

Manuscript Details

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Abstract

The purpose of this paper is to develop an insight and review the effect of FinTech development against the broader environment in financial technology and to offer perspectives in order to aid the understanding of the disruptive potential of FinTech and its implications for the wider financial ecosystem. By drawing upon very recent and highly topical research on this area this study examines the implications for financial institutions and regulation especially when technology poses a challenge to the global banking and regulatory system. It is driven by a wide-ranging overview of the development, the current state, and possible future of fintech. This paper attempts to fuse together both practitioner-led and academic research. While it draws on academic research, the perspective it takes is also practice-oriented. It relies both on current literature and insights from industry sources and other publicly available commentaries such as professional practitioners' roundtable discussions in which the author has been an active participant. We attempt to interpret banking and regulatory issues from a behavioural perspective. The last crisis exposed significant failures in regulation and supervision. It has made the Financial Market Law and Compliance a key topic on the current agenda. Disruptive technological change seems to be important in investigating regulatory compliance followed by change; we contribute to the current literature review on financial and digital innovation by new entrants where this has also practical implications. We also provide for an updated review of the current regulatory issues addressing the contextual root causes of disruption within the financial services domain aiming to assist market participants to improve effectiveness and collaboration. The difficulties arising from extensive regulation may suggest a more liberal and principled approach to financial regulation. Disruptive innovation has the potential for welfare outcomes for consumers, regulatory and supervisory gains as well as reputational gains for the financial services industry. For example, the preparedness of the regulators to instil culture change and harmonise technological advancements with regulation - as the financial services industry evolves - could likely achieve an orderly growth, aid further systemic stability and restore trust and confidence in the financial system. Our action-led research results have implications for both research and practice. These should be of interest to regulatory standard setters, investors, international organizations and other academics who are researching regulatory and competition issues and their manifestation within the financial and social contexts. As a perspective on a social construct, this study appeals to regulators and law makers, entrepreneurs and investors who participate in technology applied within the innovative financial services domain. It is also of interest to bankers who might consider FinTech and strategic partnerships as potential future strategic direction.

Keywords	FinTech; RegTech; business models; regulation; financial services, future research direction
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TITLE: FinTech and RegTech: Impact on Regulators and Banks

Highlights

We use a behavioral perspective to examine various banking and regulatory issues created by disruptive innovation.

We discuss the effects of financial and digital innovation by new types of financial providers on existing firms.

We discuss potential changes in regulation needed to accommodate ongoing innovation.

We discuss the welfare outcomes of innovation for consumers and the reputational gains for the financial services industry.

TITLE

FinTech and RegTech: Impact on Regulators and Banks

The purpose of this paper is to develop an insight and review the effect of FinTech development against the broader environment in financial technology. We further aim to offer various perspectives in order to aid the understanding of the disruptive potential of FinTech, and its implications for the wider financial ecosystem. By drawing upon very recent and highly topical research on this area this study examines the implications for financial institutions, and regulation especially when technology poses a challenge to the global banking and regulatory system. It is driven by a wide-ranging overview of the development, the current state, and possible future of fintech. This paper attempts to connect practitioner-led and academic research. While it draws on academic research, the perspective it takes is also practice-oriented. It relies on the current academic literature as well as insights from industry sources, action research and other publicly available commentaries. It also draws on professional practitioners' roundtable discussions, and think-tanks in which the author has been an active participant. We attempt to interpret banking, and regulatory issues from a behavioural perspective.

The last crisis exposed significant failures in regulation and supervision. It has made the Financial Market Law and Compliance a key topic on the current agenda. Disruptive technological change also seems to be important in investigating regulatory compliance followed by change. We contribute to the current literature review on financial and digital innovation by new entrants where this has also practical implications. We also provide for an updated review of the current regulatory issues addressing the contextual root causes of disruption within the financial services domain. The aim here is to assist market participants to improve effectiveness and collaboration. The difficulties arising from extensive regulation may suggest a more liberal and principled approach to financial regulation.

Disruptive innovation has the potential for welfare outcomes for consumers, regulatory, and supervisory gains as well as reputational gains for the financial services industry. It becomes even more important as the financial services industry evolves. For example, the preparedness of the regulators to instil culture change and harmonise technological advancements with regulation could likely achieve many desired outcomes. Such results range from achieving an orderly market growth, further aiding systemic stability and restoring trust and confidence in the financial system.

Our action-led research results have implications for both research and practice. These should be of interest to regulatory standard setters, investors, international organizations and other academics who are researching regulatory and competition issues, and their manifestation within the financial and social contexts. As a perspective on a social construct, this study appeals to regulators and law makers, entrepreneurs, and investors who participate in technology applied within the innovative financial services domain. It is also of interest to bankers who might consider FinTech and strategic partnerships as a prospective, future strategic direction¹.

Keywords: FinTech, RegTech, business models, regulation, financial services, future research direction

¹ We thank two anonymous referees for their very thoughtful and constructing comments who took a keen interest in reviewing our research and in this way contributed materially to the development of the paper. All other omissions and/or errors remain our own.

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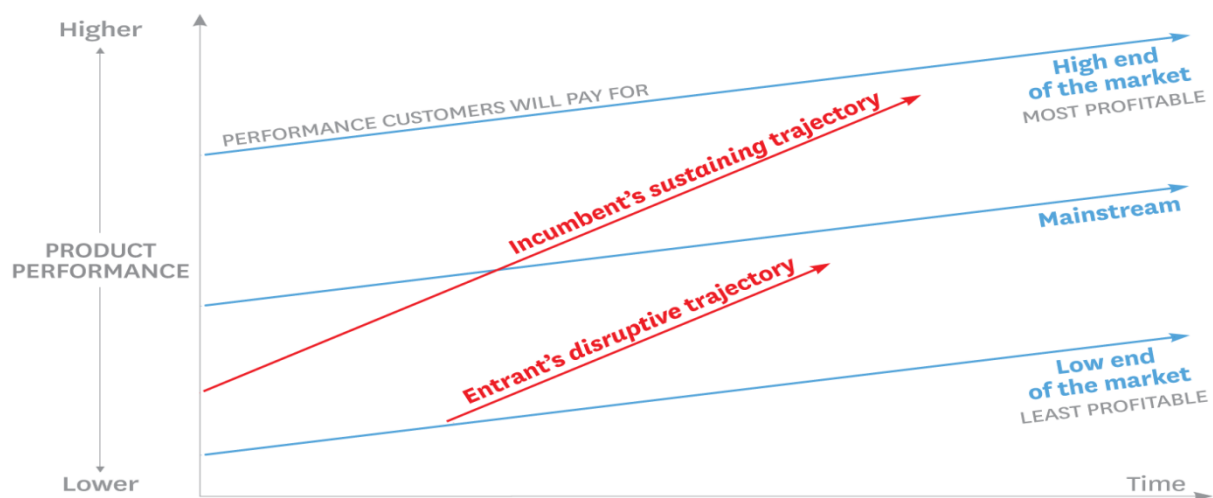
Fintech and Regtech: Impact on Regulators and Banks

1. Introduction

Since the financial crisis of 2008, the landscape of the financial services sector has been gradually changing due to an overhaul in financial regulation but also because of great advances in financial technology innovation. Within the context of banking, the nature of financial markets, services, and institutions is changing due to new entrants' disruptive and innovating technological practices following the latest financial crisis (Gomber et al. 2017). Bower and Christensen's (1995) earlier work regarding 'disruptive innovation' – while not new - can be characterised as relevant and highly topical. It is defined as a process whereby a smaller company (usually a start-up/new entrant) with fewer resources is able to successfully challenge established incumbent businesses (Christensen et al. 2015). Technology in general has an established and long history of flashes of disruption and is as infinite as ingenuity with a multitude of examples ranging across many facets of business and social life. These range from Amazon's evolutionary disruption of the publishing industry, to Uber's emergence disrupting the taxi industry, to Airbnb upsetting the hotel industry (Zachariadis and Ozcan, 2017). In the banking domain, it refers to the application of rapidly developing technology at both the retail and small business level and the entrenchment of financial technology (*fintech* henceforth) in financial services. Examples include digital reporting, digital loan origination, payment transfers, and demonetisation resulting in the conception of new banking market segments, channels, and products. Fintech generally leverages technology and innovation, delivering niche services via electronic (online) conduits by disintermediation circumventing incumbent financial institutions (Nicoletti, 2017). The creation of new, untapped (or even neglected) value networks directly impacts existing markets and customers and it can threaten to dislocate established and reputable institutions. Roundtable discussions and action research have also revealed that it also forces regulators to reconsider the use of technology both for their own - and by consequence - public benefit through the (re)formulation of the regulatory policy framework. At the outset, and flying under the regulator's radar, fintech start-ups not only promise more agile finance, they are also preferred by a large but particularly neglected electorate: banks' own retail and low-end clients. Put simply, they offer better service for lower costs. Figure 1, below schematically represents the argument above.

Figure 1.
The Disruptive Innovation Model

This diagram contrasts *product performance trajectories* (the red lines showing how products or services improve over time) with *customer demand trajectories* (the blue lines showing customers' willingness to pay for performance). As incumbent companies introduce higher-quality products or services (upper red line) to satisfy the high end of the market (where profitability is highest), they overshoot the needs of low-end customers and many mainstream customers. This leaves an opening for entrants to find footholds in the less-profitable segments that incumbents are neglecting. Entrants on a disruptive trajectory (lower red line) improve the performance of their offerings and move upmarket (where profitability is highest for them, too) and challenge the dominance of the incumbents.



SOURCE CLAYTON M. CHRISTENSEN, MICHAEL RAYNOR, AND RORY MCDONALD
FROM "WHAT IS DISRUPTIVE INNOVATION?" DECEMBER 2015

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Within the space of a few years, small, novel finance start-up firms are shifting paradigms in many areas of the financial domain. Admittedly, it is still unclear what the long-term growth trend will be for this industry and how exactly it will impact the financial landscape. Kendall (2017) though, argues that start-ups are already confronting many modules of the traditional banking models globally, resulting in wider banking access, cost cutting, expedience, efficacy but also security value. Six key retail banking channels - consumer finance, savings and investments, mortgages, insurance, lending to small and medium sized enterprises and retail payments - are within fintech's reach. The growth in fintech investment on value terms is also noticeable (Athwal, 2016). From US\$930m in 2008 it grew to US\$4.1B in 2013; it tripled during 2014 alone to US\$12.2bn and then nearly doubled in 2015 to US\$22.3B. In 2017, the global funding of fintech companies stood at \$100.2 billion, four times larger than investments in venture capital (IOSCO, 2017a). A very recent study (Ernst & Young, 2017) also claims that fintech penetration is more prevalent at the retail level in 20 major world markets where fintech adoption is forecasted to reach 52% globally.

