may differ not only across jurisdictions but even within the same jurisdiction. The target of these programmes may also be unclear, as the term Fintech lumps together many concepts, such that it is not always apparent what is meant, which works against developing a consistent focus and approach to oversight. The programmes need to be designed to work for innovative businesses that come in myriad forms and sizes.

A final challenge is the limited resources available to the regulator or oversight body. If the demand for regulatory support and tailored regulations exceeds the resource capacity of regulators and supervisors, the regulatory body will not be able keep up with demand and scaling these programmes could prove difficult. Industry led solutions, such as the industry sandbox being proposed by Innovate Finance, could potentially help to meet some of this demand, but would still require the active involvement of regulators.

Insights and suggestions to help make programmes successful

The suggestions made by participants at the roundtable to effectively support the development of innovation in finance centred around some key themes: culture, engagement and capacity.

First, regulators/supervisors need to shift their organisational culture to be more accepting of and adaptable to innovation and change. Having a dedicated team is just the first step towards achieving such a cultural shift in this new environment. The support of senior executive leaders of relevant business teams is also important for the success of this team and to support the alignment of outcomes for the regulator. Regulators and supervisors also need to learn from their interaction and experience with these programmes, and adapt their approach and/or regulations where necessary.

Another way to help achieve a cultural shift is to try to approach regulation through a lens of consumer benefit in addition to consumer risks. Such a shift in focus could also inform resource allocation. Measures of success of regulatory efforts could be used which align with this focus, such as measures of price or consumer satisfaction.

Engagement should be another priority. The engagement of regulators/supervisors with both internal and external stakeholders at the various stages of a business's development is crucial for regulators/supervisors to keep up with developments and to define their role within the Fintech ecosystem. Their role and objectives in supporting the development of Fintech will be defined in terms of their mandate. Having a mandate to promote competition is not necessarily needed in order for the regulator to play a role in this ecosystem. Rather, even just having a mandate for consumer protection should provide them with the means to encourage more consumer-friendly business models and transparent fee structures. Engaging with stakeholders will help them to identify where these objectives can align with their mandate, and internal engagement within the regulatory body can promote an integrated approach.

Engagement with external stakeholders will aid regulators/supervisors in building their knowledge and keeping up with new developments. Several jurisdictions have established Fintech advisory committees, which gather financial, technology and policy experts as well as stakeholders who may provide a source of funding. Such forums are useful to understand the challenges the industry is facing and the potential regulatory barriers that may exist.

Engagement with start-ups from a very early stage can facilitate communication and limit unnecessary costs of compliance. With early engagement, start-ups can build in the expected controls, for example, which could become quite expensive to implement at a later stage. Making an effort to engage with new businesses will also help to establish a common language and help these businesses to understand the regulator's expectations and requirements. Many jurisdictions have also observed that such engagement helps make firms more willing to be regulated and to embrace regulation as a means to gain consumer confidence and ultimately help their business expand. Furthermore, more regulatory focus and support could give investors more confidence to invest and thereby contribute to the growth of the sector, even though the financial sector remains more regulated than other sectors.

Inter-regulatory engagement will also be critical to improve the consistency of regulations and the consistency of their interpretation. While many participants acknowledged that having the same rules in all jurisdictions is not a realistic expectation at this stage, they also lamented the lack of consistent interpretation and application even within Europe for rules implemented at the European level.

Finally, the new environment may call for new ways to engage with market participants and increase regulatory capacity. While regulatory sandboxes are a positive development and have been well received by industry participants, participants also acknowledged the

difficulty in scaling up these types of solutions given the resource constraints faced by regulators/supervisors. Industry-led sandboxes could help to address these constraints and provide a solution to solve shared problems across the industry with the regulators/supervisors and help provide them with a good vantage point to follow developments. Nevertheless, regulatory involvement would remain a necessary component. Other formats to ensure that the design of policy is effective could also be envisaged. The traditional approach of issuing written consultations on proposed regulation may not effectively engage new market participants who could be most affected by the rules. One proposed solution was for the regulator to host hands-on workshops with industry participants to design policy that works for real-world cases.

7. Key takeaways

The way in which pensions are set up, managed and delivered to consumers is transforming with the increased use and applications of technology. Fintech applications are increasing the accessibility of investing in pensions to a broader consumer base and making communications with pension savers more effective. Fintech is also increasing the efficiency of the operation of pension schemes through risk management applications, the automation of investment processes and the facilitation of regulatory compliance.

Overall, governments' efforts to support the development of Fintech and the benefits this can bring to consumers is a positive trend. Several jurisdictions have successfully hosted brainstorming 'hackathon' sessions to develop solutions to specific market or regulatory challenges. Innovation Hubs are forming a key component in such support to help new businesses understand how existing regulation applies to their ideas. Regulatory sandboxes are also emerging quickly as a way to offer flexibility in how regulation applies for business models and ideas that have no precedent. Nevertheless, as these types of programmes have only just started, and time will tell if they will be able to be truly effective in their aim to ensure adequate consumer protections without stifling innovation.

The regulator will need to define its role within this new ecosystem to support innovation in a way which is aligned with its mandate and will need to work to shift its organisational culture and capacity to align with these objectives. Significant engagement will be required to accomplish this, both internally to obtain the support at all levels of the organisation, but also externally to stay on top of developments and establish productive relationships with new businesses. Engagement with counterparts internationally will also be necessary to try to ensure a certain level of consistency in the regulations and their interpretation and application. Effective engagement will be a key factor in successfully supporting innovation in financial services, so new ways to engage with all stakeholders will need to be established to ensure that the organisation and regulations will be able to adapt to a constantly changing environment.

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3. Digitalisation and the insurance sector

There have been a number of technological advances that are impacting the insurance sector in diverse ways, and conventional insurers are also actively seeking investment opportunities to advance their engagement with these innovations too. This article examines the various ways in which technology and innovations are impacting the insurance sector, and where regulation and legal developments are influencing this. The article concludes with some insights into how these developments could affect the future of the insurance sector as well as policy issues governments may wish to consider going forward.

1. Introduction

Innovation is a key driver of the financial sector and has led to immeasurable efficiency gains, even though this can initially be accompanied by uncertainty and doubt. In recent years, such innovation has happened on the back of new technological developments, with the phenomenon often being described as “Fintech”. As financial services deal in intangible products, it is well suited for technological innovation to lower transaction costs and expedite the delivery of services. Although this has, in fact, been happening over the history of finance, the recent proliferation of internet connection, home computing and mobile devices, and the development of applications has led to the possibility of lowering barriers for market entry and leading to greater competition in or “disruption” of the financial industry. However, slating technological and innovation as “disruptive” technology can be misleading, and it is likely to be more a hindsight observation than the everyday trial and error that accompanies innovation and technological advances.

The insurance sector is not an exception to this, with developments in technology leading to possibilities of new methods of service provision as well as greater opportunities for data collection that can lead to better risk identification and mitigation measures, which are being referred to as “InsurTech”. InsurTech, as compared to Fintech, is more often related to service improvements for individuals, as opposed to businesses.

Innovation is generally regarded as a positive development, delivering convenience and efficiency. For example, the advent of cash points (ATMs) assisted people to gain access to cash even out of business hours. Improvements in communication networks and processing capacity have led to faster payment processes. Insurance claims can be processed via online platforms, with less time for processing. Comparative sites permit product comparison of various insurance products.

How the insurance sector responds to economical and society-wide technological innovations, and provides insurance processes and policies that integrate such changes would be an important development to consider. For example, the sharing economy has made startups, such as Uber, making available ridesharing more conveniently and widely. While commercial motor liability insurance would be a requirement for taxi drivers, Uber drivers may not have the appropriate coverage as it is often their side business or a part-time job. Insurance companies are already responding to this specific case, but it presents a wider question of how insurance responds to new risks that do not fit the traditional lifestyle and/or economic activity of individuals or businesses.

Given that underwriting is largely based on the analysis of historical data to carry out the risk assessment of a policyholder, insurance, on first glance, appears particularly well suited for “big data” analysis. Big data and blockchain have been major topics in many insurance discourses of technology.

InsurTech has attracted large venture capital investments, and the trend of financing indicates that many startups are considered by investors to be commercially viable on a mass-scaled basis. Insurers themselves are making strategic investments in insurance startups, allowing them to have a stake in these developments while providing the capital for such enterprises to develop their business.

There have been a number of insurance start-ups such as Friendsurance, Lemonade and Policygenius that have attracted large investments. To comprehend how disruption may be happening in the insurance sector, case studies of startups are presented throughout

this article, to provide context, and better understand how such businesses are being developed and how they are different from traditional business models.

There are new forms of processes that may be improving the efficiency of intermediation and claims management. Most insurance startups involved in distribution have sites with well-developed contents, often accompanied by the application of artificial intelligence or robo-advice. These are intended to give an improved customer experience and lower commission/fees for when products are sold, although the initial fixed cost will likely be higher. There are some outlooks which predict the number of insurance employees will drop as a result of some of these evolutions (McKinsey, 2015).

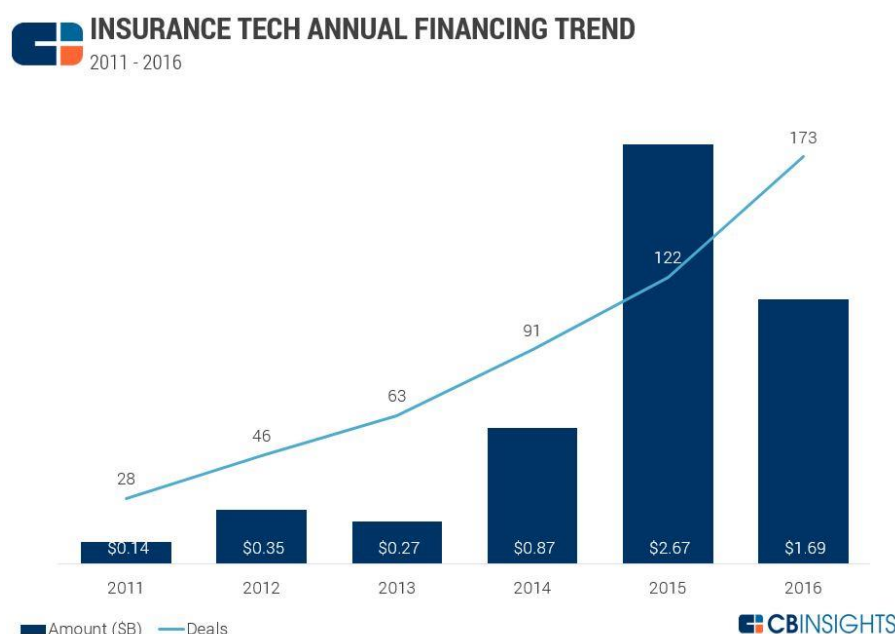
This article examines the various innovations taking place in the insurance sector, and what policy and regulatory impact they may have, as well as the benefits that could be reaped from innovation in the insurance sector, especially for policyholders. There are regulatory and competition considerations that need to be made as “disruption” to the industry is often about new market entries as well as new modes of service provision which may not fit the mode in which regulations were conceived upon. There are also wider privacy and data protection issues which require close attention given that InsurTech by nature usually involves a digital component to the technology.

2. Funding of InsurTech¹

Funding for new technology and innovation in the insurance sector is impacted by the wider venture capital (VC) possibilities in the market. In the US, InsurTechs have benefited from a rich and competitive market place for VC funding, and many insurance startups have successfully completed a number of funding rounds. Some markets do not have a strong VC culture, so the approach to raising capital would be different, with public sources becoming more important. For example, the French startup, InsPeer, has funding from a number of public sources.

Funding levels for InsurTech saw record levels in 2015, with funding estimated to be USD2,669 billion in total. The 2016 Q3 saw funding levels of USD1,401 billion, and the number of deals in 2016 Q3 were 126, already exceeding the number of deals in 2015 (see Figure 1). It should be noted that in 2015, nearly 1/3 of funding went to Zhong An, a Chinese internet-only insurer that was established in 2013 with backing from Alibaba Group Holding, which raised USD931 million in 2015, and is said to be planning a IPO.

Figure 1. InsurTech financing trend (2011-2016)



Source: CB Insights (2017a) *Insurance Tech Startups Raise \$1.7B Across 173 Deals in 2016*
<https://www.cbinsights.com/blog/2016-insurance-tech-funding/>.

In 2016, 59% of InsurTech deals went to US-based startups, followed by Germany (6%), UK (5%), China (5%) and India (3%) (CB Insights, 2017a). This may not perfectly match the population of InsurTechs, but is indicative of the VC possibilities in the market, in particular for the US, although Asian InsurTech is much weaker compared to the wider VC funding in the region. The number of VCs that are investing in InsurTech startups has increased from 55 funds in 2012, to 141 in 2016 YTD (CB Insights, 2017b).

In addition, insurers are providing funding structures that would allow them to have first pick of successful new technology and innovation that could support their existing operations and improve the customer experience. This has been via both general VC funding opportunities and targeted InsurTech investments, as well as establishing incubators that host InsurTech entrepreneurs and employees (see Box 1). A number of insurers have provided investment to InsurTech startups, as well as Internet of Things (IoT) startups.

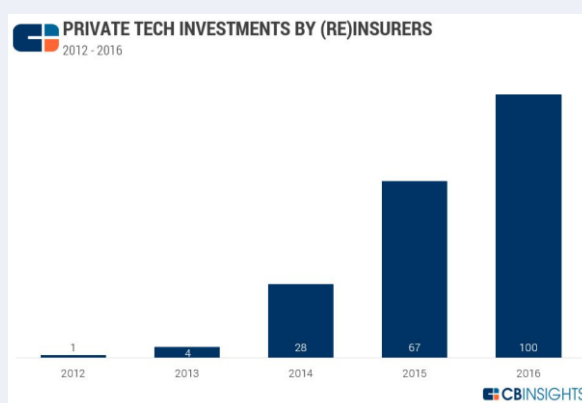
Box 1. Funding of InsurTech by (re)insurers

The wider funding landscape for InsurTech is described above, but a more interesting development has been how (re)insurers are funding InsurTech. Some of the larger insurers have set up specific funds and VCs to invest in startups, including for InsurTech, indicating the likelihood of greater investment into InsurTech, and the strategic investments existing insurers will make to ensure they have a stake in a startup that may be able to scale their business.

The number of deals made by (re)insurers in 2016 was 100 deals, compared to 67 in 2015 and 28 in 2014) (CB Insights, 2017c).

Tech startup investment by (re)insurers (2012-2016)

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Source: CB Insights (2017c), Where Insurers and Reinsurers Invested in Tech Startups in 2016 <https://www.cbinsights.com/blog/2016-insurance-cvc-total/>

Reflecting the wider InsurTech landscape but with certain specific differences, US (re)insurers are making the majority of investments in InsurTech with 64% of deals being made (as opposed to the actual funding level, for which data is not available)(CB Insight, 2017c). Most likely reflecting investments that Ping An Insurance has made in Zhong An, and Taipang Insurance has made in Alibaba Health, Chinese (re)insurance investments is 10% of deals made by (re)insurers. It may be that given the lower penetration of insurance in China, it is being anticipated that the market may develop based on the new intermediation models that are being introduced in China. France and UK (re)insurers make respectively 11% and 6% of deals by (re)insurers (CB Insight, 2017c).