Fintech has emerged as result of changing global drivers of the value chain which has led to exposing imperfections in the banks' current business models, in order to emphasise areas where changes are needed, and to help inspire adaptation of such business models for future growth (Thurber, 2012). An overview of how financial innovation is transforming the financial sector is also shown by Frame and White (2014) across three dimensions, namely: new products and/or services, new output processes, and new business models. The rudimentary (by current comparison) electronic banking of the post-2000 era provides a case in point; the financial technology employed was *esoteric* as an operational capability. It was applied exclusively only by traditional banks which followed an established path to compliance. Accordingly, regulation - by its very nature - followed reactively the same, incumbent actors throughout. Yet, this current period is characterised by innovation not only in the financial outputs delivered but largely by *who* distributes and *how* they convey such outputs. This has implications for banking and its regulation within the payments and fund transfers, insurance, lending, investment, and asset management domains (Schindler, 2017). It has also direct implications for the client base and as a result for incumbent financial services firms. Fintech is redefining the competitive setting, and is reshaping the lines that once characterised competitors in the banking industry. It causes disruption to the traditional value chain of financial institutions. Kaal (2016) for example, argues it is these disruptive technological innovations that create an exponential facilitation in the value chain proposition for customers; a value chain once considered untouchable in the complex ecosystem of the financial services industry. It is all about consumers and the channels through which they receive benefits. The conventional methods of performing financial services are lagging, and they are challenged by more modern, fresh, technology-empowered channels. Hence, the threat of fintech is also the impact it will have on customer expectations towards banking services.

1.1 Methodology and Purpose Statement

Fintechs are a new, fast-growing part of the financial services domain, and as such they are characterised by limited understanding due to new phenomena emerging. Zavolokina et al. (2016) were one of the first researchers to more systematically explore fintechs. The authors claim that *'fintech is a living body with a flexible and changing nature rather than a stable notion that is transparent and clearly understood by both academia and the media'* (p 12). They further argue that the emergence of fintech is the result of three main factors simultaneously interacting and challenging the status quo at the same time. These are: organisations, people, and geographical locations (markets). Such phenomena have the potential to change business models, bring about structural changes, and/or change any other aspect of the system under investigation (Coughlan and Coughlan, 2002). It is about real change with real managerial and research implications (Balyuk, 2017). These inform our motivation for action research. While a well documented and established amount of research concentrates on the field of financial services and the banking sector, only a few academic researchers have investigated the fintech business. We attempt to demystify the creative disruption arena and the gradually widespread presence of digital platforms within the financial community. We also attempt to shed more light on the financial services emerging ecosystem through action research.

In agreement with Orlikowski (2000), and as argued above and further below, this essay also advances the behavioural view that structural changes are not located strictly only within organisations or owed solely to technology; they are also enacted by enablers and other stakeholders. Furthermore, data availability is either scarce or non-existent in order to investigate fintechs deeper and understand further this observable phenomenon, which is due to its novelty and exponential development pace (Dapp et al. 2014). We draw on practical situations, issues, and experiences, rather than on experimental studies. We do this through our direct participation in think-tanks and roundtable discussions (for example, the City of London Forum for fintech in the UK, 17/01/2017) as well as engaging directly in projects with fintech companies in the UK (for example, Exate Technology and Funding Options). In order to overcome some of the deficiencies or limitations of traditional research methods we engage in action research (AR), where AR is fundamentally about change (Kaplan, 1998). Action research is appropriate especially in settings and contexts characterised by emerging, unstructured, or integrative issues (Westbrook, 1995) where action research is used for solving real problems in real situations. Action research is appropriate when certain aspects of the subject under investigation cannot be captured by other research approaches in order to contribute to emergent theories (Eden and Huxham, 1996). Emergent theory develops as a *synthesis* of existent contextual data and data generated and informed through intervention. Its primary goal is to generate findings and conclusions that are relevant both for practitioners and academics (Kaplan, 1998; Baskerville and Myers, 2004; Kemmis and McTaggart, 2005; Coghlan and Holian, 2007; Ou Yang et al. 2017).

Our goal here is threefold: (i) to explore, generate, and organise knowledge directly useful to a variety of people and firms; (ii) to bridge the gap between rigour and relevance in our quest of understanding real issues in this domain while building scientific knowledge and contributing to theory; and (iii) to highlight the conditions under which insights from reflective dialogues and action research give researchers a useful starting point to the field and accordingly establish dialogue with fintech practitioners. We believe that such dialogue holds the promise of much fascinating research.

Many banks have acknowledged being threatened by the growth of fintech companies. They have also formally voiced their concern about fintech competition and regulation held to exactly the same rigorous standards (Bunea et al. 2016). The industry is under siege since the boundaries have also shifted: fintech is no more the preserve of traditional financial incumbents and the regulator is (or should be) no longer pre-occupied solely with financial institutions. The sections that follow examine the enablers¹ relevant and largely responsible for such a shifting paradigm and the emergence of fintech. They are examined since at least some of them are seen as factors to preoccupy institutions and regulators alike for the years to come. The rest of the paper is organised as follows. Section 2 examines the enablers of change and the growth opportunity set of fintech. Section 3 examines the impact on banking services. Section 4 discusses regulation technology as a sub-set of fintech. Section 5 elaborates more on the impact on regulators in their role both as users of fintech (i.e. the 'RegTech' coined term) and conductors of fintech-related regulatory policy. Section 6 concludes the research.

2. Trending Enablers of Change and Fintech Growth

Within this dynamic segment right at the intersection of the financial services and technology sectors, fintech is reshaping the industry's status quo. Reflecting on Zavolokina et al. (2016)'s factors we elaborate further on this research. We enrich such dimensions and discuss how they influence and motivate the emergence and expansion of fintech and how they fit into the theoretical knowledge on the drivers/enablers of financial innovations. Demand and supply factors impinge on the interaction process among societal, economic, regulatory and technological aspects. The influence of such factors cannot be readily distinguished from one another and creates a tangential interaction of stakeholders and fintech firms. It is to these factors we turn below.

¹ We use the term 'enablers' rather than 'drivers' to point out that they require actors to innovate or circumstances to enable them to respond to changes in the political, social, technological, and financial environment.

- i) Demographics and high national internet and mobile penetration: Over the next business cycle, it is expected that the mean consumer profile will be revolutionised radically. That is, as the last string of the baby boomer generation gradually retires, Generations X and Y (the ‘millennials’ are workers/customers born between 1980 and 2000) are proportionately assigned more material roles in the global economy. Furthermore, millennials are expected to shift radically client demographics, behaviours, and expectations (World Bank, 2016). In addition, Generation Z (people considered to be born between 1995 and 2012) will operate in a world of abundant remote connectivity. All the above constitute a digital clientele, highly technically proficient, which can only serve to accelerate the business disruption and adoption of fintech. Kanzler (2015) argues that such young innovative companies have been created by people who grew up with the internet, for people who have already wholly abandoned visiting physical branches and ATM networks against services provided entirely online and through applications. They afford greater reach, clarity, speed, and assistance on the spot.
- ii) Shifting expectations: Client expectations continue to change particularly as a spin-off product of their own interactions as they *learn* from other sectors. They expect unflawed, on-time, and material relationships requiring service providers to move forward, become personal, and ‘feel’ the customers as individuals. The banks’ inability (or loss of focus or neglect) to gain better insights into client behaviour, their tailor-made requirements, and the failure to shift from product-centric and self-centric thinking to customer-centric offerings is also how fintech has earned their fortunes. Greater shifts in market share are expected in the future (Watson, 2017). A very recent study shows that customer at the epicentre of the entire financial system will be the target offering cutting-edge, KYC (know-your-customer), personalised client experience, virtual/self-managed funds and expediency (PWC, 2016). This is a strategy that has been successfully employed for many years by technologically proficient companies such as Apple, Amazon etc. As a result, customer centricity has become a main priority in meeting the needs of the digital native clientele (Zachariadis and Ozcan, 2017). There is a demand for better, cheaper, easier, and smarter access to financial services.
- iii) Re-inventing business models: for many smaller market participants, it seems that challenger banks and fintechs solve *people problems*; banks solve only *banking problems* isolated from everyday reality. The latter argument is important in that the consumer/retail banking, insurance and payments’ segment revolve around client centricity with the ‘customer’ at the heart of the operations. For example, during the crisis, confidence in mainstream banks was impaired with customers keen to protect, save, reduce costs and ‘*self-manage*’ their assets (Gulamhuseinwala, 2017). Business models which avoid the structural formalities of being a bank, while providing a more efficient means of serving customer needs, have been a huge prospect window for new finance-related, customer-oriented services. Hence, apart from demonetisation, dis-intermediation is reinventing the industry by redesigning the landscape of lending and payment practices (Románova and Kudinska, 2016; Wack, 2015). There is a supply of re-invented customer service.
- iv) Cost-efficacy: New fintech start-ups are so far free of regulatory baggage, unburdened by obsolete legacy platform systems, branch networks, thousands of employees, or indeed the urge to fund and defend existing lines of businesses as banks do. For example, for many incoming players operating expenses as a proportion of their open loan balances are about 2% on average while the corresponding figure for traditional creditors stands at 5-7% (McKinsey, 2015).

- v) Niche concentration: This is akin to specialization and stripping a bank away bit-by-bit by unbundling its constituent parts and *causing death by countless small incisions* (CBS, 2015). Examples include companies like Zopa concentrating solely on lending, Nutmeg serving the savings and investments market, PayPal in the payments niche, Mint in money management etc. What all these firms have in common is unique specialism and focus coupled with improving the quality of financial services at the same time; they undercut costs, they offer a personalized, tailor-made service, better deals to the borrowers and lenders who congregate on such platforms, and they operate a fast-matching clientele outside normal business hours (KPMG, 2015). There is supply with enhanced accessibility and expediency.
- vi) Cyber safety: cybercrime-free transactions where there have been leaps and bounds of improvement and innovation in the financial services protection over the last years (i.e. Apple Pay or the very recent disputes between Government and companies such as Google over tightly encrypted messaging). With this change new entrants have been compelled to create revolutionary digital products which afford protection in addition to the features discussed above (PWC, 2015).
- vii) The financial crisis and regulation-enabled growth: As argued above between 2008 and 2013, investment in financial technology solutions grew four-fold compared to venture capital. With the credit sector entirely stationary, mortgages became out of stock, small business loans were frozen and credit card lending was withdrawn. Over the same period, with banks feeling compelled to spend great amounts on new regulation compliance in order to assure regulators they also became unable or unwilling to lend further and also invest on innovation (Stein et al. 2012). This created the great unbanked clientele i.e. clients without a formal relationship with conventional banks, and the under-banked clients i.e. clients with simple bank accounts but with no/small credit (Usman et al. 2016). The admission of modern, online lending technology has begun to change the game for how small businesses access capital around the world (Mills and McCarthy, 2016). The changes in banking, financial compliance, disclosure, and payment regulations that also followed generated the prospects for entrepreneurs to investigate open banking and financial technology solutions.
- viii) Diversification and funds disintermediation: fintech entrant penetration creates a larger, more competitive, more varied, and potentially more stable, credit market. Financial technology innovation has been shown to widen participation in the credit markets without leading to overborrowing (Balyuk, 2017). Digital firms are more physically dispersed than traditional lenders and their lending platform reach is expansive enough to accommodate global diversification of portfolios. In terms of de-risking, such firms also naturally avoid two fundamental risk zones inherently unstable in traditional banking; that is maturity mismatching and leverage (Jakšič and Marinč, 2015). They indirectly engage in the maturity transformation process; they rather concentrate on the volume matching (and buy-side liquidity) by simply and transparently matching borrowers and savers directly. These new platforms do not directly raise finance with a view to lending; a creditor pledges their funds after they have been matched and until the final payment is due they bear all or any of the risk of default. They become the intermediary between banks and their customers.
- ix) Regulation as a source of disruption: The current banking regulation has also been partly *responsible* for the current climate and disruptive rise of technology. For example, the new liquidity regulation requirements in banking have made abundantly clear that to a large extent, deposits (accounts) as a source of funding are no longer considered an eminent source of financing; they rather carry a ‘penalty’ for over-reliance on such sources considered as less stable for the safeguarding of the financial system.

Hence, deposits experience *scaled preference* (further down in the pecking order of financing) for the bank as a whole (Huertas, 2016). As a result, competition in the traditional deposits' markets has shrunk; their importance as value-driven operations has declined along with its servicing qualities such as personalisation/tailor-made banking, accessibility, and convenience. As such, regulation in itself can also be characterised as disruptive and many finance company CEOs have themselves characterised regulation as a source of disruption (PWC, 2015). Another example is the Payment Services Directive (PSD2) in Europe. It has introduced the right to third parties to use bank accounts, the right to use APIs to connect the merchant and bank directly, and the ability to consolidate account information in one single portal. It will inevitably disrupt the payment services in Europe. It has been a significant prospect for fintech firms, and a certain problem for incumbent financial institutions.

The underlying consumer impact on the one hand is expected gains in overall consumer welfare due to the reduced costs of banking and investment, increased access and convenience, and personal banking offered by the new contestants. Fintech has provided customers with a better banking experience as the technology ecosystem is capable of scrutinising huge data-driven consumer behaviour analytics and providing tailor-made solutions. On the other hand, it will compel slacking banks to alter their business models and their cost structures, reduce costs, and be forced to adopt and apply client-centered services amidst declining margins and declining profitability, diminishing trust, and the threat of loss of market share. Yet, this disruption is also regulation-related and materially relevant to prudential regulators. At the same time it is a blessing and a challenge to the regulator's objectives for financial stability and for safeguarding the protection of consumers. The difference this time is that both the players and the processes are new; both are completely data-driven; and both move very quickly so that the pace of service and product novelty can make regulations pertaining to such product/services obsolete even before such regulations are agreed, finalised, and acted upon (Barefoot, 2015). The sections that follow examine the impact on banks and the impact on regulators.

3. Impact on Banks and the Financial Services Sector

The financial services sector has a reputation of being ingrained in their traditional ways and being resistant to change. Banking has historically been one of the business sectors most resistant and suspicious to disruption by technology (Fichman et al. 2014). As a result, today banks often show a lack of innovation either because of their stable market position or due to complex government regulations. Some banks have reacted fiercely, attempting to require the same regulatory challenges imposed to start-ups, as some critics argue that antagonism from emergent, leaner banks is likely to leave 4.7 trillion dollars at risk for incumbent institutions (Economist, 2015). The imperfection of the banking system to respond quickly has inevitably drawn the attention of the Silicon Valley community to it. In terms of profits and market share under threat for example, loan marketing, which has largely become the hub of challenger banks also, comprise nearly 60% of total banking profits globally (PWC, 2016). As a further testament of data-driven credit, relationship lending through chasing big markets is gradually ceasing to be a banker's unique terrain. As J. Dimon (C.E.O of J.P. Morgan) said '*Silicon Valley is coming. There are hundreds of start-ups with a lot of brains and money working on various alternatives to traditional banking. Silicon Valley, the Bitcoin, digitisation will all try to eat our lunch*' (Dimon, 2014).

Banks will have to engage in further cost-cutting since they remain shockingly costly, which partly also explains the market penetration by new entrants (Philippon, 2016). The new paradigm spearheaded by fintech start-ups calls for stripping banking operations into separate business segments and holistically specialising in at least one of such segments affords them recognition, higher consumer utility, and as a result, market share. Banks will have to respond to this margin compression since passivity on the side of banks could result in approximately as much as 20% of revenues being at risk by 2025 (McKinsey, 2015).

Furthermore, in open banking, assuming that major stipulations such as cyber safety measures problems are satisfied, Scott et al. (2017) claim that the new entrants will force banks to accept lower margins - on an already regulatory-diminished Return on Equity - especially for business segments that can be easily replicated. The opposite is true for products/services that the newcomers cannot easily replicate, for example, infrastructure issues, and deposit insurance. In a digital setting with flatter prices and rents, the capability to connect with customers through open networks that offer higher value experiences through more valuable applications may act as counter-incentive to move to a different platform. Van Alstyne et al. (2016) for example, assert that the greater the opportunity to produce value for customers on a particular platform, the less inclined customers will be to leave, thus creating a customer 'lock in' effect. Hence, in this context, openness can be managed so as to capitalise on positive network externalities and claw in more consumers. Traditional intermediaries (i.e. banks) not only will have to re-think and re-design the business models upon which their fortunes have been built; they will have to self-reflect and choose whether - through utilising existing know-how and infrastructure - to co-lead, co-drive and reform the future of open banking. If not, they will be condensed to regulation-driven, deposit-taking suppliers of services, secondary to emerging, creative institutions (Carney, BoE, 2016).

A very interesting, wide-ranging and influential study published by the World Economic Forum (WEF, 2015) reports the impact of fintech on the future outlook as envisioned by CEOs of major leading financial institutions, academics, and start-ups. The report classifies the following implications for incumbent banks as 'safe bets' (i.e. impact with a high degree of certainty regardless of whether the industry will consolidate or will operate as fragmented). More specifically, the major disruptive effect revolves around the channel of individual empowerment and 'loyalty'. According to this research the following markets are expected to see major changes:

- Payments
- Insurance
- Deposits and lending
- Retail and SME capital raising
- Investment and wealth management

We do not assert that banks as institutions will disappear in the future. Yet, based on the degree of innovation shown so far, many services that banks currently provide could possibly become the basis to a new startup. For example, Eisenmann et al. (2011) state that existing platforms that have 'overlapping user bases and employ similar components', (p 1271) can become notable contenders. Over the period ahead, channel diversification will be a fundamental driver in the banking sector. There is still plenty of room to innovate and provide better products. De Reuver et al. (2017) suggest that digital platforms have the advantage of being 'editable' and 'reprogrammable' which could make them more responsive to incorporating complementary modules from third-party developers in order to expand functionality. An established institution's neglect of investment in disruptive/emerging technologies can often result in the abrupt loss of market dominance and in extreme cases even in total replacement in such markets (Christensen et al. 2015). Banks will thus have to *re-train*, re-develop narrowly defined yet effective solutions, and recapture the segments previously neglected; that is re-focus on retail customers. For example, they will be compelled to heavily invest in cutting-edge technology (banks have already started to incorporate cloud computing and blockchain) in order to provide:

- B2B solutions
- Peer-to-peer (P2P) marketplaces for customers unable to secure loans from other traditional sources
- Personal finance management tools
- Mobile wallets
- Solutions for clients not capable of getting loans with no or poor credit scores
- Big Data Analytics
- Digital Currency and other Blockchain technologies
- Insurance (InsurTech)
- Investments (Robo-advisors)

While the above are merely examples of where customers move and what their expectations are, they are all central to what often troubles major financial institutions: outdated technology and distribution channels that are burdensome to manoeuvre. Another example of how technology starts to become integrated is the copying and use of Software-as-a-Service (SaaS) solutions. It is developed by fintechs in order to amalgamate, restructure, and simplify operative capacities, and deliver digital services. Application program interfaces (APIs) build up value-added resolutions and a variety of pick-and-mix elements that can swiftly be integrated within existing bank platforms within which incredible quantities of money can be created and exchanged (Parker et al. 2016). Related to this, in China, for example, fintech companies such as Alipay or Tencent have as many customers as top retail banks (Deer et al. 2015). This is where robotic advisors are a way for challenger banks to deliver investment help quickly and more cheaply than through training hundreds of advisors. Morse (2015) asserts, for example, that this is a case where investors seem to capture some rents associated with the removal of the cost of that financial intermediation. Similarly, in the UK, digital advice is seen as a low-cost channel of affording investment advice to masses of clients with low savings accounts who have been previously out-priced from the market owed to the crisis and the regulatory-led turn of banks away from traditional short-term deposits. In addition to this changing operative landscape in which banks will be forced to compete, this can potentially have a large impact on employment where 2 million jobs are expected to be lost in the US and European banking markets.² For example, the main issues for financial institutions are risk compliance costs, reliance on manual processes in data management, detecting fraud or anomalies in financial transactions as well as traditional issues related to data security, data quality and accuracy; 10-15% of their workforce is dedicated to such operations (McKinsey, 2016). It seems that for new borrowers, smaller, younger and underdeveloped firms, mortgagors etc. all lying on the periphery of the credit system, risk assessment that scans the globe for data is much more efficient, less costly, and more expedient compared to a rationality-bound loan assessment officer in a brick-and-mortar branch (Jagtiani and Lemieux, 2017).