Many of the deals are made by (re)insurers' strategic VC arm. Ping An Venture has been making some of the largest investments in InsurTech with over 20 deals. Axa Strategic Ventures has also completed 20 deals and together with Ping An have been the most active in deal making of strategic investments. US-based insurers MassMutual Venture, USAA, American Family Ventures, Transamerica and New York Life follow with between five and ten deals each. After which, the European insurers Allianz Ventures, MunichRE/HSB Ventures and Aviva Ventures continue.

More historically, Axa Strategic Ventures, Transamerica Ventures and American Family Ventures have been the most active investors in private tech investing since the start of 2012. Axa provided seed funding for five European start-ups under a fund set up in France in 2013, before launching Axa Strategic Ventures in 2015. The €200 million (USD223.47 million) venture capital fund has a mandate to invest in innovations in insurance, asset management, financial technology and healthcare services. Axa created Kamet in 2015, which is a €100 million InsurTech incubator working with both internal and external entrepreneurs. Axa recently invested €75m to take an 8% stake in e-commerce company Africa Internet Group and has become the exclusive insurance provider through Jumia and other platforms.

3. Insurance intermediation and distribution models

Insurance intermediation has traditionally used either the agent/broker or bancassurance model. While this remains the main intermediation channel for most developed insurance markets, many InsurTech startups are proposing new distribution models for insurance. These new modes of distribution are in particular interesting for less developed insurance markets, where insurance penetration is low and the conventional intermediation model of agent/brokers may not be efficient or effective. Asia and Africa have witnessed large investments being made into startups and technology based in their region.

BIMA (Box 2), Friendsurance, InsPeer and Guevara (Box 3) are all distribution-based insurance startups, providing new insurance services. While they do not intermediate policies in the more traditional sense, they all have brokering licenses to triage the appropriate policy using different business models. BIMA operates in less developed markets, and has had wide success in intermediating health insurance products through their model of combining agents with mobile platforms. BIMA has acquired a microinsurance license in some of the markets it operates. Friendsurance, InsPeer and Guevara are all peer-to-peer (p2p) insurance companies that rely on peer pressure for risk mitigation.

Box 2. BIMA

BIMA uses mobile technology to provide insurance services in developing and emerging markets, which the technology permits with the lower entry costs. In many developing countries, in Africa in particular, mobile phones are widely used for not only telecommunications, but also for accessing banking and payment services. The proliferation of mobile phones (penetration of 70% of population) and the acceptance of the technology for financial services have enabled BIMA to expand its health services in 16 markets. The success of this model has enabled BIMA to reach profitability in several markets already.

The main innovation of BIMA is the creation of a proprietary back-end tech platform which creates a mechanism for both registration and payment. Policyholders register using their handset to fill in some basic identification details which process takes approximately 2 minutes. Premium payment is collected via automatic deduction of prepaid airtime credit; unlocking a new payment channel that makes insurance affordable and accessible.

Distribution is carried out by a trained agent force. BIMA agents make the initial contact with potential policyholders, providing product education about all aspects of the policy including basics like the cost (just a few cents a day) and the coverage level. Post-sale, the customer will receive a confirmation SMS plus a monthly reminder of their coverage status and amount to be deducted.

BIMA sells a range of personal insurance products, including accident, life and hospitalisation cover (this policy pays a fixed amount per night spent in hospital). To claim, policyholders call customer support that will help them to file their claim which is paid in cash within 72 hours of the claim being completed.

BIMA is primarily licensed as an insurance intermediary and/or a licensed microinsurance provider, where applicable, and not an underwriter. Data is stored in Sweden which data protection regulation would apply.

In total, BIMA has raised USD75 million in capital so far. In 2015, BIMA closed its series C funding round with USD38 million raised from existing investors, including Investment AB Kinnevik, LeapFrog Investments and Millicom. This builds on a successful B series funding of USD22 million and USD15 million of capital invested before these rounds.

Box 3. Friendsurance, InsPeer and Guevara

Friendsurance, InsPeer and Guevara are based on similar business models, although operating in different markets (respectively Germany, France and the UK).

Friendsurance

Friendsurance was launched in 2010 and has funding from a number of internet venture capitalists (Horizons Ventures, VantageFund, e.ventures, the German Startups Group as well as the European Regional Development Fund). They are licensed as insurance brokers in Germany. Friendsurance is considered a pioneer of “social” or “person-to-person” “peer-to-peer” (p2p) insurance, offering household, personal liability and legal expenses and car insurance. Policyholders with the same type of insurance form small groups, which could either be with friends or find a group on their site. A part of the group’s premiums are paid into a cashback pool. If no claims are submitted, the members of the group can get up to 40% of their premiums paid from the cashback pool at the end of the year. Claims are settled using the cashback pool, and thus the claims decrease the cash back amount at the end of the year. Large claims are covered by normal insurers, with whom the firm has partnerships.

The benefit of p2p insurance is that the network effect discourages the group from making claims for very small amounts and policyholders seek participation from friends to increase the size of the pool.

InsPeer

InsPeer was launched in 2015 in France, and is a p2p insurance scheme that enables a group of people to share their deductible when a claim is paid. InsPeer is backed by angel investors, Bpifrance, the City of Paris, and Region Ile de France.

As the higher the deductible, the lower premiums become, a policyholder can raise their deductibles and share the risk with the designated group of people. InsPeer provides services for auto, motorcycle, and homeowners insurance policies. Other than increasing the deductible, InsPeer does not require changes to insurance contracts.

Users form small groups which share the risk that one or all will file a claim. Users can participate in as many insurance groups as they like but their exposure is limited to €100 pledged to any one participant and €1,500 across the platform. The service is completely free if there are no claims. In the case of a claim, InsPeer keeps a 10% of the claim paid by the insurer.

To assist policyholder assess who to share their risks, a risk indicator has been developed that indicates the expected claims rate of one person. This risk indicator for consumers is expressed in years, for example 8.5 years means that there is a chance of paying a claim once every 8.5 years.

Guevara

Guevara is a UK based insurer, and offers a choice of groups to join for auto insurance policyholders, to which their premium is split into one portion that is paid into the individual group (protection pool) and the rest into the single

collective pot (insurance fees) that supports all of the individual groups. The split of premium is determined by the number of members in a group.

Claims are first paid from the protection pool until it is exhausted, after which claims are paid from the insurance fees. When the insurance fee is also exhausted and the combined ratio exceeds 100%, reinsurance is taken out. Any funds left in the protection pool remain in the pool the following year, and requires being topped up only, in addition to the annual insurance fees.

By using peer pressure, the objective is to keep claims low. Guevara is authorised as a peer-to-peer insurance provider by the FCA, and can operate as a broker.

The best known carrier model is Lemonade, which has acquired an insurance carrier license, and attracted one of the largest seed funds for an InsurTech startup in 2016 (Box 4).

Box 4. Lemonade

Lemonade is one of the InsurTechs to have raised the largest amounts of seed funds, with a USD13 million seed round from venture capital Sequoia Capital and Aleph, as well as investments from XL Innovate, XL Catlin's venture capital arm. Lemonade Insurance Company is a property and casualty insurance company based in New York and with a New York state license as a full-stack insurance carrier.

Premiums are paid into a claims pool, and from that a fixed fee (20% of premiums) is taken out monthly for reinsurance coverage and expenses, with the remaining being used to pay claims. If the total of premiums paid is more than the fees and paid claims, moneys are returned to policyholders in the form of an annual 'Giveback'. Giveback is donated to charities of the policyholder's choice, and for this purpose virtual groups of 'peers' are formed around the charities of choice. Reinsurance is used to pay for claims that exceed the size of the pool.

Premiums are calculated individually for each policyholder and are based on a number of different factors including credit history, recent claims and information about the property including its age, size, and construction quality.

Lemonade has developed an AI app, Maya or Jim, to make the offer of an insurance policy. Risk mitigation factors such as sensitivity of homes to windstorms, severe weather damage, and fires are taken into account, and discounts made for protection equipment that may have been installed, such as fire and burglar alarms.

It has hired a renown behavioural scientist, Dan Ariely, as its Chief Behavioural Officer. Lemonade is a benefit corporation and a certified B-Corp, the only in the insurance industry, which is certified by the non-profit B Lab and must meet high standards of social and environmental performance, accountability and transparency. A benefit corporation is a for-profit corporation with a mission to achieve positive impact on society, workers, the community and the environment in addition to profit as its legally defined goals.

Lemonade's reinsurance partners are Everest Re, Hiscox-Lloyd's of London, XL Catlin-Lloyd's of London and Berkshire Hathaway's National Indemnity.

Finally, there is the self-governing model that often uses blockchains to auto execute the contract. There are potential benefits that could be reaped for risk transfer tools, such as cat bonds, which will be another area that blockchains are likely to further explore.

Blockchain is based on distributed computing, which results in a decentralised network. It is by design meant to avoid centralised control and is characterised by free participation. One of the advantages of blockchains in terms of financial transactions would be the improved cyber security due to its decentralised nature. Another is the transparency of transactions, which are all recorded in the node of the blockchain. Linked with this is that when a smart contract is part of the blockchain, there will be no need to authenticate the transaction, as it is effectively announced through its transparency and it is irreversible, which is another feature of the blockchain.

There are a number of ways in which blockchain technology could be applied to insurance services. InsurETH described below presents a case study, but if a blockchain can use external, third-party data sources, claims management could be automated potentially reducing the transaction cost. Para-metric insurance could benefit from such a process, especially for agriculture or disaster-related insurance for retail policyholders. Fraud detection could also be improved if blockchains were able to access data on purchase records, police reports, ownership etc.

The blockchain by nature does not permit amendments to transactions after the fact. This means that while for standard policies the technology could be a useful tool, for complex policies it may have limitations in its application. The legality of a blockchain-based contract is unclear, and thus its enforceability could be compromised as a result. As the policy would be written in the code of the blockchain, for regulatory and legal purposes an administrative step could become necessary for it to be transformed into a legal document, until the law recognises a blockchain as a legal document.

Blockchains do have limitation in the volume of data it can store and process. As it is decentralised and consensus-based, scaling a blockchain technology could face limitations. As blockchain transactions may be carried out using the applicable cryptocurrency, this would require those involved in a transaction to hold the respective cryptocurrency, which is subject to exchange rate fluctuation, albeit this could be smaller than fiat currency.

Box 5. The use of blockchains in insurance

Blockchains have the potential to change how transactions are processed, and this wave is coming to the insurance sector as well. Allianz Risk Transfer and ILS fund manager Nephilia Capital are piloting the use of blockchain smart contract technology for processing a natural catastrophe swap. The technology would process the transaction and settlement between insurers and investors.

The pilot demonstrates the technology has the possibility to simplify and accelerate contract management. Each validated contract on the open shared infrastructure contains data and self-executable codes inherent to that contract. When a triggering event occurs, meeting the agreed conditions, the blockchain smart contract picks up the predefined data sources of all participants, and then automatically activates and determines payout to or from contract parties.

Another similar initiative taking place between insurers and reinsurers is to explore the potential of distributed ledger to streamline paper work and reconciliations for (re-) insurance contracts and accelerate information and money flows, while greatly improving auditability. The B3i initiative is a cooperation between Aegon, Allianz, Munich Re, Swiss Re and Zurich, which will pilot the feasibility of using anonymised transaction information and anonymised quantitative data, in order to achieve a proof-of-concept for inter-group retrocessions by the use of the blockchain technology.

"Cat bond" payments between insurers and investors can take weeks or even months after the triggering event due to manual processing and authentication through intermediaries is not required. As blockchains cannot be altered, their characteristic assists in ensuring that ownership cannot be duplicated or forged.

A study forecasts that for the reinsurance industry, more efficient data processing and reductions in claims leakage and fraud through blockchain solutions could remove 15% to 25% of reinsurance expense ratios which are typically 5%-10% of premiums (PwC, 2016).

One of the promising example of insurance using blockchain is the startup InsurETH. InsureETH uses one of the blockchain platforms, Ethereum. Ethereum is one of the most popular blockchain platforms which is public and has a smart contract functionality. InsurETH offers automated flight insurance which relies on Ethereum smart contracts, and recording premium payment in the Ethereum blockchain. Travel insurance policies often cover delay of flights or lost baggage, but policyholders are not often aware of this coverage and often only make claims for higher expense claims such as delays due to a medical emergency or to access medical benefits. This is in contrast to the flight delays and lost baggage being a much more frequent incident and one which can be tracked using third party data sources. InsurETH uses this advantage by selling flight insurance, and automatically sources proof for claims using a public data feed Oraclise. This automates the process, in that if a flight delay occurs claims are paid automatically based on the data feed information.

The simplification of the contracting, which is done by inputting the flight number and coverage amount, enables travellers to easily access the coverage. The payment is done through the deposit of Ether, although denominated primarily in pound sterling, which is the cryptocurrency of Ethereum. So the traveller would be required to create a Ether wallet which is also a simplify process using applications.

4. The sharing economy and insurance

The sharing or gig economy is becoming a larger part of the economy, as services such as ridesharing (Uber, Lyft, BlaBla Car) and homesharing like AirBnB become common and popular service platforms. As a commercial service, these services will be required to have insurance coverage for certain aspects of their business.

As part of this, there is strong recognition that millennials,² which are one of the largest age cohorts in the US and are entering their highest consumption period, have a preference for having digital solutions available for transactions (Goldman Sachs Global Investment Research, 2016), and this is also prompting insurers to review how to approach distribution and claim management. Millennials have a 10% less positive customer experience of insurance transaction than other age cohorts, which is indicative of the dissatisfaction felt by this generation to conventional insurance solutions (Capgemini Consulting, 2015).

One of the key features of millennials and the sharing economy is that complete strangers share their personal experience/review, car, house, quite freely, while confidence in established business processes, such as insurance, is considered less positive. From the distribution sites, robo-advice and data analytics discussion below, it could be that insurers can expect greater willingness by policyholders to provide more personal data and prefer computer generated advice. Insurer may have to adjust their business processes in accordance with such consumer behaviour and take greater care of privacy.

While the provision of insurance coverage for ridesharing services is improving, the nature of the service creates unique challenges to underwriting. Public transport and taxis require insurance coverage as commercial service providers which are excluded from standard auto insurance. Commercial coverage is based on the driver having certain qualification and experience transporting the public, and the vehicle being maintained to a certain standard on a periodic basis. Ridesharing typically uses drivers not authorised to drive taxis and their personal vehicles, although in some cases they are licensed drivers providing services in their spare time.³

Some insurers are addressing the unique nature of ridesharing. For example, Uber has coverage by separating the coverage to the core policy of when a driver has picked up a customer and dropped them off, lower coverage for when the driver is logged on to the system and waiting for a pick up and a separate coverage for physical damage to the driver's vehicle while it is being used for the rideshare services. There is still a potential gap of when a commercial coverage is in effect, and when the driver's personal auto insurance will be expected to cover any unplanned incidents.