One area untouched so far is the regulatory implications of fintechs as opposed to banks and the shaping of the regulatory level-playing field. Strongly financed, highly connected, and massively attractive start-ups with a large client base are bound to draw regulatory scrutiny especially when they challenge state and local laws at a time when they do not clearly fall within the financial regulation sphere (Pollman and Barry, 2017). In addition, both regulation and the associated compliance costs scale ever higher at an unprecedented pace following the crisis at around one billion dollars yearly; and while anecdotal, they illustrate the significance of the challenge (Institute for International Finance, 2015). As the regulatory requirements keep rising, business models based upon regulatory demands have to adapt as well. Only, adaptation of banks has always so far been gradual and slow. Yet, banks, despite their aversion to regulation, have been traditionally relatively content to satisfy regulatory demands provided that regulation took the stance it has always followed so far; that is, a *'wait-and-see'*, passive approach. The banks' own traditional conformity resolutions have allowed them to do so; their legacy IT infrastructures, their branch networks, defending their existing lines of business are complicated, and costly to change and become acclimatised to new or altered settings. They have also been content to deal with disruption as long as such disturbance was managed strictly within the known regulatory boundaries and regulation in that respect has reactively followed banking throughout. The new economics though dictate that while some of the regulatory standards may indeed be onerous and problematic for banks these are gradually changing; banks will have to adapt. Importantly, they do not currently, automatically affect or fully apply to challenger banks that are drastically changing the financial sector. Buchak et al. (2017) show that already by 2015 fintech shadow bank lenders accounted for roughly 12% of mortgage loan issuance in the US and comment that this is a substantial share regarding the expansion of shadow bank lending that delivers fresh tensions.

² A variety of professional think tanks and institutions, such as the Roundtable discussions in the City of London Forum for fintech in the UK (17/01/2017), The Financial Press (Financial Times, January 22, 2016), and the Office of the Comptroller of Currency (O.C.C henceforth, 05/24/2018) have voiced their concerns that the potential inability of the banking sector to compete in this domain poses great risks for jobs, competition, market share, and profits.

As an example, if challenger banks compete directly with banks and they contest/replace the current status quo as the established funding channel to SMEs and individual households (Mills and McCarthy, 2016), the banking industry translates to an extent to 'narrow banking'; fintechs will do much of the regulatory-monitored matching whereas banks could take in more of the deposit market and hold thicker portfolios of safe and highly liquid investments. A lower concentration of credit in banks is valuable when there are idiosyncratic problems at banks and as a result leverage across banks and the system would be reduced; a much sought-after regulatory objective. Equally, there are factors that may give rise to new risk considerations. For example, there is the potential risk of lower quality credit risk assessments and hence of lowering lending/credit benchmarks in markets where credit channels are already deeply established, particularly in upswings. The procyclicality element of credit provision could be re-introduced rendering Basel regulations inoperative; a constriction of credit can potentially materialise much more quickly in the fintech environment in the event of changing investor sentiment and a loss of investor confidence during crisis events or at times of tension. Moreover, fintech creditors have yet to experience a full business and credit cycle and existing banks may actually leverage more on credit risk as a reaction to increased competition from new entrants. How the challengers' business models, their credit provision and their distribution channels will perform in a decline is a significant ambiguity (Jopson, 2016).

All of the above discussion merits further thinking as it can potentially re-shape banking as overwhelmingly as any regulator has done so far. It opens up another area of discussion with regard to regulatory issues; societal norms, changing values, and structural changes sometimes merit regulation for the benefit of orderly markets and public welfare. In many instances response has been slow due to the fact that regulatory efforts have always been bound by substantial political economy, harmonisation and third-party costs. At the outset, fintech potentially brings a much needed, welcome revolution but is also prone to pose further regulatory conundrums such as new systemic risk considerations, timing response, data security, and agency issues. At the same time, while it is true that human agents can be much more biased than pure algorithms introduced by fintechs it is equally the case that fintech business models have not yet been tested either for their implications or their resilience. It is still early to draw any conclusions and while some have welcomed this change, other market participants find themselves in the same position as they were amidst the internet and technology boom and IPO bubble nearly two decades ago querying whether this high tech-revolution today is different and if so how and why. Like all 'revolts', however welcome they may be, the swift revolt of fintech that markets currently experience creates risks as well as opportunities for regulators and market participants alike. The main current concerns of policymakers and the industry arise not from the technology itself only but also from *who* is applying technology to finance along with its speed of development. What the potential impact is and what improvements are required in the regulation of the technology domain (the fashionably coined term '*RegTech*') are also examined in the two sections that follow since such enablers discussed above are major catalysts to fintech, RegTech,³ and banking activities.

4. Regtech as a subset of Fintech

RegTech refers to a sub-division of the fintech sector that focuses on technologies that may facilitate the delivery of regulatory requirements more efficiently and effectively than existing capabilities. Companies that develop agile financial technology can not only help financial companies to better comply with regulations but also assist regulators to better enforce prudential regulation and supervise financial institutions (Arner et al. 2015). More specifically, as argued above, fintechs have taken the view that the challenges to traditional banking currently are simply questions of engineering and technology that can be solved through a combination of high-quality data and automation (FRB Chicago, 2016).

³ For the avoidance of confusion and clarity the term 'RegTech' refers to the use of new technology to facilitate the delivery of regulatory requirements. It consists of a group of companies that use technology to help businesses comply with regulations efficiently and inexpensively (Financial Conduct Authority, UK, 2016)

FinTechs amplify the burden on incumbent financial services providers by exposing weaknesses in their existing business models. They also amplify the burden on regulators to effectively monitor their subjects. A blurred line though lies in the interaction of RegTech as a tool to be used and applied by regulators on their *subjects* and the subjects themselves as well as the benefits and risks that this interaction brings. That is also partly because in contrast to fintechs, regtechs have been more of a top-down phenomenon. This is a setting where technology providers act in response to demand from bulge bracket financial institutions (and regulators) in order to address both the objective of decreasing regulatory and compliance requirements costs as well as increasing market monitoring capabilities and as such, this has also introduced opportunities for RegTech start-ups (Eyers, 2016). Furthermore, this increasing use of technology in finance progressively demands more pressure on the regulators to switch their approach from regulating human behaviour to controlling and supervising the algorithmic/electronic processes and this accelerated growth of fintech has also spurred the need for RegTech (Ernst & Young, 2016). Such developments have the potential to deeply impact behaviour, products, financial industry practices, delivery channels, and possible regulatory responses to changes in any of the above. It is these aspects in terms of the benefits and challenges that RegTechs introduce that we turn to below in an effort to provide a balanced view on the development of non-financial firms entering the financial services business and the related arising regulatory challenges.

4.1 The principled benefits of RegTech

The interaction of hi-tech innovation, informational incompleteness, instability and riskiness, market imperfections, and regulatory issues have all fuelled disruption and forced novelty where finance and technology overlap. RegTechs afford the opportunity to simultaneously encompass all tools related and necessary for compliance by utilising near real-time data capabilities, automating advanced algorithmic processes, linking advanced models and analytics with self-taught and fast-moving artificial intelligence. They reduce costs, decision timing and they speed up matching thus they massively enhance the value of compliance functions (Economist, 2016). They have the potential to provide continuous, uninterrupted reporting for audit, finance, and all risk management areas that sharpen the surveillance of market trends and emerging risks. Kaal and Vermuelen (2017) for example, show how investment data can provide important feedback on innovation trends and associated risks for regulators, optimise the timing of regulation, and support anticipatory rulemaking.

RegTech integrated within the financial services domain claims to guarantee alertness, speed of processing, timely dissemination, and enhanced analytics. The anticipated enhancement of a holistic view of data, its automated analysis based on self-learning technology and the production of expedient, less costly, compliant and user-meaningful reports can be used to improve key business decision making by regulators, market users and contestants alike (Hill, 2016). In addition, new ways of enriching the assessment of the risk have surfaced mitigating in this way existing informational asymmetries, market deficiencies and imperfections to some extent. Such companies openly collect vast amounts of data (which in the past may have been deemed as irrelevant to banks, yet in open banking this is paramount) ranging from social-media evaluations to a firm's own utilization of other peripheral firms, with a view to assessing how smaller businesses are performing.

Some use algorithms and machines eager to learn as much in order to underwrite individuals whose credit scores were dented during the crisis of 2008, while others utilize social learning and the knowledge of the crowds for funding startups (Shedden and Malna, 2016). RegTech-generated solutions enhance the ability to scale and flex operative capacity and provide:

-Agility: disordered, cluttered, and tightly knit data sets that can be de-cluttered and re-organised. This provides the potential for the universal harmonisation of data compliance tool standards to be shared nationally, regionally, and globally; a level-playing, much sought after data quality (Deloitte, 2016).

- Timely reporting: reports that can be configured and generated quickly. It offers, for example, near real-time transaction analysis, online registration, and open source compliance systems. It enables data-driven compliance and pro-active regulation and risk management (Brummer, 2015).
- Speed and Integration: they afford much shorter timeframes to devise and implement a solution.
- Analytics: intelligent mining of existing large data sets and unlocking the full potential by using ready-made, repository data for multiple purposes. It creates risk data warehouses and monitoring activity tools; it potentially affords smarter regulatory policy modelling to simulate impact of new policies on a case-by-case basis even before legislating through for example, regulation gap analysis tools (Deloitte, 2016).
- Various management information tools such as: financial health check, transaction reporting, regulatory reporting, and training tools.

RegTech, while incremental, is still in relatively early stages and follows in parallel as a subset of fintech. Yet, neither a strict designation of what it actually is exists nor a trajectory to verify potential full-scale effects. This informatively richer and innovative technology does not properly fit into any current legal category created by recalcitrant regulatory structures, as some have put it (Kaal, 2016). As a novel concept it is a feebly ‘quiet’ structural transformation force in motion in the financial services sector and in-depth knowledge of this ‘sub-sector’ is still in its early stages. Its market stake is still not large enough to warrant a materially risky status in terms of a commanding share of the financial services industry and hence a commanding share of regulation as well. This is also partly due to the current industry participants’ status as obstacles to entry and hence the scepticism regarding innovative products and services (a point which we discuss in our concluding section). More specifically, due to their closeness to the end-user, incumbent financial institutions have habitually considered challengers and other non-financial companies as rivals rather than partners. At the same time, the fintech/RegTech ecosystem is not as small to be neglected (Fernández De Lis, 2016) and yet challenger banks are still hovering silently away from the regulators’ watch owing to their size. But as with any other large market player they are expected to draw scrutiny as they begin to reach significant size/volume (McKinsey, 2015). This is an important consideration to be discussed in the next section below as it poses the challenge for the regulator in terms of *when* and *how* to intervene. With regard to the latter argument for example, Cortez (2014) argues that although it is nowadays widely accepted that novel, disruptive technologies as a whole are generally less expensive, less complicated and more accessible than pre-existing ones, their impact on regulatory infrastructures is often diverse and thus it potentially demands different policy responses to various challenges posed. This scepticism and the associated challenges are discussed below.

4.2 Scepticism and challenges posed

Until recently, regulators have been relatively impartial. Instead they have concentrated on the outcome of the application of fintechs in the finance domain (maybe quite rightly): for how does one regulate an instinctively inquisitive learning mechanism from learning? What are the risks behind such an innovative change and ceding too much control to technology too soon? The regulatory ‘*wait-and-see*’ approach as argued above affords the regulator the opportunity to observe and learn of the potential risks technology generates. As Kirchner (2011) puts it, regulation is slow because regulation is fact-based, it is a trial-and-error-rulemaking process with stable and presumptively optimal rules, and it always emerges ex-post. At the same time, in a fast-paced, technology-led environment that makes money move a lot faster important systemic risks include:

- Fast scalability and speed of matching and loan originations; fast credit has the potential to undermine loan-to-value (LTV) caps and hence increase credit risk in the market (Braggion et al. 2018) (we start the next section with an example of this).
- Liquidity risks emerging from either faster maturity mismatching in money market funds or exponentially simultaneous unexpected withdrawals of retail funds on demand (Aggarwal and Stein, 2016).
- Capital requirements quickly becoming irrelevant or inappropriate. For example, while algorithms are tremendously effective in producing routine decisions quickly when it comes to managing

complex decision-making duties, they can also produce judgement errors at intense paces that are difficult to contain if something sets off wrong. A very recent example is the massive algorithmic sell-offs of assets in the recent financial crisis.

Other equally valid reasons that help explain the caution and scepticism around RegTech are: (i) a cultural, knowledge, and incentives gap between fintech specialists on the one hand and regulatory agencies on the other; (ii) uncertainty surrounding the development potential and dynamic of the RegTech market from an entrepreneur's point of view for venture capital (that is, companies supported by venture capital focus on the development of absorptive capacity and they do so by utilising esoteric R&D and acquiring exoteric knowledge. Absorptive capacity has been defined as *'a firm's ability to recognise the value of new information, assimilate it and apply it to commercial ends'* (Da Rin and Penas, 2017); (iii) resistance resulting from the potential for dislocations in the financial and labour markets (Komlos; 2014, Kaal and Vermeulen; 2017); and (iv) the regulatory domain traditionally does not synchronise well in pace with other exoteric, fast-changing environments such as hi-tech and artificial intelligence by nature. It rather encompasses slow cultural and gradual customary change since this may have considerable behavioural repercussions, resistance and scepticism of how to steer and ingrain a changed code of conduct percolating through the institutions it seeks to regulate. The electronic banking of the past is again a proportionally good illustration of the reason why regulators move slowly in regulating innovations; how should they do it this time? Sceptics have also argued that new technologies have the potential to bring about larger negative and systemic externalities than in previous periods by forcing the early and premature redundancy of the products and the firms they displace and that these externalities are not adequately understood (Kaal and Vermeulen, 2017). Others, to an extent, criticise disruption as a process creatively being taken to a whole new level, branding it *'devastating innovation'* since it disregards the potential social impact on customers and market participants: *'the question [is] whether a novelty is an improvement: the world may not be getting better and better but our devices are getting newer and newer'* (Lepore, 2014). The capability to accrue (data) experiences and learn from those with a view to make individual decisions, while acting custody-free can potentially effect more damage to markets than the anticipated benefits it brings. Others take a long-term, socio-economic view arguing that while the new technologies might as well be brilliant, they only generate immense prosperity for a niche market. As such they contribute in shielding the affluent from crises and in aggravating inequalities where the numbers of unemployed, the underemployed and the working poor swell (Brynjolfsson and McAfee, 2014). In that line of thinking, man-made, uncontrolled intelligence presents considerable regulatory challenges in the existing regulatory framework that warrant reform and a more dynamic response.

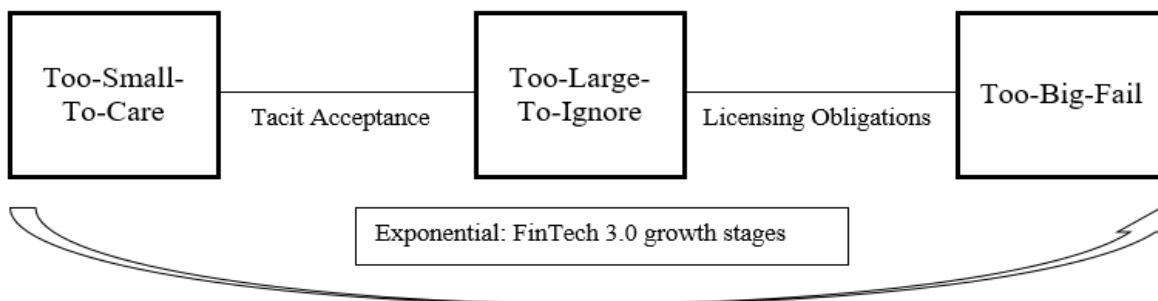
The timing and strength of regulatory response vis-a-vis exponential innovation is also thus a concern for regulators. This conundrum of how technology regulation synchronises and connects (or not) with fintech disruption, real people, and real businesses delivers tension in terms of managing risks and the resolution of regulatory stakeholder interests (Butenko and Larouche, 2015). It is also because agency and informational asymmetries also significantly affect and are affected by fintechs. For example, medium-to-long range planning, such as the traditional business practice of a three-to-seven-year strategic timeframe has been already made redundant by disruptors and banks seem not to have too much choice but to adapt (Brito, 2014). At the same time and as argued above, disruptors are largely flying under the regulator's radar enjoying the benefits of regulatory-free market access. Some important questions thus that surface are: (i) whether the scale of this disruption is regulatory-relevant and material to the supervisors' objectives; (ii) whether fintech/challenger banks ultimately comprehend the need to be regulated; (iii) whether fintechs should consequently be licensed in order to be *'allowed'* to disrupt banking and pave the way for a novel, more competitive, narrower banking and a crisis-resistant financial services' sector; (iv) whether the use of regulatory technology delivers benefits for the stakeholders. Finally, and following from the 4 points above; (v) whether incumbent banks should oppose new entrants or understand the imperative to embrace such a change instead of counteracting it. While the principled benefits of RegTech may indeed be welcome and promising, at the same time they are not a panacea for systemic challenges. The questions posed above are considered in the section that follows.

5. Regulators as stakeholders: remaining relevant in the digital age

We start our critical discussion by linking back to the concluding paragraph of the above section (i.e. whether disruption is regulatory-relevant and material to the supervisors' objectives). We begin with a borrowed example below so as to demonstrate the exponential growth potential of fintech companies, the response-timing and monitoring issue, and its significance for the macro-prudential policy of financial stability. Admittedly, monitoring, controlling, and swiftly disciplining changing financial institutions, structures, and markets whenever necessary calls for the use of agile, flexible, and real-time tools that will promote effective responses. Whilst it cannot be argued that within such a fast-changing environment the regulatory and prudential objectives for systemic stability have changed, it can be argued that the current tools utilised for doing so become quickly outdated.

The case of Yu'E Bao – an Alibaba owned Chinese firm - illustrates how a money-market, systemically insignificant, small intermediary firm went from 'too-small-to-care' to 'too-big-to-fail' within the space of nine months. The company grew from a few thousand accounts to a platform managing over \$165B surpassing JP Morgan's \$150B comparative fund (Lucas, 2017). Regulators, as argued above, have always opted for a blanket, 'sequenced approach' in risk and its build-up; that is, observe, monitor, gather data, examine, analyse, supervise, request compliance, and (re)act. However, the above example embodies a direct challenge to such an approach towards regulating innovations and the associated stakeholders, purely on account of the speed of transformation and the inability of the existing regulatory radar to flag up risks in a timely manner. This example shows how the regulator is forced to skip the 'too-large-to-ignore' threshold phase (that is when regulators would have started to contact and request compliance of said entity once it was identified that it poses significant systemic risk threats, Zhou et al. 2015) and intervene swiftly leading to a very hasty response from the Chinese regulator. Figure 2 below, from Arner et al. (2015) demonstrates the changing dynamics.

Figure 2: Regulatory threshold approaches compared to growth models, **Source:** Arner et al. 2015



This can also serve as an example of a system that rapidly transforms agents from insignificant to systemic with the potential to transform economic systems as a whole (Arner et al. 2015). The supply of funds and liquidity should be central in forming a regulatory response since alternative providers (i.e. new entrants) circumvent traditional sources and afford investors direct access to new and possibly riskier types of investment (IOSCO, 2017a). At the same time such investors can be potentially vulnerable if companies have difficulty in being self-sustained during contra-business cycles. This is even more important especially when such platforms have not been adequately stress-tested (i.e. in volatile/ changing) interest rate and funding scenarios. From the evidence so far, it follows that disruptors that focus on SMEs and other small retail investors, are likely to be regulated differently compared to companies that focus on sophisticated, established institutional investors, or those that fund loans through their own balance sheets (Zetsche et al. 2017). In terms of the regulatory requirements and intervention on the matching and lending activity of a fintech, there are

further tensions to be considered which are exacerbated by ‘amorphous’ regulation owed to the plethora of jurisdictions involved. For example:

- There can be various threshold approaches such as the approach of being regulated as an online lending platform, or being licensed and regulated as a bank or a credit intermediary (Arner et al. 2017). It makes it also challenging to distinguish when such institutions must transit from one licensing (and hence regulatory) level to the next.
- There are no domestically or internationally agreed regulatory standards or even guidelines for fintech intermediation. This problem is further exacerbated by the fact that platform lending also varies across the markets. For example, in the UK and China, loans are made through direct contracts between the investor and borrower, whereas in the US, platform lenders will often stand between the investor and the borrower (Aggarwal and Stein, 2016).
- There is evidence of growing disparities in national jurisdictions as fintech grows; Agarwal et al. (2014) argue that the discrepancy in regulator behaviour is related to different weights given by regulators to local economic conditions and, to a certain extent, differences in regulatory philosophy approach as well as differences in regulatory resources (Brummer, 2015).