Peer-to-peer homesharing, such as AirBnB, would likely require additional coverage as a homeowner policy would not cover liabilities caused by a renter. When renting out a home on a single occasion, it is likely that homeowner or renter's insurance will cover such an occasion, although it may require notification to the insurer in advance. However, for repeated homesharing/renting, an add-on to the policy or commercial insurance may be required, in particular to cover liability from guest damage. Monthly coverage is becoming available for such additional coverage by a number of insurers.

Beginning in January 2015, Airbnb began including no-extra-cost USD1 million "Host Protection Insurance" for hosts – and in some cases their landlords – designed to cover the liability associated with a peer-to-peer rental. Intentional acts that aren't the result of

an accident are not covered by the insurance, as well as what the website terms “property issues,” such as mold, bedbugs and asbestos.

5. Robo-advice and artificial intelligence

While price comparison and distribution sites are becoming wide spread, much effort is being made to develop sites that provide financial guidance which is tailored to the policyholder’s income and needs with greater automation through algorithms for products with investment and/or long-term saving components. This could assist in narrowing the protection gap of the lower income population as the cost of such services is lowered.

In comparison to robo-advice, human interaction has benefits in that long-term relations can nurture trust and understanding between a policyholder and financial advisor/broker/agent, in particular in times of financial difficulty. Financial advisors may be better at persuading policyholders to take certain actions. In addition, robo-advice has not been challenged in poor market conditions where assets lose value. How robo-advice might cope in such situations is unclear.

However, robo-advice has the ability to develop a financial plan addressing multiple goals, including retirement, protection needs, estate planning and health/long-term care coverage. Robo-advice has the privacy which some may feel more comfortable with given the sensitivity in discussing money matters.

What would be important for many policyholders is that the fee would be lower than the fee charge by financial advisors. In the investment advisory sector in the US, for example, financial advisers generally charge 1% of the assets under management as fees, this is opposed to the between 15 to 35 b.p. of assets under management charged by investment robo-advisors (Investor Junkie, 2016).⁴ In comparison, in the UK, for example, Santander’s branch-based investment advice fees are 2.5% of assets invested, with a minimum investment of £500 and a maximum of £150,000.

AI is being used in a number of sites such as through the algorithm used by Lemonade for its policy offering and PolicyGenius (Box 6). AI has the potential to simplify and tailor policy offerings to match the needs and financial situation of the policyholder. This is different from robo-advice, where AI is specifically designed for personal advice, primarily on investments.

Box 6. PolicyGenius

PolicyGenius was founded 2014 to provide users with price comparison information on life insurance, long-term disability insurance, renters insurance and pet insurance. As opposed to most insurance comparison sites, it is not based on a lead generator model, which interprets an inquiry as a request for a quote and sells the client inquiry to insurance brokers/agents who would then try and sell the policy. Also the user experience is considered a key factor of the business and contents is developed for an improved user experience and provides advice on the offers being made. They are not affiliated with any particular insurance company and their algorithms work to match the user with the best policy to fit their needs. It is licensed as an independent broker in New York state.

Life insurance is the company's most popular product, followed by disability insurance. Through its "insurance checkup tool" it analyses and generates the advice that is suited for the user.

It raised USD750 thousand in seed funding, and has raised USD5 million in a series A and \$15 million in a series B round of funding. Revolution Ventures led the Series B round, with previous investors including Karlin Ventures, Susa Ventures, Axa Strategic Ventures, Transamerica Ventures and MassMutual Ventures. PolicyGenius reached 800,000 users by the end of 2015 although whether the user inquiries led to actual policies is undisclosed.

However, the algorithms are a blackbox, which in some instances could be leading to poor advice. A study indicates that for the majority of age groups, a combination of robo-advice and personal advice was deemed to be optimal (E*Trade Financial, 2016), which has generally been the way in which most insurer AI would be developing their robo-advice (Acord & Surely, 2016).

The underlying algorithm of robo-advice and AI are not transparent in most cases, and biases could be built in, both unintentionally and intentionally, leading to inappropriate advice. The understanding of how this impacts policyholder behaviour and how regulation should address this is unclear but an area that requires greater discussion (see Box 11).

6. Data aggregation and analytics

Internet, the Internet of Things (IoT), hand held devices, and applications are all contributing to the possibilities that technology can have in collecting more data from businesses and individuals. Social media as well as devices such as Fitbit and Apple watch permit device operators to collect individual activity data as well as health related data. While insurance has traditionally relied on quantitative data to make risk management decisions, data analytics goes beyond this remit and can be contentious in some occasions. Underwriting and claim management are particularly data rich, and insurers use data collected for fraud prevention, marketing, claims management and pricing risk.

For example, personal auto insurance in the past relied on internal data sources such as loss history. However, auto insurers have started to incorporate behaviour-based credit

scores from credit bureaus into their analysis, based on empirical evidence that people who pay their bills on time are also safer drivers. There is an issue of risk awareness, as a US Government Accountability Office report in 2005 reported that 53% of respondents to a survey in the US did not know this when they could request credit scores to be excluded for premium considerations in times of hardship (GAO, 2005).

Some insurers are engaging such data by having an arrangement with the data collector or purchasing the data from a data aggregator. As insurance depends on making an actuarial assessment of the risk, having more relevant data would assist the analysis. The release of previously unavailable or inaccessible public-sector data has greatly expanded potential sources of third-party data. The US and UK governments and the European Union have recently launched “open data” websites to make available massive amounts of government statistics, including health, education, worker-safety, and energy data, among others.

One example of such endeavour is the marriage of longevity data, face recognition technology with underwriting for the provision of life insurance. Face recognition technology is used to predict factors such as chronological age, gender, smoking habits and body mass index (BMI). Based on this data, and accompanied by an activity sensor, such a FitBit or physical activity tracker on a mobile phone, your expected life expectancy is provided. A term life offer is made based on this, and the term period can be selected by the policyholder.

Telematics and insurance is another avenue in which data analytics is being used to monitor the behaviour of policyholders and mitigate risks in advance as well as discounting premiums where applicable. Motor insurance related data has been abundantly accumulated in insurance companies as it is one of the largest lines in most countries. Telematics insurance is when a device is fitted into motor vehicles and used to track driving. For example, the Italian Insurance Association estimates that blackboxes have been installed in over 2 million cars in Italy, to support the provision of blackbox insurance, “telematics car insurance” or Usage Based Insurance (UBI), and is one of the large markets for telematics car insurance. Blackboxes devices track speed, braking, acceleration, cornering and the time of the day a journey is made via satellite technology. The data is transmitted to the insurer by GPS which enables the insurer to estimate the likelihood of a claim being made. Such programmes benefit young drivers that do not have a track record to influence their premiums, for example. While there is no research that clearly indicates the link between telematics and accident rates (UK Transport Research Laboratory, 2015), anecdotal evidence suggests telematics solutions can reduce collisions by up to 20%, operating costs by up to 10%, and fuel consumption of between 8% and 11% (Zurich Fleet Intelligence, 2016). It is estimated that the number of consumer subscribers to telematics insurance is expected to grow to 142 million globally by 2023 (IHS Markit, 2016).

On a risk management level, there are a number of data analytic solutions that could assist insurers. These include integrated geospatial analytic tools, geo-spatial analysis, and data quality management tools and claims/exposure matching. In particular, claims processes could benefit from the use of pictures taken and filed via smartphones and concierge services to smooth the process.

If data aggregation is being used for actuarial purposes, it could lead to potentially too high premiums or uninsurability of certain segments of the society or individuals, or ethically questionable outcomes. If premium are risk-based, granularity of the data could have both a positive or negative impact. The negative impact would be when potential

policyholders are not able to purchase insurance at a reasonable premium level when it is a risk-based premium (Keller & Hotte, 2015).

The Internet of Things (IoT) is when sensors and actuators embedded in physical objects—from roadways to pacemakers—are linked through wired and wireless networks, often using the same Internet Protocol (IP) that connects the Internet. The connection permits large volumes of data to flow to computers for analysis (McKinsey, 2010). Telematics insurance is the best known example of insurance using the IoT. Other examples of IoT devices being used for insurance are sensors in private homes, farms or businesses to alert policyholders about risks such as bad weather conditions and security surveillance, or to provide feedback about individual risks. Biometric data such as electrocardiogram (EKG) and arrhythmia detection, pulse and variability, blood pressure, respiration information, blood sugar level, muscle activity, sleep patterns, body temperature, blood oxygen levels, skin conductance levels, brain activity, hydration levels, posture, eye tracking data, ingestion and fertility information can also be generated and applied in data analysis for insurance purposes.

Having granular data may have a number of unintended consequences. The most immediate would be the privacy of those who provide the data. While the data protection of data relevant to the contracting of an insurance policy is clear, the treatment of data collected additional or outside of this may not be. Tracking of data, whether by a blackbox device or an activity sensor, provides much data beyond what the insurer may require to determine the behaviour of the policyholder or the premium reductions. Insurers would not only have data on the driver's behaviour, but where they travel to and visit, and the frequency of this. While activity sensors permit a better understanding of a policyholder's lifestyle, genetics also account for a large part of a policyholder's health and life expectancy. It would become important that a distinction is drawn by insurers for when a poor lifestyle caused ill health, for example, and when a person is born with poor health which have no way of being addressed by lifestyle choices.

The ownership of data generated through the IoT, as with many digital devices, is still being discussed, and currently general privacy and data protection regulations would apply. The US Federal Trade Commission issued a report in 2013 (FTC, 2015), examining some of the issues on the IoT and privacy. The manner in which IoT collects data makes it difficult to gain consent every time data is collected, and is not necessary either. However, it is important that a choice can be made by the individual before data is collected, although not in instances when the context of collecting data is consistent with the transaction the individual is entering with the company (FTC, 2012). Where the use of data would be inconsistent with the context of the interaction, a clear and conspicuous choice should be offered.

Another issue is how cross-border data transfers should be treated. Data can be ubiquitous if structured, and can be used to analyse behaviour in other countries. This is discussed in detail in the next section.

7. Policy and regulation: its role in InsurTech

Insurance regulation and innovation hubs

While innovations are generally a positive development, there are a number of potential policy and regulatory ramifications which can create some uncertainty and certain limitations in business developments. In terms of competition policy, the potential to have new entrants to the market through the application of innovations and new technologies

could bring greater consumer utility. The rationale for competition law or policy is to improve the consumers' welfare and the efficiency in production and supply, which would lead to lower prices and wider choice. The possibility of new entrants in the form of startups and greater choice as a result of innovation and technology could bring a number of positive developments to competition in the insurance market.

When startups want to become an insurer or an insurance agent/broker, there are potentially prohibitive capital and/or fit and proper requirements that must be met to gain authorisation to operate. Perhaps for this reason, there are very few InsurTech startups that have gained insurance underwriting licenses, and most have broker licenses. While for prudential purposes these requirements are an important cornerstone to ensure policyholder protection, these could potentially be a barrier to new market entry. There is a constant tension in the financial sector regarding the appropriate balance between financial regulation and competition, and this is very much relevant in the context of innovative technology.

To address this, some financial regulators have established platforms relaxing some of the regulatory requirements to enable Fintech startups experiment with their technology. The UK Financial Conduct Authority (FCA)'s Innovation Hub is one of the first applying the "regulatory sandbox" approach (Box 7). Singapore's Monetary Authority of Singapore (MAS) has also adopted the regulatory sandbox approach (Box 8). Australia's Securities and Investment Commission (ASIC) has established an Innovation Hub to mitigate risks by engaging early with Fintech innovators and helping new entrants understand the regulatory requirements. The Hong Kong Monetary Authority and Canada's Ontario Securities Commission have also launched similar platforms in recent months. These platforms are all designed to assist new market entries that would encourage greater competition and innovation in the market, ultimately benefiting consumers.

Box 7. UK Financial Conduct Authority's Project Innovate

The UK's Financial Conduct Authority (FCA) launched Project Innovate in October 2014 to encourage innovation that would benefit customers, and promote competition through disruptive innovation. Project Innovate is led by the Innovation Hub which assists innovative business gain access to fast, frank feedback on the regulatory implications of their solutions, and identifies areas where the regulatory framework needs to adapt to enable further innovation in the interests of consumers.

Support through the Innovation Hub is based on an eligibility criteria that includes whether it is a genuine innovation, what would be the consumer benefit, has the business invested appropriately to understand the relevant regulations, and does the business have a genuine need for support from the Innovation Hub. The Innovation Hub has had over 600 requests for support and offered direct support to over 300 firms.

The FCA has also developed a Regulatory Sandbox. The objective of the regulatory sandbox is to create safe spaces in which businesses, both authorised and unauthorised, small and large, can experiment with innovative products, services, business models and delivery mechanisms without immediately incurring the normal regulatory consequences of engaging in the activity in question. Unauthorised firms are subject to a tailored authorisation process and

must meet threshold requirements, but it grants them restricted authorisation to test their ideas. The restricted authorisation option is not available for a banking license. For authorised firms, the sandbox could provide clarity to applicable rules that do not easily fit into existing guidelines. Consumer benefits would be a prerequisite for applications to the sandbox.

The FCA has stated that it has accepted four applications from the insurance sector to develop towards testing.

Box 8. Monetary Authority of Singapore's approach

The Monetary Authority of Singapore (MAS) has adopted the regulatory “sandbox” approach to Fintech, which is applicable to the Singapore financial sector. The approach that MAS has taken is to acknowledge that new technologies can increase efficiency, manage risks better, create new opportunities and improve people’s lives.

A regulatory sandbox approach is being proposed to carve out a safe and conducive space for Financial Institutions and Fintech players to experiment with Fintech solutions, while containing any consequences of failure. However, Financial Institutions are free to launch new solutions without MAS’ guidance if they are satisfied with their own due diligence and there is no breach of legal and regulatory requirements.

MAS carried out a public consultation in June/July 2016 and issued the finalised Fintech Regulatory Sandbox Guidelines in November 2016. The below summarises some of the key points of MAS’ regulatory sandbox approach.

The regulatory sandbox approach would involve MAS’ support by relaxing specific legal and regulatory requirements prescribed by MAS for the duration of the sandbox. It would generally not be available to Fintech solutions that are:

- Similar to those already being offered in Singapore unless the applicant can show that either a different technology is being applied or the same technology is being applied differently, and
- When the applicant has not demonstrated that it has done its due diligence, including testing the proposed financial service in a laboratory environment and knowing the legal and regulatory requirements for deploying the proposed financial service.

There should also be an intention that the Fintech solution would eventually be deployed in Singapore after exiting from the sandbox.

MAS has identified requirements that should continue to be applied even to sandbox applicants, and those that could be relaxed. Requirements that will not be relaxed are related to customer information confidentiality, fit and proper criteria particularly on honesty and integrity, handling of customer’s moneys and assets by intermediaries, and prevention of money laundering and countering terrorism financing.

Source: MAS, FinTech Regulatory Sandbox Guidelines (November 2016).

The regulatory sandbox approach intentionally creates a space for insurance technology to be experimented in a different regulatory regime from the regular. Although it is early stages of the approaches, it would be worthwhile to understand when technologies are deemed successful and scalable, how they will be graduated into the regular regulatory framework. Going forward, this will be important in ensuring that a level playing field is applied at the appropriate stage.

A relevant development that is taking place between MAS, FCA and the Australian Securities and Investment Commission are bilateral cooperation agreements between the authorities that allow them to make referrals on innovative businesses seeking to enter each other's market. This would assist in enabling startups transfer their business models on a cross-border basis, assisting with the businesses to scale when the opportunity arises.

Another relevant consideration, for developing countries in particular, is whether there is merit in having a specific regulatory framework to allow new insurance products that target specific limited risks, that are low in value and may benefit from greater penetration of insurance policies while having a limited policyholder impact.⁵ To date, a number of countries (Brazil, India, Mexico, Pakistan, Peru, the Philippines, South Africa, and Taiwan and other African countries) have specific microinsurance regulation (Biener, Eling & Schmit, 2013). Microinsurance can also be beneficial in OECD countries, as the example of the startup Trov demonstrates. Trov is on-demand insurance for your possessions, which can be switched on and off through a mobile device. The mobile app enables the value of the inventory of possessions to be tracked in real time and insurance premiums as well. With the lower transaction costs that mobile technology can bring, microinsurance may find a way to be more readily provided in developed insurance markets as well.

In the age of new technology, insurance regulations which will likely be affected are governance and market conduct related rules. The OECD Guidelines on Insurer Governance recommends that board members and key executives should establish internal controls that ensure compliance with applicable laws, regulation and standards, as well as an incentive structure that promotes the fair conduct towards consumers and policyholders. Controls functions are expected to assess the appropriateness of policies, processes and procedures, and identify and follow up on any deficiencies.

If an insurer does adopt new technologies or innovates processes/products, it should consider whether the appropriate internal control considerations have been made, as well as being appropriate in terms of market conduct.

A number of countries are engaged in a wider discourse on, for example, autonomous cars, which will have an impact on auto insurance coverage. The recent fatality resulting from a self-driving car in the US (see Box 9) has brought to the attention the reality of autonomous cars and how to ensure their safety. Together with this, how the liability of such a car in an accident has yet to be fully resolved. The UK and US have carried out consultations that touch upon this issue, and how this proceeds will likely impact how other markets respond as well.

Box 9 Autonomous cars and insurance

The advent of mass autonomous or driverless cars is expected to be not in the far future, and a number of countries (US, UK, France, Switzerland and Singapore) have started to permit the use of certain roads for driverless cars. In the US, several states have enacted laws on the use of autonomous cars. Driverless cars do have the potential to improve road safety by preventing human error, and efficient traffic flows and fuel usage. As trials take place, the appropriate framework for insurance coverage for such for vehicles will also become an important aspect for governments to consider.

The UK carried out a consultation on product liability insurance that would be required for autonomous driving or driverless cars in July 2016. The expectation is for driverless cars that can be parked by remote control within the line of sight of the driver, and/or cars that can be auto-piloted with human oversight at high speed will be available for sale in the coming few years.

The US Department of Transportation and National Highway Traffic Safety Administration have issued a paper that proposes updates to its Federal Automated Vehicles Policy in September 2016. In the US, states have responsibility for motor vehicle insurance and liability regimes. As part of this, states are asked to consider how liability should be allocated among highly automated vehicle (HAV) owners, operators, passengers, manufacturers, and others when a crash occurs.

Insurance coverage of a motor vehicle is for damages and third-party liability (TPL). The difficulty for driverless cars is with who the liability is placed with: the driver or car manufacturer. The manufacturer would be involved through product failure (liability) that resulted in a collision while the driver would be liable when s/he did not take control of the vehicle in certain circumstances resulting in a collision. There is much uncertainty as to how the liability of a collision would be addressed when there is a mixture of human input and autonomy involved in driving.

In May 2016, a Tesla self-driving car was involved in a collision when driving on autopilot mode on the motor way which was fatal to the driver. TPL insurance would not cover the driver unless supplemental insurance was acquired. Some motor manufacturers are offering self-insurance to their automated vehicles.

The UK government inquires on whether there is a need for supplemental insurance coverage such as product liability, and drivers and passengers. The industry has responded that insurers could provide cover for all liabilities, and then take over possible liability claims to the manufacturer for any potential product liability.

The Bank of England recently published projections that with the development and uptake of autonomous cars, the UK motor insurance market may contract by 21% by 2040.^c

- a. UK Department for Transport and the Centre for Connected and Autonomous Vehicles, Pathway to Driverless Cars: Proposals to support advanced driverless assistance systems and automated vehicle technologies (July 2016).
- b. US Department of Transportation and National Highway Traffic Safety Administration, Federal Automated Vehicles Policy: Accelerating the Next Revolution in Roadway Safety (Sept. 2016).
- c. Bank of England, Quarterly Bulletin 2017 Q1.

AI and the regulation of technology-based advice

As AI and robo-advice become more widely used, there could be uncertainty as to how current regulation applies. For example, in New Zealand, current regulation requires that advice be provided by a ‘natural person’. Planned changes in New Zealand seek to broaden the definition of advice in order to accommodate technological innovations, and require that entities providing robo-advice be licensed and held to the same requirements as other types of advisors (New Zealand Ministry of Business, Innovation and Employment, 2016). Fully automated services are not allowed to provide advice in Canada, and any robo-advice service must provide some access to personalised advice from an advisor (Lortie, 2016).

Regulators in several jurisdictions have been assessing how technology-based advice should be regulated going forward. The Australian Securities & Investment Commission (ASIC) issued a regulatory guide on robo-advice to retail clients in August 2016 (ASIC, 2016). The guide maintains that the qualification requirements for providers of robo-advice be the same as those for normal advisors, and lays out the requirements for testing the algorithms used and the governance controls and processes in place.

In April 2016, the US Securities Exchange Commission (SEC) approved a rule proposed by the Financial Industry Regulatory Authority (FINRA) that requires developers of algorithmic trading to be registered as a securities trader, and be subject to the same qualification requirements as securities traders to reduce market manipulation (SEC, 2016). The European Supervisory Authorities (European Banking Authority, European Securities and Markets Authority and European Insurance and Occupational Pensions Authority) have issued a joint discussion paper on the automation of financial advice looking at the potential benefits and risks of such innovations in order to determine any additional regulatory action needed to address automated financial advice (Joint Committee of the European Supervisory Authorities, 2015).

The regulations and consultations taking place indicate the need for consistency with the regulation of human financial advice and proper risk and governance controls of the robo-advice being provided. The type of advice being provided by the platform should clearly indicate whether the advice being generated is general or has been personalised. If the advice is determined to be personalised advice, clear processes would need to be in place with respect to how suitability for the client is determined. The algorithms used for automation should be extensively tested, and controls in place to ensure that procedures are in place to ensure their proper functioning.

There is also the issue of whether algorithms may have biases that, whether intentional or unintentional, may be leading to inappropriate advice. This could impact policyholders on a wider base than advisors, as the bias would be built in and anyone who uses the algorithm will be subject to it. Another issue that has been highlighted is that robo-advice and risk management algorithms could lead to herding, increasing pro-cyclicality (Carney, 2017).

Privacy and data protection issues

Technology that engages big data is complex, opaque and often uninterpretable. For this reason, even those who develop the technology for usage of big data may not fully comprehend the impact or appropriate usage of data. Firms should be able to demonstrate that their use of data is appropriate and free of biases in so far as possible.

Privacy and data protection regulations for big data and data analytics by insurers, should be rigorously addressed, and ethically uncertain use of data should be fully assessed. In this respect, the wider data protection regime will have a large impact on how this is addressed. In addition, when notification requirements for data breaches are introduced, insurers will need to ensure that databases have the capacity to support this requirement. However, notification requirements are also likely to assist the development of standalone cyber insurance markets.

Under the current EU regime, for example, cross-border data transfers are not permitted unless made to an Adequate Jurisdiction or the data exporter has implemented a lawful data transfer mechanism (according to EU Data Protection Directive (95/46/EC) and the EU General Data Protection Regulation (GDPR)(Box 10). To be deemed an Adequate Jurisdiction, the GDPR will be extending the requirements from the Directive for the jurisdiction to have *inter alia* fundamental rule of law and legal protection of human rights, access to transferred data by public authorities, and effective and functioning data protection agencies (DPAs), international commitments and other obligations in relation to the protection of personal data. For transfer of data within the corporate group, GDPR requires corporate to have Binding Corporate Rules (BCRs) that are legally binding and apply to and be enforced by every member of the group of undertakings envisaged in joint economic activity, and have DPA approval of the BCR.

Box 10. EU General Data Protection Regulation (GDPR)

The EU Parliament and the European Council agreed on the General Data Protection Regulation (GDPR) in December 2015. It would be applicable to firms that process personal data from those residing in the EU irrespective of whether their services are free or fee-based, whether the firm is based in the EU or not. It is an update to the Data Protection Directive which came into force in 1995. Under the GDPR, fines can be up to €20 million or 4% of global annual turnover, whichever is the higher, if the action of the firm leads to a loss of information or a data breach. It will take effect in member states from 25 May 2018.

GDPR requires private information to be erased without undue delay when the data is no longer required in relation to the purpose for which it was collected. The data used must also restrict use of data when the data quality has been contested by the data subject. The firm must maintain an accurate record of the data subject's agreement for their data to be used for primary and any secondary purposes, without which the firm may not have the right or ability to use the data.

Depending on how and where insurers process their data, this could have implications on how new technologies could be introduced. In addition, the market of cyber risk insurance could expand depending on how GDPR is implemented. It could also impact data analytics which may have relied on data collected for different purposes.

In the EU, outsourcing arrangements and distribution agreements must be agreed with caution, in terms of who is controlling and processing data. Under the current EU directive data protection regime, the processing of personal data cannot take place unless there are legitimate grounds to do so, which under GDPR will require insurers (data controllers) to carry out a “data protection impact assessment” before processing personal data. Insurers are expected to implement sufficient consents and effective protocols for collecting, handling and processing all data an insurer controls.

Further, under the GDPR, data controllers will be required to notify personal data breaches to the competent supervisory authority, where feasible, no later than 72 hours after becoming aware of the breach, unless the data controller is able to demonstrate that the breach is unlikely to result in a risk to the rights and freedoms of the data subjects concerned. Notifications must also be made to data subjects “without undue delay” if the breach is likely to result in a high risk to their rights and freedoms. Businesses could be fined up to €20 million or 4% of annual global turnover in the most recent financial year, whichever is greater, for failure to comply with GDPR.

RegTech

RegTech is an emerging area in Fintech, that uses technologies to solve regulatory and compliance requirements more effectively and efficiently (IIF, 2016). Given the various regulatory reforms introduced after the financial crisis, RegTech has the potential to ensure more effective compliance of complex regulations. Technologies that are deemed to be applicable for RegTech include machine learning and artificial intelligence, biometrics, the interpretation of unstructured data such as e-mails and Facebook posts, and the use of application programming interfaces (APIs). Box 11 discusses RegTech and algorithms. Those tools can be brought to bear on such areas as aggregating big data, modelling risk for stress-testing, monitoring of capital-requirement compliance, updating compliance manuals, improving anti-money laundering and know-your-customer (KYC) programs and preventing fraud and in-house violations.

RegTech is an area where countries which have developed regulatory approaches to Fintech have benefited more from startups, with 31% of RegTech startups incorporating in the UK, as opposed to 20% in the US (Mulder, 2016).

For insurance, for example, there are data analytics platforms that allow internal data of financial institutions to be converted into regulatory reporting formats, and this could be applied to the insurance sector. There are a number of know-your-customer (KYC) platforms which may use external, open data to verify customer identity. As solvency modernisation initiatives require asset managers of insurers to be able to report investments on a look-through basis, RegTech solutions could provide a platform for insurers to grasp their asset-under-management in a simple interface.

Box 11. RegTech and algorithms

While a number of solutions are being proposed for insurance in the area of RegTech, in particular for fraud prevention and solvency compliance, an emerging area is how insurance companies can ensure that their algorithms are compliant with market conduct regulations. Some startups are working to address unintended consequences of algorithms, to ensure that financial institutions, including insurance companies, can integrate algorithms in their customer interface as well as enterprise risk management in a manner that corresponds to the objective of efficiency and effective of business processes while minimising potential risks of algorithms.

ORCAA is a NY-based technology startup founded by a data scientist to carry out audits of algorithms. The model being used is examined from four phases: data collection and integrity, objective of algorithm, the basis in which the algorithm has been built, and monitoring and updating of the algorithm. Algorithms have been known to use certain proxies, such as post code, which could result in certain segments of the population being unfairly treated depending on how the algorithm is modelled.

An area that financial regulation has been relatively exposed to algorithms is in high-frequency trading, where trading algorithms are used to execute high volume, high speed automated trading in financial markets. Financial regulators such as the Federal Reserve Board (2009) and the French Autorité des Marché Financiers (2009) had issued reports on this issue; nevertheless, a mutual fund trade resulted in a mass withdrawal by high frequency trading and the subsequent crash of the Dow Jones (“Flash Crash”) in May 2010. Germany adopted the High-Frequency Trading Act in 2013, which requires high frequency trading firms, not previously supervised by BaFin, to be supervised by BaFin. Firms are required to ensure that markets are not distorted or interrupted. The algorithm-tagging rule mandates that exchanges have to implement rules requiring all exchange members to flag all algorithmically generated orders with a unique key when sent to a German exchange so as to allow the market surveillance system to allocate all orders to the generating algorithm (Coombs, 2016). The EU Commission has issued a technical standard to the Markets in Financial Instruments Directive (MiFID) II, which will be implemented in 2018, on how to implement articles relevant to high frequency trading in April 2016.

Monitoring of algorithms is complex, requiring special skills and expertise, and regulators and supervisors are often not equipped to understand or assess algorithms and/or whether big data is being appropriately used. In the insurance sector, the known uses of algorithms are primarily related to the customer interface, although solvency initiatives are likely pushing insurers to use algorithms for the measurement of solvency as well.

Regulators should consider how to approach the use of algorithms and big data by insurers that would ensure that they are being appropriately developed and are avoiding, in so far as possible, biases and unintended consequences. In particular, stress testing might be carried out to determine how robo-advice would cope in certain extreme market conditions.