The US is a case in point, where the regulatory regime has done little in order to address the fintech market. It so far relies instead to existing rules of enforcement where such entrants are regulated by activity-based regulation (FSB, 2013). For example, if a lending platform is engaged in an underwriting, origination, or servicing activity, it may be subject to state lender licensing requirements. As such, the level playing field is uneven because it affords new entrants the opportunity to place themselves favourably in the US regulatory system through regulatory arbitrage. That is by circumventing expensive compliance and regulatory capital requirements (FSB, 2014). The O.C.C, in 2016, announced and tried to set in motion a proposal for allowing Fintechs to conduct business nationwide through a new, national, special-purpose bank charter that will provide for transparency and greater regulatory uniformity (Office of the Comptroller of Currency, 2016; 2018). Further, the aim of the charter is to streamline the process for Fintechs to operate across the country without having to meet state regulators’ demands. This charter had been on hold until very recently in the midst of legal challenges from state regulators that directly license fintech firms and claim that an OCC charter would exceed the agency’s mandate. At the same time, the incumbent banking community is very concerned about the regulatory advantage currently enjoyed by fintech providers. They have voiced a deep concern over the applicability of such a charter. Unless the regulatory framework for online lenders is held to the same stringent requirements as is the case currently for community banks, it could be used to access the banking system and avoid state consumer protection laws. The Independent Community Bankers’ Association (ICBA) along with the US Government Accountability Office (GAO) jointly reacted by announcing that excessive and unnecessary regulation is stifling their ability to meet the needs of local communities (March, 2018).

In another setting, other authors (Powell, 2014) demonstrate the case of Alibaba Inc., a Chinese company with huge growth, wide market penetration, and international clientele spread in domestic markets while largely being subject to very opaque regulation. In Japan, there are regulatory caps on interest rates where fintechs are not allowed to lend to riskier consumers. The regulator there currently considers making fintechs subject to the same rigorous bank regulatory standards (Allan and Hagiwara, 2018). In the UK the regulatory activity is principles-based and is limited in P2P and P2B loans but does not address balance sheet lending. The FCA for example has made clear that the priority is the principle of protecting retail investors and those UK businesses that only offer credit to other businesses do not need to be authorised by the FCA. The UK along with China and Singapore are at the forefront of demonstrating how RegTech focuses on technologies that may facilitate the delivery of regulatory requirements more *efficiently* and *effectively* than *existing* capabilities (FCA, 2016). This is what has made the FCA not only keen to keep on top of the next possible scandal but also to create, promote and collaborate in a market for RegTech in which compliance products are rolled-out, tested, re-tested, and secured in incubators before used by financial services companies or regulators alike. In the United Kingdom, the Financial Conduct Authority (FCA, 2016) announced the

Regulatory Sandbox Innovation Hub back in 2014 to not only embrace change and evolution in financial services but also to provide a single point of a two-way contact for startups and regulators.

The macro-prudential regulatory policy so far has sought to utilise considerable amounts of data ex-post, transferred to regulators in order to locate and control risks. It follows as argued above that responses come with a lag rendering the form, substance and timing of such data obsolete or irrelevant to a large extent (Ranchordas, 2015). In such a setting the regulatory risk of failure can also either be an excess-apportionment of risk regulation or inertia where regulation is disproportional by over/under regulating without a sufficient relevant and timely data-driven justification. Inexorably in this scenario, the valued prudence principle reintroduces risk because the principle becomes the norm. It maintains the status quo where regulation becomes cyclical resulting in the same data-cycle where information struggles to reach markets in a timely, relevant and efficient manner. As a result it can also stifle new technologies that work exactly on the principle of data-driven, relevant, timely and highly efficient information (Fenwick et al. 2016) and it can actually hamper growth, competition and overall consumer welfare. This prompts the need for re-aligning regulatory objectives with the current pace of developments.

5.1 RegTech development: paradigm shift necessitates the remodelling of financial regulation.

The focus of the prudential regulation and its aim for financial stability has concentrated on the safety and soundness of banking markets based on the concept of granularity. That is, based on the hypothesis of constituent elements (solitary banks) being safe and sound, then it follows that the whole system is safe as well. Critics of this approach have voiced their concerns with regard to the efficacy of such an approach. Llewellyn (2016) calls this the *fallacy of composition* where regulating singular joints in a network is not automatically the optimal approach as it does not necessarily safeguard the solidity of the network as a whole. Neither does the well known, unitary, ‘one-size-fits-all’ approach due to its well documented potential to stifle innovation by increasing barriers to entry for small players and new entrants in the market, which can make it harder for them to compete with the incumbent players (Hoskins and Labonte, 2015; Goodhart et al. 1999). Regulators obviously have an all-important role to play. Think-tanks and specialist roundtable discussions have warned that banking is changing and will continue to change. New technologies shift paradigms, business practices, and models and imbalance tradeoffs surrounding particular laws. For example, regulations and restrictions that had an impact or made sense in the past before say a disruption may become problematic afterwards and regulators should be mindful of that. Technological innovation in the financial services industry requires regulatory innovation (Zetsche et al. 2017). Striking a balancing chord between devising a structure that safeguards the safety of users and the public on the one hand, whilst promoting the commercial use and consumer welfare benefits of disruptive innovation simultaneously on the other, is not an easy task. Much more than that though, it encompasses change of vision, behaviour, and culture.

FinTech and its disruptive capabilities emphasise the opportunity direction of RegTech as to how macro-prudential policy and regulation should be re-shaped (Fernández De Lis, 2016). It is still relatively early days, yet it highlights the need for a new risk management philosophy where the regulation does not necessarily have to be impartial, market neutral, or reactive. This does not mean that it has to be disproportionate either in order to be fair. In a fast-moving, financially engineered, data-driven environment regulation needs to be proactive rather than reactive, dynamic instead of static and responsive as opposed to being inflexible. As innovation cycles become shorter and shorter there is progressively less time to react and hence what the new risk management framework needs is to be matched by ‘shorter life-span’ regulation that is dynamic. This does not equate to changing regulations becoming even more cyclical though. In our opinion, it equates to a mix-and-match approach where the regulator through the increased use of information technology becomes more vigilant and reflectively flexible in differentiating among various types of market players (i.e. size/volume and systemic risk, business practices, ethos and ethics etc). In this way, consideration is also given for example as to whether the regulatory approach impacts a particular institution or types of institutions without stifling innovation, competition and consumer well-being. Regulators have

always been heavily affecting the 'buy' side and RegTech only became characteristic on its own merit since regulators actually have also started shifting the responsibility to the sell side as well (i.e. the new entrants).

New entrants are incoming within the financial sector on a purely demand and data-driven momentum by changes in client behaviour and expectations regarding increased transparency, expediency, and comparability – not only in financial services but everywhere else as well. Market participants have become more informed and educated; as such they are more demanding and may evaluate services more critically than ever before. For example, a wide range of information - previously the niche domain of banks - nowadays becomes increasingly available and at much lower costs. In this environment then, further discussions, questions and tensions surface as to what value-added banks really deliver. Equally, the question of what value-added regulators contribute is also part of most discussions related to fintech risks introduced. Hence, the potential for stronger oversight is not one that fintech firms should ignore. Fintechs have though, also tried to head off additional regulatory scrutiny, in fear it could prohibit entry, place unnecessary extra costs and limit innovation (Accenture, 2016). Over the same issue, bankers have voiced the concerns over the rise of shadow banking and have called for fintechs to be held fully up to the same rigorous standards as banks are (Sunderam, 2015). This granularity of the financial system today, the increasing heterogeneity of the market participants and the increased use of technology in finance has led bankers to protest on the 'regulatory fuzziness' of the supervision on the fintech domain. It positions incumbent regulated entities in a peculiar setting in that there is a certain degree of uncertainty as to how their competitors operate, what is the level-playing field and the circumstances under which their competitors enter the market. At the same time, Fintechs come in this domain with no previous experience regarding the relationship and the interaction of firms and their regulators. Historically, they lack the traditional risk management philosophy where the main objective of risk management is to timely identify risks arising from their activities, analyse the consequences, prioritise the risks, and take mitigating action (Pilkington, 2016). They also lack the compliance culture ingrained (almost) by nature in the financial services regarding system-wide and consumer integrity requirements when they convey their services.

For non-bank financial firms, in order to successfully compete in the financial arena, it is a necessity to handle themselves with an eye toward regulatory scrutiny in the future (Deloitte, 2017). The solution can potentially be found in 'risk management and compliance by business-model-design'; regulation should take a pro-active, 'joint learning' stance and actually co-operate with fintechs. That is, understand fintech business models and then evaluate the management philosophy that underlies such models of said companies. Hence reciprocal learning – both sides simultaneously understanding innovation and understanding regulation - and the combination of fintech with RegTech provides grounds for the evolution of a more vigilant and agile system compared to what there is available today (Zetzsche et al. 2017). Thus virtue lies in turning supervision and compliance into a competitive advantage and not something to be feared of (Gulamhuseinwala et al. 2015). That is, regulation in principle should be substance-driven where the 'substance' is that data-driven fintechs require a data-driven, real-time, agile regulatory design.

Hence, the success of designing a modern and resilient financial infrastructure lies in formulating an approach that incorporates the views and interests of all stakeholders (i.e. fintechs, banks and regulators) and regulation is proportionate to their systemic size and obligations. Both types of *competitor* firms may actually be much closer than apart (Park and Vermeulen, 2015). They are joined in the understanding that each firm's future depends on their capacity to earn customers as result of a responsible and a proactive risk culture and enhanced service provision that is complementary rather than substitutive. Thus, the relationship between the bank and the venture capitalist (start-up fintech) as its 'strategic' investor is not actually a 'winner takes it all' or 'first mover gains' scenario. The future financial ecosystem will see a modern, collaborative supervision and monitoring system built on flexible and inclusive, '*synagonistic*' processes (as opposed to antagonistic) that involve start-ups and incumbent competitors, regulators, and the public. Fintech companies and banks can retain their competitive advantages in their respective areas of specialisation simultaneously acknowledging that their future concerns are more likely to converge than not. Some recent research has investigated the

complementarity/substitution debate (Garrett, 2015) suggesting that banks are already learning and evolving prepared to invest in new fintech exoteric solutions specifically intended to address regulatory and compliance burdens (hence embrace regtech) while maintaining their differentiating advantage of infrastructure and know-how leaving the rest to vendors.