8. Conclusions

It appears that InsurTech businesses are developing business models that may, in fact, better address the insurability of policyholders by using technology to simplify the contracting process, and tailoring policies to better suit their needs. There is also scope for insurance to adapt to wider changes in economic activity, such as the sharing economy and the large millennial cohort. Another characteristic of many InsurTechs are the social and environmental considerations that their business models incorporate. Many of the InsurTechs try to improve the transparency of the contracting as well as the claims management process, including fraud detection, providing greater clarity to where the premiums paid go, which could have an impact on the wider insurance industry.

There also seems to be a wider recognition that the fine print of an insurance quotation is tedious to read, without giving much insight into the actual coverage of the policy for retail clients. Sites are being developed that simplify the information on coverage of a policy and try to clarify the level of premiums, while introducing peer pressure for risk mitigation. There is often an algorithm to carry out the risk assessment using a few questions which may also use external data sources to assist the assessment.

The scale of InsurTech investment is growing, and by (re)insurers in particular. As InsurTechs start to attract a large number of users/policyholders, and provide an improved customer experience, (re)insurers will likely hope to capitalise on the success of such startups by having a stake in them. A number of (re)insurers have created strategic venture capital arms for this purpose, and have been making strategic investments in a number of startups.

Some countries are establishing regulatory platforms, such as the regulatory sandbox approach, that allow innovative technologies to enter the market, and this will assist in encouraging startups to develop their business model while becoming acclimatised with regulatory requirements. Startups may opt to initiate their business in markets which have such a ready platform.

More broadly, these technologies have the potential to bring better and more customised insurance coverage to more people, including those in the lower income bracket, and bring greater financial protection. In addition, the new distribution models can simplify the insurance process, and bring insurance to less developed markets.

However, InsurTech will have to meet insurance regulations as well as wider data protection and cyber security requirements as they try to scale their business. Ensuring that not only is the customer experience positive when it is scaled up, but that consumer protection and safety standards are met will remain a challenge for startups and regulators alike.

The development of innovation hubs and regulatory sandbox approaches provides an environment for new technologies and innovations to be nurtured, and has the potential to enable a greater understanding of their impact on the markets. However, greater clarity on the appropriate level of regulation in such platforms and how they graduate into full regulation requires further discussion in order to balance the need for innovation as well as the need for adequate protection of policyholders.

The impact of the use of big data and algorithms and how regulators could approach their evaluation is unclear. The complexity involved has implications for how regulators organise themselves as well as for how the spirit of regulation is applied. Firms should be expected to demonstrate that their use of data is appropriate and free of bias in so far as possible. RegTech may have a role to play in assisting that this is carried out going forward.

Notes

1. This section draws heavily on data from CB Insights which is the leading data and information provider on private company investment.
2. Millennials are generally referred to as those born between 1980 and 2000.
3. This has resulted in the service being banned in a number of cities as a result of opposition from taxi unions.
4. For example, Charles Schwab's robo-advisor does not charge a fee.
5. India's Insurance Regulatory and Development Authority adopted a regulation on microinsurance regulation in 2015.

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4. Robo-advice

The accessibility of appropriate and suitable financial advice has become a topical issue alongside the increasing prevalence of defined contribution pensions for which individuals need to manage their own investments. Riding the wave of technological innovation in finance, the robo-advice model has emerged as one potential solution to increase the accessibility and affordability of getting help to invest savings for retirement. These models are challenging traditional distribution channels, and are rapidly gaining market share in terms of assets under management. This article provides an overview of the types of robo-advisors that are now available and discusses the potential benefits, risks and challenges of such platforms.

1. Introduction

This article discusses the robo-advice platforms that are rapidly emerging as an alternative to traditional financial advice and that are increasingly available for investing pension assets. These platforms automate much of the investment process, suggesting particular investments based on information provided by the consumer.

The emergence of robo-advice platforms has been driven by a combination of regulatory, market and technological trends. Regulation of financial advisors has been moving towards increased transparency for consumers with respect to what they are paying for financial advice and the potential conflicts of interest that their advisor may face. This has been achieved through the requirement of simplified and comprehensive disclosure requirements as well as limits on opaque remuneration structures that present conflicts of interest (OECD, 2016^[6]).

These developments have had an impact on both the supply and demand for financial advice for retirement, particularly for low to moderate wealth consumers. On one hand, the limits on opaque remuneration structures can result in an increase in the use of more transparent structures such as fees based on a percentage of assets under management, which reduces the profitability of lower wealth clients and thereby the incentives for the advisors to serve these clients. On the other hand, the increased transparency has made consumers more aware of the cost of advice, and many are simply not willing or able to pay the high fees. This has directly impacted the advice gap, reducing the availability and the perceived affordability of financial advice.

These trends have created an opportunity for low-cost technology-driven business models offering investment advice services to enter the market. Robo-advisors, a term coined to refer to digital platforms which offer automated portfolio management services, have multiplied exponentially in recent years, with assets under management expected to reach USD 1 trillion by 2020 (BI Intelligence, 2017^[7]). Their business models rely heavily on automation and algorithms, allowing them to offer services at significantly lower costs compared to traditional investment services due to gains in efficiency. Many of the early movers in this market were independent. Established players in the investment advice market are also beginning to offer their own proprietary robo-advice services as a lower cost alternative to their traditional advice channels in order to be able to compete in this market.

While all robo-advisors generally emphasise their lower cost services and transparent fee structures, they can differ widely in their individual value propositions. The majority target individual retail investors, though an increasing number are also offering services for institutional investors such as pension funds or even to financial advisors themselves as a means to increase the efficiency of their services. Robo-advisors also differ in terms of their investment approach and advice services offered. The low-cost feature of robo-advice has been its main draw, but these types of platforms also offer additional benefits for consumers such as increased accessibility and objectivity. Nevertheless, this innovation is not without risks. Regulators will need to ensure that the appropriate framework is in place to ensure adequate consumer protection for the users of these platforms and to mitigate the potential investment and other risks that these platforms present.

The key findings of this article are:

1. Robo-advice platforms have the potential to increase accessibility of investing to a broader market and to do so relatively more cheaply than through the traditional channels.
2. Robo-advice platforms have the potential to deliver financial advice that is objective, consistent and transparent.
3. However, the increased level of automation may require different approaches to ensure that the users have a sufficient level of understanding of the investments they are making.
4. Policy makers will need to ensure that existing legislation applies to robo-advisors with respect to the applicability of duty of care requirements, avoidance of conflicts of interest, transparency of disclosure and access to redress in the case of an unfair outcome for the consumer.
5. Regulators and supervisors will need to have processes in place to ensure that the algorithms that these platforms use are accurate and robust.

The structure of the article is as follows:

- Section 1.** presents the introduction and key findings.
- Section 2.** describes the main features of robo-advice platforms.
- Section 3.** highlights the benefits that these platforms can present to consumers.
- Section 4.** discusses potential risks that these platforms could present.
- Section 5.** addresses additional challenges that policy makers may face with the increasing prevalence of robo-advisors.
- Section 6.** concludes.

2. The value proposition of robo-advisors

The main value proposition of robo-advisors for retail clients is to make investing more affordable and accessible by relying on user-friendly digital platforms, algorithms and primarily low-cost passive investments. Those targeting mass retail consumers and younger generations often have low initial investment requirements to encourage new investors to begin investing. There are also a few robo-advisors that target more affluent investors and therefore require a higher minimum investment, and often also include some level of access to a human advisor.

Robo-advisors are also increasingly offering their services to institutional investors, particularly for pension providers. These platforms can allow pension providers to reduce the costs for their members and more easily manage their investment risk profile.

Still other robo-advisors target financial advisors as a way to improve the advice services they offer to their clients and remain competitive given the increasing prevalence of retail robo-advisors. These services propose to reduce the time the advisors spend on monitoring the portfolio and meeting regulatory requirements, and to improve the investment interface for their clients.

While robo-advisors all tend to offer a lower-cost alternative to existing investment advice solutions, they differ in their approach to providing investment recommendations

and portfolio management. These differences can relate to the types of investment accounts offered, the funds which are available to invest in, the algorithm to generate the recommended investment, the additional services offered and finally how they are compensated for their services.

Type of account

Robo-advisors can allow their retail clients to open various types of accounts on their platforms. The standard type of account is a simple brokerage account which allows the client to invest in the securities market. However, tax-sheltered accounts, such as those used for retirement savings, can also be offered subject to meeting the relevant regulatory requirements. In the United Kingdom, for example, many robo-advisors offer Individual Savings Accounts (ISAs) for which the capital gains are not taxable, and some also offer investment for personal pensions. In France, life insurance, which offers reduced taxation on capital gains, is commonly offered by robo-advisors. In the United States, robo-advisors offer Individual Retirement Accounts (IRAs) which either defer tax to retirement or allow capital gains to be tax-free at retirement. For the moment, the focus of most of these services for pensions is on the accumulation phase, as automated services for the decumulation phase are much more complex.

Robo-advisors also offer services for institutions sponsoring pension plans. Betterment, for example, offers a service directly targeting employer-sponsored 401(k) retirement savings plans in the United States, and Decimal offers a wrapper for superannuation funds in Australia.

Investment products offered

Most robo-advisors focus on offering low-cost passive investment. The most common of these are Exchange Traded Funds (ETFs), favoured for their low cost, high liquidity and high diversification potential. ETFs behave like index funds, in that they are designed to track a basket of underlying assets. They are regularly traded on exchanges, and can be purchased in small amounts making them convenient for individual investors.

Robo-advisors typically use a set of criteria to select the ETFs they make available on their platform based on the desired profile of investment options. These criteria can include cost, liquidity, tracking performance, spread, sector, risk level and volume, among others.

While many robo-advisors offer ETFs exclusively, some robo-advisors also offer other options, such as direct investment in indices. Other robo-advisors may not subscribe fully to a passive investment strategy, and may offer actively managed options such as mutual funds.

The provider of the product may also be a consideration in product offer when the robo-advisor is not fully independent. Some robo-advisors have partnered with specific product providers, and others act as proprietary distribution channels of large asset managers whose products would be favoured for selection.

Investment recommendation

The type of recommendation provided by robo-advisors varies in the extent to which it is tailored to the situation of a specific individual. At the very least, the recommendation will take into consideration the investment goal and the time horizon of the investment in order to define the risk level of the recommended portfolio. If the goal is retirement

savings for someone under the age of 40, for example, the initial recommendation would include a higher proportion of equities given the long time horizon. A more thorough assessment of an individual's risk tolerance is also often performed before making a recommendation. This assessment usually takes the form of a questionnaire and many rely on insights from behavioural economics to more accurately assess the individual's willingness and ability to take investment risk.

While most robo-advisors currently only take into consideration the individual's goals for the specific investment in question, some platforms offer recommendations based on a more comprehensive view of the individual's particular financial situation. For example, such recommendations may also take into consideration other assets and investments, spousal income and tax implications.

Based on these inputs, algorithms will generate a recommended asset allocation based on commonly accepted financial theories such as mean-variance optimisation, which aims to maximise return for a given level of risk. While the individual usually does not have much of a choice in which specific funds are invested in, they may still be able to adjust the risk level of their portfolio, for example by increasing the proportion of equities. Algorithms can then automatically continue optimising the portfolio on a regular basis. While this process can be fully automated, some robo-advisors include a certain level of manual management of assets by investment managers which can take into account dynamic considerations such as current events. Robo-advisors targeting non-retail clients may offer more flexibility in how the portfolio is determined. Decima, for example, allows the institutional client to select the algorithm applied.

Hybrid robo-advisors offer the possibility of consulting with a human advisor in addition to automated services, though usually in a limited manner. For example, this component could be reserved for those with sufficiently high balances, or the length or frequency of the consultations could be limited. These consultations are usually offered via telephone or internet, but YellowAdvice is an example of a platform which also provides this service through physical branches if the client prefers to discuss in person.

Platforms which are the most automated naturally tend to offer lower fees, while those offering higher levels of human involvement and/or interaction also charge more for their services. Jurisdictions vary with respect to the type of business model which is most prevalent. Platforms in the United States, for example, tend to offer higher levels of automation, while those in continental Europe tend to maintain relatively high levels of human interaction with their clients.

While the types of robo-advisors discussed here provide an explicit recommended investment strategy, the term 'robo-advisor' is also commonly applied to a wider range of digital trading platforms which may not provide an investment recommendation. Box 1 provides a brief overview of other types of automated trading platforms which also aim to increase the accessibility and affordability of investing through user-friendly platforms which have low and transparent fees, but which do not make a specific recommendation.

Box 1. Other 'robo' trading platforms

Online platforms which facilitate investing in securities at a low cost are increasing in prevalence along with robo-advisors. While these platforms are more self-directed and do not provide specific investment recommendations, they can incorporate a certain level of automation (e.g. rebalancing or tax optimisation) and a variety of pre-packaged investment strategies that individuals can choose from.

One type of platform offers the opportunity for individuals to invest in pre-defined strategies which can be purchased as-is or can be adjusted by changing the exposure of each of the underlying securities. Folio, for example, offers target-date funds which reduce investment risk as the target date approaches, and offers conservative, moderate and aggressive risk options. Other portfolio options offered include those based on investment strategy, geography, or sector. Motif offers a similar platform, including professionally built portfolios based on certain income strategies, values, even global opportunities, among others.

Online investment platforms have also facilitated the phenomenon of social trading, where investors can copy the strategies of others or be copied themselves and be compensated. Motif, for example, allows individuals to also construct their own portfolios in which other people can then invest. eToro offers an algorithm that automatically copies the investments of selected traders.

Other services offered

Beyond the initial portfolio recommendation, robo-advisors can offer numerous additional automated services for their clients. The most common are automatic rebalancing of investment to maintain the desired level of risk and automatic reinvestment of dividends. Tax efficient investment is also commonly offered for taxable accounts, namely using tax-loss harvesting algorithms which sell securities generating losses to offset capital gains for tax reporting purposes. This can improve total net returns for the investor.

The robo-advisor may also provide suggestions for the investor that are not automatically executed. These could be suggestions to buy or sell, or simply a suggestion to stay put during a period of market turmoil, providing some of the hand-holding that human advisors claim to provide to prevent their clients from panic selling following a market downturn. Indeed such communications can be quite effective; advise reports that 90% of clients follow its recommendations within 15 days (Finance Innovation and Cappuis Holder & Co., 2016^[8]). Some services also suggest actions to meet specific goals on an ongoing basis, for example additional deposits or suggestions on how much income to withdraw from a pension. Active Asset Allocation, for example, provides proposals for pension funds on how to best reach their funding objectives or optimise drawdown.

Several platforms offer self-directed tools that the individual can use to help them plan for their financial goals, particularly for retirement. Such tools can recommend how much an individual needs to save to maintain their desired standard of living, taking into account factors such as spousal income, desired location and tax implications. Others can help individuals decide how to draw down their pension savings. Evalue, for example,

has created a pensions freedom planner in light of the removal of the requirement to purchase an annuity in the United Kingdom, helping individuals to decide what to do with their assets at retirement. Some platforms also promote financial education, such as Yellowadvice, which provides easy-to-read articles on financial news and incorporates gamification on its website to improve investment knowledge. WealthKernel stresses the importance of educating clients, as if they understand the risk they face, they will stay invested longer and ultimately be more profitable clients in the long term.

Services can also be provided to facilitate the fulfilment of regulatory requirements for institutional investors or financial advisors. For example, suitability reports can be automatically generated in compliance with regulatory requirements. Regulatory alerts can also be provided to help advisors stay up-to-date with any changes.

Pricing structures

As one of the main benefits of robo-advisors is their ability to offer investment services at a lower cost, they tend to be upfront and transparent about the fees that will be charged to consumers. Generally, the platform charges a management fee as a percentage of assets under management. The level of this fee varies widely from one platform to the next, however, and also depends on the additional services offered. The high end of the range charges around 1%, but often management charges are significantly lower than this. The management cost can also be defined in terms of a flat fee, but this is less common particularly for investments above a certain minimum threshold.

On top of this management fee are the expense fees of the underlying funds which are invested in. For robo-advisors which concentrate on offering ETFs these fees are generally quite low, coming in at under 0.2-0.3% on average. Fees for other investment offerings, however, may be higher.

The services that robo-advisors offer to their clients are usually included in the management fee. However some business models offering ultra-low management fees may generate their revenues from charging for complementary services. WiseBanyan, for example, charges 0.25% for tax-loss harvesting which intends to increase total net returns on investment by reducing the taxes owed.

Despite the increased transparency in costs, the potential for conflicts of interest remains. Proprietary platforms face the conflicts of offering their own funds for investment. Some services also accept retrocessions and rebates from third parties. Therefore although the cost that the consumer pays upfront may be transparent, there may still be hidden costs with respect to the criteria used for the selection of investments available on the platform.

3. The benefits of robo-advice

The increased prevalence of robo-advisors has the potential to greatly increase both the affordability and accessibility of financial advice, particularly for mass affluent clients. The use of digital platforms and algorithms can reduce costs and improve efficiency, while user-friendly interfaces can facilitate investing and make the process more transparent and accessible. The use of algorithms can also increase the objectivity of financial advice, overcoming the challenge of human and emotional bias in traditional channels. Furthermore, algorithms make the logic and rationale of the financial advice transparent, facilitating the audit and supervision of such platforms.

Increased affordability and accessibility

First, robo-advisors can reduce the cost of financial advice in terms of direct fees paid by the client. Robo-advisors can automate many of the time-consuming activities of financial advisors such as the monitoring and rebalancing of the portfolio, reducing the need for costly human intervention. Indeed, algorithms can perform some portfolio management tasks such as rebalancing and tax-loss harvesting much more efficiently and effectively than a human advisor. Furthermore, the reliance on passive instruments reduces the cost of investment compared to actively managed funds.

Given the online nature of these platforms, robo-advisors can also reduce the search costs and the time individuals spend to make their investment decision and monitor their investments. The time it takes to make a recommendation can also be significantly reduced. For the fully automated platforms, clients may spend only around 15 minutes filling out the questionnaire about their goals and risk tolerance. Once invested, consumers have the ability to access their account and see their investments on demand whenever is convenient for them.

These platforms have the potential to have a significant positive impact on financial inclusion. The user interfaces of robo-advisor platforms are typically designed to be user-friendly, making them easy to use and understand. This increases their accessibility to a much wider audience, even those with lower levels of financial literacy. Clients are prompted with questions and proposed recommendations in simple and concise language, and these platforms often make linking to other accounts straightforward.

Furthermore, digital platforms offer flexibility of access that investors could not previously have. People can access their portfolios when it is most convenient for them, such as in the evenings or on weekends. They can take the time to look up terms or concepts that they do not understand without embarrassment or feeling pressured.

The benefits of the affordability and accessibility of robo-advice furthermore have the potential to increase the proportion of individuals investing, particularly in stock markets, which could help to address the problem of the inadequacy of pension savings by allocating more savings to investments with higher expected returns. One study with a German bank showed that sending customers an invitation to use their robo-advice service significantly increased client participation in the stock market (Scheurle, 2016^[9]). As an invitation to receive personal advice did not have the same observed effects, the author attributed this participation to the reduced perception of the cost of participating, both in terms of time and potential advisor fees.

Increased objectivity, consistency and transparency

The use of algorithms allows investment recommendations to be based on financial techniques and theory free from the behavioural bias of an advisor, resulting in objective recommendations for the client. This is a key benefit of robo-advice, as advisor bias can significantly influence the investment recommendations they make to their clients, though some bias may still remain in the selection of the algorithm itself. Conflicts of interest, particularly those relating to the compensation received from advisors' recommendations, has been shown to result in recommendations that are not in the client's best interest and that result in inferior investment performance.

The use of algorithms will also result in consistent recommendations. The standardised profiling of clients to assess their goals and risk tolerance will be free from subjective or emotional judgements of the financial advisor, resulting in consistent recommendations

for clients with a given profile. Critics of this type of profiling cite the lack of ability to check the accuracy of the responses or the ability to follow up if responses are not consistent. However, such profiling techniques can also include consistency checks, and should define how any inconsistencies are treated, and some platforms such as Easyvest still follow up with the client with a human advisor to address any anomalies.

Finally the use of algorithms increases the transparency of the process followed and logic used to make the recommendation. Unlike advice from a human, the reasons why a specific recommendation is made are unambiguous, as the recommendation simply follows the logic underlying the algorithm. This facilitates supervision to ensure that the advice is compliant with regulation and that the necessary due diligence was performed and duty of care standards respected.

4. The challenges and risks of robo-advice

The potential benefits of robo-advice in helping individuals reach their retirement savings goals are clear, but policy makers must also be aware of the potential risks from these platforms and make sure measures are in place to mitigate these risks. Regulators need to ensure that existing regulation for financial advice is appropriately applied to robo-advisors, particularly with respect to how the recommendations made by these platforms fit within the definitions of financial advice, how potential conflicts of interest should be addressed and how the robustness and appropriateness of algorithms is assessed. Ensuring that consumers continue to pay attention to their investment is also likely to be a challenge, as an automated process where no large decisions are required by the consumer may result in consumer disengagement from the investment process even when financial circumstances may change. Finally, mechanisms need to be in place to protect consumer's assets and mitigate potential systemic risk from these platforms.

Definition and suitability of financial advice

A key challenge for the regulation of robo-advice platforms is determining to what extent they actually provide financial advice and how the existing regulation of financial advice, particularly relating to duty of care standards, should apply. Regulation often stipulates that a recommendation is considered advice only when it is personalised, i.e. is tailored to an individual's specific circumstances, rather than a general recommendation (OECD, 2016). Which personal details need to be taken into account for advice to be considered personalised therefore need to be clearly defined. It needs to be determined, for example, whether a recommendation based on a goal of retirement in 20 years' time is simply a general recommendation or one which is personalised.

Where regulation determines that the recommended advice is personalised and/or in scope of the regulation, it must also clarify the scope of the advice. Regulation often distinguishes between simplified advice, which is provided for a matter of limited scope, and comprehensive advice which considers the entire financial situation of the individual (OECD, 2016^[6]). Many robo-advisors provide recommendations which relate only to the specific account and investment goal. However several robo-advisors are now also taking other assets or spousal income into account. The definition between the two types of advice will need to be clear in order to determine the level of due diligence required, as established by the existing regulation. Policy makers will also need to consider whether the existing regulation is sufficient for these platforms and business models.

Ultimately, whether or not the client perceives the investment recommendation as being personalised for them should determine the applicability of regulation. Numerous platforms have tried to avoid regulatory requirements by including a disclaimer that the recommendation they provide is a general recommendation and should not be interpreted as personalised. Regulators will need to ensure that suitability requirements still apply to the recommendation provided if it is likely that the client would feel that it has been tailored according to their characteristics.

The effectiveness of the questions asked to determine the suitability of a recommendation for an individual should also be considered. Robo-advisors vary with respect to the number and types of questions asked to determine an individual's needs and risk profile. Among the platforms participating in the roundtable, the number of questions used to profile clients ranged between five and 22. Yomoni, which was at the high end of this range, asks not only how much money individuals are willing to lose in a market downturn but also how much they have ever lost in order to determine a client's risk tolerance. All participants recognised the importance of getting the profiling right and providing a suitable recommendation to their client, however. If clients are invested in line with their risk tolerance and needs, they will be more likely to stay invested for longer and less likely to panic sell in a market downturn. Therefore regulators and supervisors should emphasise this point and ensure that the interests of the provider and the consumers remain aligned.

Conflicts of interest

While the use of algorithms can remove human bias in the recommended portfolio, there may still be bias with respect to the funds chosen to be available on the platform, as this choice in particular could potentially be influenced by conflicts of interest. Platforms that are not independent may have incentives to recommend their own products and funds more frequently, which could result in higher costs for the consumer. There are also robo-advisors that accept retrocessions and other payments from third parties relating to the funds or their trading. As such, even if the consumers are not paying these fees directly, there may be hidden costs in terms of the fund options which are available to them and the process followed to execute the trade. These costs and conflicts are not always made clear to the consumer.

Regulators therefore need to ensure that the relevant regulation requiring the avoidance, mitigation or disclosure of conflicts of interest is applied to robo-advisors and consider whether adaptation of the current regulation is necessary to ensure that issues specific to robo-advisors are in scope. Avoidance and mitigation of conflicts of interest could be enforced, for example, through a required conflicts of interest policy, which is already mandatory in several jurisdictions for entities providing financial advice. Applied to robo-advisors, such policies could require details of transparent and objective processes and criteria used to select funds, and define the frequency that funds are reviewed to ensure that they continue to fulfil the criteria. Regulators also need to ensure that full disclosure requirements are being met, particularly with respect to how these services are being compensated and earning revenue.

Robo-advisors should not be held to lower standards than their equivalent human counterparts. For example, the robo-advisor quirion is registered in Germany as a fee-remunerated investment advisor, and must therefore pass all commissions and kickbacks received to their clients, in line with regulatory requirements for all investment advisors

registered as independent. By contrast, Vamoo (also operating in Germany) did not register, as it claims that it is simply a placement agency and not an advisor.

Robustness and transparency of algorithms

Given the high reliance on algorithms for providing investment recommendations and managing portfolios, it is vital that these algorithms are accurate and robust. Procedures need to be in place to ensure proper oversight of the development of the algorithms, thorough auditing, and testing for resilience in extreme scenarios as well as mechanisms to allow consumer access to redress in the event that the algorithms fail.

The individuals developing the algorithms must have a sufficient understanding of the financial theory underlying the algorithm and its output. Some jurisdictions are considering aligning the qualification standards of those who develop the algorithms with those of financial advisors to help ensure that this is the case. The process to set and update assumptions used for inputs into the model also needs to be clearly laid out to make sure that the models can adapt to changing financial environments, and checks need to be in place to ensure that the underlying model continues to be relevant.

Existing regulation for financial advice, however, may not address the need for auditing and stress testing of financial advice provided. Regulators will need to make sure that these aspects are addressed to ensure that the algorithms are robust and will not cause problems for consumers or the financial markets particularly in extreme scenarios, such as the flash crash of 2010, where markets fell dramatically before rapidly rebounding. Even in normal markets, however, coding errors could result in large-scale systematic mis-selling to consumers.

In addition, robo-advisors should be required to be affiliated with the relevant dispute resolution scheme in the jurisdiction to ensure consumer access to redress as a result of any flaws in the algorithm or investment process.

Consumer disengagement

Another risk in automating the investment process is that consumers may not take the time to understand how it works or to consider the assets underlying the investment, though the reduced need to do so is arguably one of the benefits of robo-advice. Reduced engagement is even more probable where mass market consumers are targeted, who have lower levels of wealth and are also likely to have lower levels of financial knowledge. Further, given the automated nature of robo-advice, individuals may simply disengage from monitoring their investment, which could lead, for example, to not updating their information and needs following a change in circumstances.

One potential way to address this concern is to require that the algorithms and investments are appropriate for their targeted consumers. For example, high risk investments such as leveraged instruments are not likely to be appropriate for consumers with lower levels of wealth and financial knowledge, and should not be included in automated platforms targeting the mass market. Such requirements to ensure that products are appropriate for the market that they target are already included in the insurance regulation in several jurisdictions to ensure that the products being developed are likely to be suitable for the consumers who purchase them.

Regular communication with consumers could also aid in maintaining a certain level of engagement. For example, emails or texts could be sent to consumers to inform them of

their progress towards their financial goals and/or to remind them to update their information if their situation has changed.

Required disclosures should also be presented in a simple and comprehensible manner so that consumers will read and understand them. Simplified and standardised disclosures are already becoming a mainstream requirement in many jurisdictions for financial advice.

Consumer engagement is not only an issue for retail clients. Regulators will need to ensure that businesses using robo-advice services to manage the investments that they offer to their own clients understand how these platforms operate and make their assessment of suitable recommendations. Since these businesses are the contact point for their consumers, they will need to be held responsible for inappropriate investment recommendations and should not be allowed to fully pass this responsibility to the third party provider.

Sustainability of business models

While the use of algorithms and automated processes allows robo-advisors to charge lower management fees than traditional channels, some critics are concerned that the fees which are charged in practice may be too low to sustain their business models. Reasons for this include high cost of customer acquisition, low average account balances and short average holding periods (SCM Direct, 2016_[10]).

Client acquisition seems to be a major challenge for these types of platforms. Many rely at least partially on referrals by existing clients to expand their consumer base. There is also some evidence that the market is becoming overcrowded, contributing to the lower-than-expected levels of consumers investing with a given platform (BI Intelligence, 2017_[7]). Scaling up for platforms that have started by targeting a niche market may prove to be challenging.

Given these potential concerns and the fact that many of these platforms are start-ups for which the business model has not been tried and tested over the long run, regulators need to ensure that mechanisms are in place to protect the assets that consumers invest with these platforms in the event that these platforms fail. Robo-advisors should be required to be affiliated with any relevant securities insurance fund that other brokers or asset managers are required to join.

Systemic risk and pro-cyclicality

A final concern is the potential for robo-advisors to lead to pro-cyclicality in the market and affect the stability of the financial system. This could be a concern where the algorithms used by robo-advisors recommend very similar investment strategies leading to herd behaviour, and where the robo-advice market achieves a significant volume to move markets with its trading activity.

This concern is partially mitigated by the fact that differences do exist in the assumptions behind the inputs into the algorithms used to generate the recommended investment portfolio for clients. This is true even where the investment propositions are very similar, for example focusing on the offer of low-cost ETFs through mean-variance optimisation. First, robo-advisors use different criteria to select the funds available on their platform. Second, the granularity of asset classes across which the portfolio is diversified can differ, which impacts the overall balance of the recommended portfolio across funds. Third, even where an equivalent financial theory is employed, the derivation of the underlying

assumptions (e.g. mean return and variance) can differ based on the methodology used. Finally, the optimised portfolio will differ depending on the individual's inputs regarding their investment objectives, risk tolerance, and other personal characteristics.