In such a ‘new economy’, in an ever-changing, fast-paced financial ecosystem dominated by platform models that can literally mobilise large groups of people and trends, market participants need to be economically regulated and regulators need also to become entrepreneurial (Pollman and Barry, 2017). For regulators, the fintech-fuelled momentum can deliver tangible and durable value to a sector hampered by fraud, mis-management and communication breakdowns that needs to rebuild trust based on enhancing competition, viability, safety, reliability and the interests of consumers. What regulators need to bear in mind when trying to regulate and bring new products and practices to markets is pushing a similar ethos of proportionality (Llewellyn, 2016). RegTech provides the means to move towards a proportionate risk-based approach where access to and management of data enables more granular, real-time and effective differentiated, case-by-case supervision of markets and market participants.

True, there will be areas that are new and have not been touched upon before, but as Kaal (2017) argues, areas that have traditionally fallen outside the regulator’s sphere of influence (such as peer-to-peer lending, currency innovations, machine-to-machine trading) maybe will grow in importance and hence they will need to focus on these intelligently. Regulators have not yet made clear how they will strike the balance between accommodating innovation and safeguarding the system. A regulatory response to disruptive innovation demands policymakers to equilibrate genuine policy objectives such as financial stability, consumer protection and public welfare while defending against regulatory capture and policy that potentially protects incumbent firms, disrupts competition and reduces welfare. From the regulators’ perspective, it will be important to ensure greater transparency around the future regulatory agenda, and for regulatory policy to focus on the role of both banking and fintech as constructive providers of economic growth.

The ability to access, manipulate/restructure, analyse, and re-synthesise data in any way and whenever fits the regulator, is a fundamental leap forward to providing case-by-case, pro-active and flexible regulation and making the entire regulation and compliance value chain more efficient. The pro-active positioning of regulators in developing regulatory sandboxes signals their willingness and intention to also open up competition characterises a distinctive change and departure from the current regulatory model. For example, ‘compliance by business-model-design’ and substance-driven regulation is also an idea where the creation for example of a common platform (in the sense that it becomes the norm for every participant) provides both the regulators and institutions with a ‘status signal’ and the capability to simultaneously access real-time data and act instantly whenever material changes have taken effect in terms of size and risk volume. These are examined in our concluding section below.

6. Concluding remarks and suggestions for future research

The competition between banks and fintechs for loyalty is not new. However, new technology and technologically advanced regulatory tools are now showing a shift towards alliance. Competition between banks and challengers has already given way to direct collaboration across the fintech/regtech ecosystem. Banks with a fresh core and open and flexible digital architecture will be better positioned to capitalise on the advantages and prosper. However, various key barriers restrain business relations between them. From the incumbents’ viewpoint, new entrants lack the regulatory-compliant IT security and regulatory certainty. From the point of view of fintechs, the tensions lie in differences in culture and operational processes. Banks own legacy, financial expertise, infrastructure, and stable ‘old’ customer base; fintechs own agility, innovation and future customer base. In addition, banks’ own systems cannot yet accommodate fully a digital ecosystem; hence banks need to ‘re-specialize’, and potentially benefit from viewing fintechs as partners rather than competitors. The new economy demonstrates that no one is the indisputable expert in any field, thus the old business model of attempting to control the entire terrain is not as effective.

In their very recent global and highly influential report, the World Economic Forum (2015) forecasted that this disruption will not be a one-off affair; it will rather be a continuous force to innovate that will influence customer behaviour, business models, as well as the long-term structure of the financial services.

In an industry facing the pressure of constricted growth in a highly competitive sector, innovation can potentially as argued invigorate and rejuvenate old business models. The financial architecture and the ecosystem are more open than ever, therefore dependence lies with collaboration among differentiated participants and not any one single vendor can be relied upon to provide solutions. Jooyong and Eunjung (2016), for example, in a very recent study argue that cooperation and partial integration between financial and non-financial firms can be more beneficial for overall welfare than competitor collision and substitution.

It is important also for regulation to keep abreast and run alongside innovation and the developments in the financial services industry, monitor the potential risks, and evaluate the approach alternatives of whether it is necessary to intervene or allow evolution before action. Collaboration between regulators, incumbents, and new entrants is necessary to understand how the new innovations will change the risk profile of the industry both positively and/or negatively. But it is also important for the regulator not to second-guess or front-run innovation since introducing regulation impulsively may come disproportionately and stifle innovation and potentially *double-disrupt* the implementation of valuable technology. The regulator should step into action either when the risks posed by disruptive technology cross the threshold of systemic proportions and become materially destabilising or when there are individual company systemic status signal changes in terms of size, volume, and risk. Ideally, this would progressively require more of a coordinated regulatory response as various types of finance providers become more correlated in the global finance domain. As things currently stand, regulators either offer additive, spot reactions targeting the industry as it develops (notably the US), or proactively manage and target their responses - such as the UK, China, and Singapore - in order to promote development, competition, and deal with explicit problems (Aggarwal and Stein, 2016). In conclusion, we draw attention to potential areas of regulatory concern and potential responses as well as future research or emerging issues that warrant further examination.

- 1) Technology enabled lending platforms could enhance the resilience and stability of credit in the financial system and contain liquidity risks in the economy to pure liquidity shocks, provided that: (i) investors are educated with an understanding that such networks are not direct providers of liquidity, and (ii) that the end investors are not traditional banks. Fintech platforms are *currently* less exposed to system-wide shocks compared to traditional banks since on aggregate and by scale they are more domestically driven in their operations. Large exogenous shocks and spill-over effects might be further moderated by the degree of low system interconnectedness compared to banks. Yet, this degree of low connection may potentially gradually decline as fintechs become more interconnected with banks (FSB, 2018). This is an aspect for competition and regulatory authorities to consider further. It would also be interesting to study the degree of correlations and interactions between bank and fintech activity as companies evolve (see also for example securitisation and/or IPOs, points 2 and 7 below) and more data becomes available in terms of researching and addressing credit provision and systemic exposure.
- 2) Following from the above, market liquidity may indeed be aided further if the securitisation of credit obligations originated by fintechs can be actively traded. This would allow for further funding released from different classes of investors. Yet, subject to its composition and degree of *engineering*, the use of securitisation may front other financial stability risks; (i) securitisation increases interconnectedness among fintechs, banks, capital markets and individuals; unchecked expansion through new transmission channels and mechanisms (which are arguably much faster) can replicate the recent crisis risks spreading to the wider financial markets; (ii) bundles and slices of loan commitments, owed to the speed of availability may actually become less transparent in the market both for prospective investors

and for regulators alike; and (iii) new financial products and services are creating significant regulatory uncertainty and fuel perceptions of regulatory arbitrage.

In the absence of carefully designed regulation the dynamic for skewed incentives and capital arbitrage can potentially be more serious than in the case where such obligations were unbundled and loans are further removed from the platform (IMF, 2017). This could result to credit-risk reallocated imperfectly through loan risks transmitted from originators to investors, where there is a potential for reduced loan quality and lack of due diligence. For example, in the securitisation process there is the risk of the underwriters having very low incentives to safeguard that the assets are of suitable quality if they are not exposed to the risks of the loans not being paid back. Hence, another area for research in the future is the risk distribution through examining the underwriting and securitisation volume flows in the new ecosystem among market participants.

- 3) Recently, Mark Carney, the Governor of the Bank of England in a statement to the Financial Stability Board (2017) supported the view that along with new opportunities, the fintech 'boom' risks a fresh 'bust'. Innovative companies going public could generate systemic risks due to heightened interconnectedness and complexity through greater herding and liquidity risks, and opportunities for regulatory arbitrage. If various market agents become more interrelated, the above will have implications for further studying the synchronisation of bank and non-bank credit cycles over time and across markets. It would be interesting to examine also the links between non-bank credit and its interface with bank credit as signals for crisis occurrences. This may also have competitive implications as to how will financial intermediaries differentiate their business models from one another as improved information flow and trading associations lessen the gaps in such companies' opportunities to locate counterparties for their client base. Point 4 below elaborates on further related research.
- 4) There is also an emerging serial consensus (Kindleberger, 1978; Shiller, 2000; Allen and Gale, 2000a; 2000b; 2004; 2007; Reinhart and Rogoff, 2009; Brunnermeier and Oehmke, (2012) that bubbles stimulated by credit differ from bubbles that are not. This is an interesting proposition in that the current landscape is characterised both by intermediating and non-intermediating finance providers (i.e. banks vs. fintechs). It has also been argued that regulators and central banks should safeguard against credit bubbles, but not against bubbles not fuelled by credit. More research is needed on this issue however, especially when non-traditional agents come into play. On a theoretical level research could concentrate on the cost of credit bubbles from a social perspective. On an empirical level, research could concentrate on the identification of credit bubbles. The regulatory reactions so far to the recent financial crisis have largely concentrated on behaviour and incentive distortions, both as a rationalisation for the crisis but also as the major tip of the attack for policy interventions. However, a key topic of concern is the degree to which behavioural factors lead to the crisis, and how regulation should address them. A continuous, unresolved issue for research is how welfare standards can be defined and established and incorporated within models suitable to address behavioural distortions in such a manner that policy suggestions are feasible.
- 5) Linking competition and credit provision. As shown by the FED, the consumer credit is one of the major, vital credit markets, with outstanding credit of \$3.9 trillion as of April 2018 (FED, 2016). Fintech companies have produced a public market for consumer debt, analogous to the bond market; this market did not exist prior to 2006 and it was largely owed to financial and informational frictions on the part of banks (Balyuk, 2017). Furthermore, on the one hand, the literature on financial innovation and financial markets concentrates primarily on information acquisition channels and competition effects of improvements in screening technology. On the other, the research on the effect of fintech on borrowers in general, and on credit provision in particular, is sparse (Banerjee and Mullainathan, 2010; Philippon, 2015). It would be interesting to research this impact practically by examining the flow of credit supplied by incumbents, following the use of lending platforms by consumers. Such research

for example, provides a future research avenue that revolves around addressing three main dimensions: (i) whether fintechs amplify access to credit and whether this produces excess borrowing and the associated delinquencies; (ii) whether fintechs reduce financing frictions and informational asymmetries in the consumer credit market; hence, the challenge for legislators is to certify that fintechs develop in such a way that maximises the opportunities and reduces the risks for society; and (iii) whether credit risk mapping and measurement is more efficient and its transfer is indeed spread better in the system through more efficient credit risk assessments. The latter leads to credit scoring model considerations in point 6 below.