With respect to pro-cyclical selling in market downturns, these types of platforms do not seem to necessarily present more risk than traditional advisory channels. Participants who had experience in both anecdotally noted that they even observed more pro-cyclicality with traditional channels. However, mechanisms do need to be in place to prevent pro-cyclical investing, namely through an accurate assessment of risk tolerance and effective communications to reassure clients in volatile markets.

The volume of trading activity by robo-advisors relative to the markets they trade in should be monitored by supervisors. The size and liquidity of a fund can be criteria in its selection in order to prevent regular trading activity of the robo-advisor from having an influence on the price. For the moment, the volume of assets invested by robo-advisors does not pose a concern, but these volumes are expected to grow rapidly and should be followed closely to prevent increased pro-cyclicality and market volatility.

5. Additional challenges for policy makers

The digitalisation of the financial advice market is not new, and actually began over a decade ago as advisors started using digital and automated models to inform their own advice to their clients. Regulators and supervisors have therefore had a gradual introduction to the types of issues that robo-advice presents in its current form. Nevertheless, existing regulation may not always be adapted and ensuring its continued relevance remains a key challenge for policy makers going forward.

In many cases, new legislation may not be required, but regulators will need to assess how existing rules apply and help new businesses to understand the regulatory requirements that they must abide by. New businesses may not understand, for example, whether they are required to be licensed and which regulations will apply to them. Some roundtable participants noted, however, that many businesses want to be licensed and regulated, as this lends more credibility to their business and may help them gain consumer trust and confidence.

Existing legislation should also be examined to assess any regulatory barriers that exist for the robo-advice market to successfully develop in a way that is most beneficial for consumers. Regulatory requirements should not be an undue burden for small players to enter the market, and regulation should apply proportionality in its application, taking into account the size of the business and risks that it may present. Inconsistent regulatory requirements across sectors may also hinder the development of some types of models. In Europe, for example, banks and insurance companies are not held to the same disclosure standards. Cross-border regulations will also need to be addressed to take advantage of the portability that digital investment platforms can offer and to facilitate the international expansion of the platforms. Fragmented regulations, and in particular different tax regimes, present large challenges for cross-border transactions to become the norm.

Regulators and supervisors may also need to undergo a cultural shift in how they operate and enforce their rules. Going from supervising humans to auditing algorithms, for example, will require a different mind-set and skill-set. Compliance with regulatory processes will also need to be adapted to a digital world. For example, Know Your Customer requirements and contract signing will need to be able to be fulfilled digitally to maximise the benefits of increased accessibility that robo-advice platforms can offer.

Regulators will also need to be mindful of the challenges of likely future developments in the provision of robo-advice. While many of the platforms existing today focus on pension accumulation, pension decumulation will become an increasingly important issue. Regulators will need to consider the scope of products that these platforms are required to offer. Purchasing an annuity, for example, could be a better solution in some cases than gradually drawing down invested assets in retirement.

Another looming challenge is the development of platforms using artificial intelligence to provide investment recommendations. Such developments would make the underlying algorithms less transparent to supervisors and more difficult to determine the basis of the recommendation and whether or not it was suitable for the client. Policy makers should be forward-looking in how they approach regulation of the robo-advice market in order to be able to address these types of issues more easily when they arise.

6. Key takeaways

Robo-advice platforms vary widely with respect to the level of automation and the value for money that they offer to their clients. One thing that virtually all have in common, however, is an aim to increase accessibility of investing to a broader market and to do so relatively more cheaply than the traditional existing channels.

These new channels present many of the same regulatory challenges as traditional financial advice from human advisors. Policy makers will need to ensure that existing legislation applies with respect to the applicability of duty of care requirements, avoidance of conflicts of interest, transparency of disclosure and access to redress in the case of an unfair outcome for the consumer.

Robo-advice platforms also present new challenges which will need to be addressed. Regulators and supervisors will need to have processes in place to ensure that the algorithms that these platforms use are accurate and robust. The increased level of automation may require different approaches to ensure that the users have a sufficient level of understanding of the investments they are making.

With risks appropriately managed, however, robo-advice platforms have the potential to greatly increase the accessibility of investing in the capital markets for pension savers, thereby helping individuals to accumulate more retirement savings.

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5. Competition and open application programming interface standards in banking

Given the erosion in the public's trust in market mechanisms and globalisation as a means for delivering inclusive prosperity for all, the creation of effective markets is a priority for policy makers. This article looks at the creation of open application programming interface (API) standards in banking, and explores the competition problems that they address. It argues that by fundamentally changing the way that consumers buy and use banking services this represents the development of a more entrepreneurial approach to remedying malfunctioning markets. It also underlines the importance of competition authorities being able to investigate market failures on the demand side (and to take action to resolve those failures), and notes that these remedies may have consequences for other markets where consumers lack property rights over the data that is collected on their behaviour.

1. Introduction

The role that the state plays in innovation has become a matter of great debate since the financial crisis. While some continue to argue for the state to stand back, get out the way, and let firms innovate, others such as Mazzucato (2013) and Rodrik (2012) argue with force and some success that crowding out effects are sometimes illusory, and that the state can play a key role in generating innovations for the economy (citing its success in developing the internet, GPS, AI, and pharmaceutical compounds) and should continue to do more to form its own vision as well as simply plugging the gaps where private sector investment is lacking, as Keynes suggested.¹ At the same time as this debate has unfolded, competition authorities have increasingly seen their role as protecting competition not simply to keep prices down, but also to drive innovation and quality. Concerns over the impact that a lack of competition has on innovation have therefore increasingly come to the fore (e.g. in the European Commission's recent Dow/Dupont merger decision).²

A longer-term trend has been for competition authorities to look to remedy a lack of competition through remedies that operate on the demand side. This has led to market studies that recommend or require measures to help empower consumers to drive competition and make markets work better (rather than divestments or conditions that apply to the firm's behaviour). These include the provision of better information that helps consumers compare products and measures to make switching easier. At the intersection of these trends is the case of open application programming interfaces (APIs) in banking.

A competition investigation in the UK by the Competition and Markets Authority provided the grounds for pushing through requirements that the largest UK banks enable consumers not just to share their data with third parties, as required by the European Union's second payment services directive (PSD2), but to do so using open access and common standards for data, security and APIs (which enable software applications to share data and functionality). The remedy was expressly designed to create a new class of innovative business models in which third parties would help consumers to drive competition by providing tools to manage their money and their banking services so as to obtain better value. The remedy recognises that consumers have been unable on their own to drive the market to offer this better value by switching, or considering switching, and that efforts to help them do so by providing better information or reducing switching costs have proved inadequate.

As an intervention it articulates a middle way by which the state, can develop and exercise entrepreneurial vision and pro-actively intervene in markets to stimulate and incentivise innovation in particular areas. Moreover this can be consistent with the established principles of competitive neutrality which sit less comfortably alongside some of the direct interventions proposed under the auspices of new and so-called modern industrial policy that are becoming increasingly popular across the OECD. Such remedies will therefore be of interest to those considering interventions in other markets in which consumers are found to be reluctant to switch, either due to a lack of confidence in their ability to compare products (e.g. energy), or as a result of strong network effects (e.g. social networks).

2. What is API?

Whereas a User Interface (UI) allows a human being to use a software application, an API allows one piece of software to use another application's data or functionality. For example, the API on Google Maps gives third party developers the building blocks that make it simple to embed Google Maps on their own webpages (see Uber or CityMapper for example). In a similar fashion, access to consumers' bank data through APIs (where they give consent) would make it easy for third party developers to program applications that help consumers to better understand and manage their finances.³

A key difference in what is to follow is between open and closed APIs, and standardised and non-standardised APIs. An open API can provide a third party access to publicly available data (such as a bank's product offerings) and secure shared access to private data (such as a user's transaction history). This access can be provided to either a broad or a narrow group of third parties that meet certain criteria, hence where a broader list is used the API is more open than those where a highly restricted list is used.

A standardised API may increase competition by allowing entry, promoting innovation and reducing costs. In contrast a non-standardised API might be useful if a bank wanted to make it easier for third party developers to create applications for the bank's own customers. However, in order for these developers to make applications that work across banks, and hence allow both comparability and management of multiple accounts with different banks, they are likely to need a standardised API to be agreed amongst the banks. If not, a different building block would be required for each different bank, and these would need to be updated if a bank subsequently altered its API. This could be expected to radically increase the third parties costs and therefore prevent entry and innovation in this space, particularly from smaller app developers. By requiring agreement on a standard set of APIs that are available to wide list of third parties, these costs can be kept low and entry and innovation can be stimulated amongst a broad range of entrepreneurial firms.

What type of applications might third parties develop?

There are a number of different types of application that might be developed by third parties. These might require APIs for account information, or payment initiation, or both.⁴ For example:

- Applications that compare bank accounts, open new accounts, and automatically switch money between accounts in order to maximise the consumer's returns.
- Applications that help consumers analyse and understand how they use their money, and prompt them to change the way they manage their money in order to achieve their goals.
- Applications that make payments straight out of the consumer's bank account (without going via a credit card) such as Amazon's one-click payment option.
- Applications that draw together information on offers available (including cashback) when the consumer makes a purchase.
- Applications that help banks to offer better value personalised savings or loans services to consumers (by providing access to the data required to personalise an offer which traditionally only your existing bank has and hence has little incentive to use).

- Applications that include affordability checks that speed up loan processes by giving lenders access to a user's data.
- Applications that connect online accounting software with their bank accounts.
- Applications that offer fraud detection across multiple accounts.

Box 1. Three Examples of Open API driven Banking Applications

Safteynet Credit. This app makes a secure connection to the user's bank account during the application process, and uses this to track the users balance and to deposit money into the account to prevent the user incurring unauthorised overdraft charges, and then takes repayment when there are sufficient funds in the account. Similar applications optimise the interest users receive (rather than minimising fees incurred) by automatically moving money into higher interest paying accounts.

Yolt. This app provides a single view by which users can monitor their current accounts, savings accounts, and credit cards. It analyses user spending, provides insight to users on their spending patterns, and allows users to manage their utility bills and subscriptions. It also offers a comparison service.

Credit Kudos. This app takes the data from the user's bank account and uses it to provide a measure creditworthiness that is based on their most recent data. This has the important benefit of enabling those with thin credit records (those that have not borrowed and hence have not demonstrated creditworthiness by repaying a loan).

Where banks are not required to make their standardised APIs openly available these applications are likely to operate as multi-sided platforms that might earn revenue from consumers, from banks or from advertisers. Competition agencies would therefore need to consider the difference that these other sides make to their analysis. For example, when considering market definition, measuring market power or efficiencies, or investigating exclusionary conduct or vertical agreements. In particular, a key lesson from the OECD's recent work on rethinking the use of traditional antitrust enforcement tools in multi-sided markets is the need to assess the importance of cross-platform network effects. These quantify the extent to which additional participation or use by one side increases the value of the platform to users on other sides of the platform.

While these applications are currently generally being launched by start-ups it is not difficult to imagine that larger established tech platforms might acquire or launch their own services as banks' API data becomes available. Banks are naturally also likely to react to this innovation by competing to provide services that analyse consumers spending and help them to manage their money.⁵

3. What competition problems arise?

Banking consumers have, across many jurisdictions, been found to exhibit the same inertia that is evident across a number of other markets (e.g. pensions, energy). The explanation for this may of course be different in different markets. However, a fairly

typical set of findings are those of the UK's Competition and Markets Authority, whose market investigation found that:

1. "Current accounts for both personal and business customers have complicated charging structures, and the actual cost to the customer depends on how they use the account. Customers generally know very little about the charges and service quality provided by other banks. It is therefore hard for customers to know whether they could get better value and service from another bank or a different product with the same bank.
2. Personal and business current account relationships are open-ended and do not have regular trigger points (like the annual renewal of insurance policies, for example) when customers might be prompted to ask themselves whether they could be getting a better deal elsewhere on their current account rollover
3. There is now a reliable and efficient Current Account Switch Service (CASS). This makes it easy for customers to switch current account from one bank to another, but the service is not widely known, and does not command as much confidence as it deserves.
4. Charging structures for overdrafts are particularly complicated, making it even harder to compare providers. Customers worry that if they switch they might not get the same overdraft from their new bank. Moreover, we found that many customers underestimate their overdraft use."⁶

The inactive and inert nature of the consumption of banking services therefore emerges as the key malfunctioning of the market mechanism. The extent of this inertia can be significant – in the UK, the average consumer stays with their bank for nearly 20 years, making them more likely to divorce than switch bank. This means there is very little opportunity for rivals to challenge or for comparison websites to earn revenue.

Perhaps the most important driver of inertia is the first finding that the costs of the selected service can vary significantly depending on how the consumer manages the account. If the consumer cannot accurately anticipate their behaviour and hence the costs they incur then this suggests that the textbook model of a market in which rivals can offer an alternative product at a better price (or quality) and hope to persuade consumers to switch to them, may not apply. In these markets the consumer only finds out the price (or quality) of the product after consuming and experiencing the product. This is because the price paid depends on the consumers' behaviour after selecting the product. In isolation, this is a fairly common problem that is often resolved. For example, manufacturers of products that break down obtain bad reputations and reviews from consumers, and consumers learn not to make the same mistake twice, firms therefore learn that there is only a short-term gain to producing poor value products when better alternatives exist.

However, if a consumer is unaware of their own usage pattern then they are unable to understand whether the product they have purchased was a good or a bad deal, relative to the other products that they might have purchased, and hence whether they might have done better or not. This makes the product a 'credence good'. In markets for credence goods, the consumer learns nothing from their own experience, and is likely to repeat any mistake they make when choosing again.⁷ In this context, rival firms have little incentive to offer better value products, since these are unlikely to be recognised as providing better value, and hence are unlikely to make additional sales. As a result, the incumbent firm has a clear incentive to deteriorate the value of its own product and to exploit its consumers.

The findings allude to other past and possible solutions to inertia which have failed or been considered unnecessary or ineffective. For instance, the changes to the switching system have been effectively implemented but have failed to shift perceptions. Similarly removing automated rollover and forcing a choice point for consumers each year has been required in insurance products but was not pursued in the case of bank accounts.

4. What is the solution to these issues?

The solution to credence goods problems lies not on the supply side but instead on the demand side of the market. It involves aggregating experiences of those consumers with similar characteristics in order to help consumers understand the average value of different products for their ‘type’. This enables consumers to compare the experiences of those like them that have already experienced a specific product sold by a given firm against that benchmark. Where consumers expect they can obtain value by searching and comparing across products, more will do so, and this drives incentives for firms to offer better value.

Since outcomes depend on post-choice behaviour as well as pre-existing characteristics, these benchmarks also require information on this behaviour if they are to be of value. For example, how much exercise did the patient take, how many lectures did the student skip. Otherwise, variations in outcomes can easily be mistakenly attributed to differences in the product rather than differences in behaviour of those that purchase the product. Where this happens, trust in the validity of the benchmark can evaporate and its value therefore diminishes.

Health and education are classic examples of credence goods. Indeed the credence good problem leads many governments to fix the prices of these services (if indeed they use any market mechanisms to improve the quality and efficiency of these services).⁸ In a healthcare setting, say the market for replacement knee surgery, the solution might involve a description of the average increase in mobility that patients with a certain diagnosis and certain characteristics experience post-surgery. Consumers are then able to compare the average increase in mobility for patients with their diagnosis and characteristics at a specific hospital against that benchmark in order to understand whether they are likely to get a relatively good deal or not. Alternatively, in a university setting it might be the average wage premium achieved by students that take a particular course at a particular university given a particular set of grades at entry. In these cases, there can be important unobservable exogenous factors that affect the outcome, but which are outside the firm’s control. Most notably the effort put in by the patient (or student), and unobserved pre-existing conditions that create unexpected complications.

In banking, things are simpler since the final price is largely dependent on post-choice behaviour rather than pre-choice characteristics. Moreover, as result of technological developments, almost everything that is relevant to the outcome can be observed and recorded in a data file. This data file of a consumer’s behaviour can crystallise the consumer’s sometimes-vague recollections of their behaviour and allows them to obtain a more accurate quote from rivals. It also creates the possibility for consumers to use this information to analyse and change their own behaviour to better reflect and achieve their preferences. A system of open APIs recognises that these data files belong to the consumer as much as the firm that collects them.

Clarifying that the property right to data collected on their behaviour remains the consumers, and cannot be signed away exclusively through small print conditions, allows

consumers to trade and hence to extract value from that data. Moreover, the value of the data is maximised by setting a standard format that makes it easier to trade. For example, consumers might choose to sell their data file to third party apps that analyse the data and create value for the consumer. These apps might reduce the price that consumers pay by searching and switching them into and out of different products for different transactions, by efficiently reallocating their funds and credit across different products at different times; or by opening up new specialised options whose availability depends on the offeror knowing more about the consumer's behaviour (e.g. credit). Alternatively, app producers might help consumers analyse and change their spending/saving behaviour by designing personalised plans to nudge them into behaviours that help them to achieve their longer-term preferences (rather than gratifying their possibly inconsistent short-term preferences).

UK approach

The UK's Competition and Markets Authority released its provisional findings on the banking market in October 2015, identifying concerns and setting out possible remedies including the type of Open API that the Open Banking Working Group would later recommend in early 2016. In its final decision the CMA decided to require the nine largest banks to provide open standardised API data on their retail customer and SME account data to third parties (where the consumer elected to do so).⁹ This uses digital technology to create the possibility of a new market for firms to design applications that advise and help consumers to better manage their money and the financial products they use.

The CMA suggested it had two main aims in adopting the Open Banking Standard into regulation, namely:

- to make it easier for customers to switch current account providers, thus increasing competition
- “to change [the] nature of the customer journey itself by facilitating the emergence [of] a large scale of new service providers with different business models offering innovative solutions.”

All of this is much more ambitious than traditional demand side remedies to competition investigations which have often focused on making information on the product available (not on consumers use of the product), and then leaving the consumer with the responsibility for using it. Instead, here the objective is to fundamentally change the way that consumers purchase by creating the building blocks (e.g. property rights, data standards) that facilitate the emergence of new service providers with different business models that offer innovative solutions. This pro-active design of a role for new business models in a malfunctioning market is a big step for competition agencies that are traditionally minded to let incentivise innovation, remove regulatory barriers, and stand back and let it happen (as Price Comparison Websites did).

Competition Agencies are traditionally sceptical (and rightly so) of arguments that they should mandate access for rivals to certain assets that firms have invested in building on the basis that they constitute essential facilities. A firm's right to refuse to deal with a rival is therefore very rarely challenged (and then typically only in cases where the firm received the asset without investing in it, for example through privatisation). However, in an era of concern at big data and its impact on the ability for rivals to compete, there are increasing populist demands for such access to rivals to be granted. In contrast, by simply

clarifying a consumer's property right to their own data, the API remedy neatly sidesteps questions of whether or not the data is an essential facility, allows firms to continue to refuse to deal with rivals if they wish to do so, while also allowing consumers to decide whether or not to do their own deals with these rivals. Helpfully, this means that the rivals pay a market price for the data, rather than having a price determined by what is considered a fair, reasonable and non-discriminatory price (FRAND).

It is true that by making it difficult for a bank to agree with a consumer that it will have exclusive access to their data, the remedy makes the retention of the consumer less valuable to the bank (since the profit to be made by using the data is reduced). In a well-functioning market, the firm would therefore pay the consumer less for its data. However, since the market investigation identified that the market was not functioning well, and that these nine firms had significant market power, this concern did not arise in this case. However, in other cases where the market is working more effectively, the concern might have some merit, and so using the same remedy might have important drawbacks (if indeed evidence suggested that the firms paid consumers for the data).

EU approach

At the same time, the EU has developed and put in place its new payment services directive (PSD2). This applies to all payment accounts not just current accounts. Like the CMA approach, it breaks down bank's monopoly on their user's data and allows third parties to make payments for consumers, and to display and manage multiple accounts on a single application.

However, it is in some respects less ambitious than the CMA remedy. Firstly, it does not require a common standard and so allows banks to make their data available through different standards. This allows the banks to raise the costs of rival third parties and hence reduce the strength of the competitive constraint that they provide. Secondly, it opens the data only to specific institutions and so does not allow for third parties such as price comparison websites or other independent application designers to access the data. In that sense, it is less open than the CMA remedy.

These differences appear to demonstrate the added teeth that can be provided where the effect of a problematic feature of the market has been evidenced through a market review. However, it is also notable that as a result it is not tied to only those markets in which a problem had been identified. This means that it can be applied more broadly than the CMA remedy and so for example it will apply to markets such as savings accounts or mortgages in which no competition issues has been identified.

US and Australian approaches

In the US, there is not an open API standard, however there are some third party applications that are providing some of the services that API can facilitate. They are able to do so using screen-scraping techniques that ask consumers for their log in information to different accounts and then scrape the account data out of those accounts. There remain question marks over the safety of these techniques. This is because the app asks the user to share their bank log-in details, and the app uses these to access the accounts on the users behalf. In effect, the app poses as the user to see the information. There is therefore a risk that this may open users up to liability if money goes missing, and may violate the bank's terms of service.¹⁰

US banks are using API, however, they are tending to use it to work with partners to develop applications that provide services for their own accountholders. For example, Chase and Intuit, and Wells Fargo with Xero and Finicity.

In Australia, the Parliamentary Economics Committee last year announced that, in line with the recommendations of the Productivity Commission, Australia's four largest banks will be required to enable open API access by 2018. The Treasury was then asked to undertake an independent review of what the scheme should involve. The review reported in February 2018 and identified the importance of common standards and recommended that an "Australian Data Standard Setting Body, chaired by an independent data specialist, should design these Standards (using the UK's technical specification as a starting point)."¹¹ Notably one of those banks (National) has already chosen to make its APIs openly available.¹²

5. How might API be blocked? What might block it?

Open common API standards pose a significant threat to banks. These banks face being relegated to one side of a new platform market, and hence see their margins squeezed as the platforms compete for users. The size of potential damage to banks position could therefore be substantial. The Bank of England estimates that competitive pressure could mean that in 5 years' time the aggregate profits of UK banks are £1.1 billion lower than at present. Moreover, it considered this may well be an underestimate and that Open Banking may cause greater and faster disruption to banks' business models than banks project.¹³ With the stakes this high, there is inevitably the risk that incumbents will engage in anticompetitive behaviour to block or capture rents. For instance, the digital platform model in ebook markets led publishers to collude to protect their profit margins.¹⁴

In banking, the large banks have historically been very successfully in obtaining significant rents by appealing to their systematic importance (too-big-to-fail) and the distribution of these rents has resulted in employees of financial institutions becoming an increasingly large proportion of the richest 1 and 0.1% whose income and wealth have pulled away from the rest of society.¹⁵ This appears to have triggered a corrosive effect on the public's trust in market mechanisms and globalisation as a whole. It is therefore important that the slower burning competitive threat to bank profit margins from API is allowed to play out in a way that was not possible during the financial crisis (due to the urgent need to maintain stability in the interests of all as the crisis unfolded).

In practice, this means firstly no regulatory protection for banks from the threat of API. Secondly, it means zero tolerance on banks refusing to provide open access to their consumers' data in a standardised format (where their consumers consent). Finally, it means careful scrutiny of any collusive or exclusionary allegations, not just against the banks but also against those that might seek to leverage their position in associated markets. For instance, firms providing operating systems have been accused of using their dominant position in that market to exclude smaller rivals to their online shopping and mapping services. In such cases, there is always a question of why those firms do not extract the full monopoly profit straight from the operating system market in which they hold the dominant position, rather than reducing the profit they take in that market as leverage in order to create a dominant position in the tied market. The thinking being that it can only earn the monopoly profit once (the single monopoly profit defence). However, this often does not hold. For example tying products can increase market power in either the operating systems market (further protecting an already dominant position from

competitive entry), or the tied market, for example by increasing the costs of rivals in that market by denying them economies of scale or network effects. In addition, it can also facilitate price discrimination among buyers of operating systems (if buyers use varying quantities of the tied product) and/or buyers of the tied product (if there is not a strong positive demand correlation between the two products).¹⁶

6. Might API create additional problems?

As discussed these API driven applications may benefit from considerable cross-platform network effects. This might mean that they, like other platforms with strong cross-platform network effects, might tend towards tipping into monopolies. The fear is that such monopolies are not contestable as they are protected by strong economies of scale that are created by the cross-platform network effects. The fear is then that the creation of a market for API driven applications might simply replace an inert and oligopolistic banking market with a monopolised banking platform market. In such a situation, consumers that pay higher prices to the platform rather than the banks might feel that little has changed and their situation is not improved.

This concern is recognisable to those leading the start-ups in this area such as Monzo's CEO Blomfield: "Blomfield is positioning Monzo for precisely this eventuality. "We tend to avoid the M word" – monopoly – "for various reasons," he says. "But I think it's true. I do think one player will have a massive market share."¹⁷

However, such concerns may well turn out to be baseless (or overly optimistic from the perspective of aspirant monopolists). Firstly, it is not at all clear that strong network or cross-platform network effects would exist in this new market. For example, if all banks, or at least all large banks, have to provide open standardised APIs then any third party application would be able to provide the same coverage as a potentially dominant application provider (thus removing the scope for differences in cross-platform network effects enjoyed by different applications). Similarly, it is unclear why consumers would obtain more value from using the same application as other consumers. Secondly, if an incumbent application's access to some consumer data were, for some reason, to enable it to build more attractive services for other consumers (as Google's search algorithm is said to), then there would in any case remain the option for third party applications to offer to pay consumers for consent to access to their API data. By re-establishing price competition this would then provide those entrants with their own attractive product with a means by which to enter and gain a foothold and the volume required to achieve the same economies of scale as the incumbent.

7. Conclusion

Open API standards in banking can increase competition by fundamentally changing the way that consumers purchase banking services. In particular, they facilitate the entry of new business models that help consumers to obtain better value from their existing banking services, and to move between services without consumers having to do the hard work of evaluating how different offers fit with their requirements (which can be identified in their usage data).

The article argues that these demonstrate a way for the state, or rather its independent competition agency, to be entrepreneurial and exercise a vision of how digital innovation can make markets work better for consumers, while remaining consistent with the

principles of competitive neutrality (which can pose challenges to other proposed roles for an entrepreneurial state).

The article also highlights the importance of competition agencies not being restricted to examining and resolving supply side problems if they are to be effective in making competition work for consumers. Effective markets require an active and empowered demand-side, and this requires much more than simply protecting them from mis-selling and other unfair practices, this is well demonstrated in the case of open API standards.

Notes

1. See: www.economist.com/node/21553017; Mazzucato “the Entrepreneurial State” (2013); Rodrik “The Return of Industrial Policy” (2012); and, Keynes “The End of Laissez Faire” (1926).
2. See: <https://promarket.org/mergers-bad-innovation/>. This builds on research work identifying the nature of the relationship between competition and innovation by Aghion et al (2005), and Gutiérrez & Phillipon (2016), and models of the effects of mergers on innovation (Federico, Langus and Valletti “Horizontal Mergers and Product Innovation: An Economic Framework (2017).
3. Another example of the use of open APIs in banking has recently arrived in the form of the Gates Foundation’s recently released open API for mobile money interoperability. This open API makes it easy for mobile money providers to integrate their applications with an open source blockchain-powered payment platform called Mojaloop, thereby creating interoperability between a customer’s mobile money provider and those banks, merchants, government institutions and other mobile money providers that build products using the Mojaloop open API.
4. A slightly different API is needed to construct an application that provides payment initiation services, rather than account information services. Therefore, there is typically one set of APIs for Account Information Service Providers (AISPs) and another set for Payment Initiation Service Providers (PISPs).
5. See HSBC in www.which.co.uk/news/2018/01/the-apps-revolutionising-your-budget-in-2018/
6. www.gov.uk/government/uploads/system/uploads/attachment_data/file/544942/overview-of-the-banking-retail-market.pdf
7. Notably the second finding suggests the consumer may not consciously choose again in any case. However, this automatic roll-over effect has been addressed effectively in other markets by restricting the length of contract
8. See Biggar & Fels “Choice, Competition and Markets: Education, Health Care, and Public Services” OECD, 2017. For example, France, Germany, Norway and the UK all set fixed tariffs for healthcare services in their publicly funded healthcare markets. Similarly, the UK and other countries generally fix the price that they reimburse state schools for each pupil whose parents choose to send them there (see OECD, School Choice and School Vouchers: An OECD perspective, 2017).
9. Notably a broader requirement has not yet been brought forward by the Treasury and so the role of the CMA’s remedies has been key in delivering Open API standards.
10. www.which.co.uk/money/banking/switching-your-bank/guides/open-banking-sharing-your-financial-data

11. https://static.treasury.gov.au/uploads/sites/1/2018/02/Review-into-Open-Banking-_For-web-1.pdf
12. Hong Kong, Singapore, Japan and Israel are also following a similar path
13. www.finextra.com/newsarticle/31382/bofe-stress-tests-banks-coud-be-underestimating-the-risks-from-fintech
14. U.S. v. Apple Inc et al, U.S. District Court, Southern District of New York, No. 12-02826.
15. www.economist.com/node/21543178
16. See Elhauge, “Tying, Bundled Discounts, and the Death of the Single Monopoly Profit Theory” (2009). Harvard Law Review, Vol. 123, No. 2, 2009
17. www.wired.co.uk/article/open-banking-psd2-regulation-banking