- 6) Traditional credit scoring draws on a relatively thin stream of data collected monthly from a small number of sources (for example, general repayment history, credit cards, savings accounts, pay stubs, and mortgages). Based on such thinly spread data, debt capacity is hard to judge accurately and this poses limitations for risk modellers. Fintech induced credit modelling on the other hand, has enhanced financial inclusion and has allowed some borrowers to be assigned better loan ratings and receive lower-priced credit than before (Jagtiani and Lemieux, 2017). Furthermore, such models nowadays are more efficient and incorporate more data points per borrower than ever before by utilising dozens of new personalised features that are faster and more prognostic in assessing risk (Phillipon, 2015). For example, instead of using aggregates, the new models use layered, granular analysis of credit data which detect individual borrower behaviour vs. a simple aggregate (i.e. an individual's credit card balance per credit card vs. their total credit card balance). This seems to be a welcome development, yet participants in our action research also declared some reserved enthusiasm regarding the agility and suitability of such models. Specifically, the concern revolves around the fact that the latest credit models are built on the most extensive *current/topical* data set ever and validated on *recent* data. This allows the model to better reflect the *current* environment. The primary concern is with changing market conditions as this industry has not been through a full market cycle. There is limited data regarding the sustainability of the model in the event of a major downturn in the market. As a result, model testing focuses primarily on performing loans. In an interesting, recent study examining Fintech lending/borrowing in China, Lai and Van Order (2017) claim that: *'loan originators and sellers, as well as borrowers, gamed the newly evolved automated underwriting systems by exploiting things not covered in the models... It is also clear that risk was often hidden in the complicated structures that were used to fund the pools'* (p 29). The accuracy and agility of such models could be further tested/simulated over multiple years including stress-test scenario simulations in order to research fitness-for-purpose for risk pricing and systemic risk considerations.
- 7) Fintech IPOs, M&As investment, and valuation issues. Technology firms in general are well-known for their challenging and often off-the-mark valuations due to *thin* fundamentals that produce fizzy prices (Damodaran, 2001). IPO shares have been hitting record highs, and investors have done even better from IPOs than from the market as a whole while venture capitalists have seen this as a very profitable exit strategy (Rhodes-Kropf and Viswanathan, 2004; Griffin et al., 2011). The NASDAQ has had 108 IPOs in the financial and technology space in the last three years (Bloomberg, 2018). In addition, as of May 2018, there were close to 30 private fintech startups valued at or above \$1 billion, according to the same report from Bloomberg. This links back to our argumentation in the concluding paragraph of section 3; what is different this time and how? The problem once again is what happens to those billion-dollar-plus valuations when the public attempts to evaluate such companies' financials and growth projections. In the very recent past, fintech companies have not fared too well according to Ernst & Young. For example, the Lending Club Corporation has been hit particularly hard since their IPO, with shares falling 82 percent. In addition, excluding those companies that are already listed, 33% expect an IPO for their fintech in the next five years, with a further 35% pondering over whether to list or not (EY, 2017). Greenwood et al. (2017) in a very recent research studying IPO bubbles argue that indeed investors can earn superior

returns by timing the bubble. The pending damage of a potential bubble bursting though should, in principle, be limited to companies that have received funding and to the private investors and those funds invested in them. Economists though (Brunnermeier, 2008; 2009; Brunnermeier et al. 2013) have warned that there is always the potential for a much wider impact for example, on employment, asset values and real estate values, where asset bubbles become dangerous when there are linked and correlated among actors (through IPOs and M&As following poor IPO performance for example). That is, a wave of consolidation among larger technology service providers leading to other imbalances in the economy. As new challengers come in the financial services domain it would be interesting to research segment concentration levels for financial stability. This is due to the fact that consolidation can create a heightened third-party concentration risk, in which eventually a small number of financiers service big sections of the banking industry for main financial services. If not properly managed both by the regulator as well as the service providers and their clients, operational risks at these larger service providers could affect significant parts of the financial industry and the system.

- 8) Fintech standards, principles and ‘mindset’ should be made relatable within regulatory competence: as markets and their agents transform with increasing digitisation, so must do regulatory capacity in parallel. Similar to fintech’s disruption of financial markets, RegTech should incorporate algorithms and analytics and make regulation highly data-sensitive. Regulation could then automate compliance tasks, increase monitoring capacity and supervisory discipline, and use real-time data to develop real-time, pro-active responses. This is linked to point 9 below.
- 9) Regulation density (i.e. level of regulatory status) and policy options should be proportionate to the size and liability volumes, geographical expansion and scope as well as the competitors’ business models. In order to address possible (systemic) risks from non-bank intermediation regulators have to consider the appropriate targeting of macro-prudential tools at both lender and borrower level. At the same time they should consider the business model through which funds flow from lender to borrower. The area where innovations have the greatest impact is at the point where they employ platform-based business models (WEF, 2015). Roundtable forums, expert discussions as well as the literature so far have shown that the most impactful business models and relevant to the financial services industry in terms of flow of funds and risks are:
 - (i) *Matching platforms* (peer-to-peer lending): they provide an online marketplace on which borrowers applying for loans are matched with prospective lenders, with the loan contract typically established between the borrower and one or more lenders.
 - (ii) *Notarised matching platforms*: they operate in a similar manner to pure matching platforms but the loan is originated by a partnering bank (after a bank lends funds, the loan is sold or assigned to one or more creditors). This model is applied where regulatory constraints forbid non-bank licensed institutions from engaging in lending activity.
 - (iii) *Originate balance sheet lenders*: they originate and retain loans to borrowers using their own balance sheet assets. In some cases, these entities securitise the loans they have made, either directly or with the help of a bank.
 - (iv) *Originate **and** borrow balance sheet lenders*: they operate as above (iii) with the addition that balance sheet lenders can also obtain funding from hedge funds or banks thereby carrying the underlying credit risk of the loan.

As can be seen each business model carries/adds one extra layer of complexity than the previous one and hence regulatory responses will have to be varied and applied on a case-by-case basis. Hence ‘layered’, timely regulation might be an approach to be effected whenever a business transits from

one business model to the next. Business models, volume and size transitions can act as switches that signal status changes from one regulatory level to the next. For example, changes from being an online lending platform to a credit intermediary will actually require a layered/sequenced response to provide say a special charter status, then to a restricted license and all the way up to being fully licensed and regulated as a bank. Yet, there is no commonly accepted taxonomy of fintech business models or an understanding of which of those models are the most regulatory relevant from a risk perspective. At the same time, a platform for example, might be a lender to one transaction and the borrower in another; the regulation of platform lending then will depend on who is the borrower/lender, and their level of sophistication. This is where RegTech with its enhanced analytics, real-time information and timely reporting provides the regulator with a unique opportunity to focus on the financial risks that technology-enabled competitors to deliver for financial stability as well as what type of response such risks require. In addition, lack of technology-enabled monitoring and analytics might also render the current policy options and tools available to regulators in order to address systemic risks from non-bank intermediation less effective. Generally, controlling lender behaviour is effected through entity-based regulation (i.e. risk weightings, capital buffers). Moderating borrower behaviour on the other hand is implemented through borrower-dependent instruments (i.e. Loan-to-Value caps, debt-to-income ratios, interest coverage etc.); that is, activity-based regulation. Most importantly though, the latter, as things currently stand, apply only to loans provided by licensed banks. Hence the lack of such limitations in the fintech domain could support relocation to other types of financing as well as risk migration and may be insufficient to effectively contain financial stability risks. This is also where business model and status monitoring becomes also important.

Finally, only a few companies around the world are able to quickly export their fintech/regtech products and services to other countries. These are usually the 'first movers' and they are strongly financed by established financial markets and supported by advanced technology-platforms for scaling. For smaller markets, the small and medium-sized companies potentially face the future scaling and funding problem. Such companies may already be partially successful in their respective markets but further expansion financing for growth and internationalisation can come across the 'bottleneck' consequence. Much of the decline in the number of 'smaller' companies becoming listed is attributed to the very difficulty of being a small public company; this is reflected in the actions of venture capitalists, who once sought public listings when they wanted to exit their investments and now overwhelmingly choose private sales (Ritter, Economist, 2018). There is thus the real potential that firms are going to seek strategic alliances with incumbent financial institutions within the sector as their survival strategy. The risk for promising fintech/start-up companies is that there is also the potential to be constricted under the pressure of having to meet invariable demands in the services and products they offer. As such the issue becomes one of scale and capacity against larger firms, possibly the incumbents or indeed technology giants (i.e. Amazon, Apple etc.). This is important as at this stage. This is an industry with no 'made', crisis-resistant, proven businesses thus far. We do not know yet whether start-ups are mentally prepared for 'exchanges' in order to finance growth. In an industry under exponential development, pure cash exits do not exist as well for venture capital nor do acquisition evaluation models of a 'made' fintech business exist. Established institutions have the scale to absorb this which potentially gives rise to growth through a mergers and acquisitions wave. A pragmatic way for mergers to go through at this point is via exchanges of shares. The dangers in such a scenario are the 'old-new firms' where they 'grow-and-consume' entrants.

It is impossible to envisage the future and what direction the fintech/regtech wave of change will take especially when that direction depends to a great extent on the future direction of scientific knowledge. Perhaps Popper's lessons in the Poverty of Historicism (1957) still provide a clearer exposition of uncertainty: *'...society and markets have evolved rapidly and are becoming increasingly more complex. The growing number of rule enactments, revisions, and revocations suggests that existing rules and institutional structures for rulemaking are becoming less capable of addressing the rapid pace of change'*. In that manner, fintech's and regtech's combined dynamic is positioned way beyond any single industry's or regulator's domain.

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