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THE EVOLUTION OF FINTECH: A NEW POST-CRISIS PARADIGM?

DOUGLAS W. ARNER*, JÁNOS BARBERIS†, AND ROSS P. BUCKLEY‡

ABSTRACT

“FinTech,” a contraction of “financial technology,” refers to technology-enabled financial solutions. It is often seen today as the new marriage of financial services and information technology. However, the interlinkage of finance and technology has a long history and has evolved over three distinct eras, during which finance and technology have evolved together: first in the analogue context; then with a process of digitalization of finance from the late twentieth century onwards; and since 2008, a new era of FinTech emerging in both the developed and developing world. This new era is defined not by the financial products or services delivered, but by who delivers them and the application of rapidly developing technology at the retail and wholesale levels. This latest evolution of FinTech, led by start-ups, poses challenges for regulators and market participants alike, particularly in balancing the potential benefits of innovation with the possible risks of new approaches. We analyze the evolution of FinTech over the past 150 years, and on the basis of this analysis, argue against its too-early or rigid regulation at this juncture.

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I. INTRODUCTION

“Financial technology,” or “FinTech,” refers to the use of technology to deliver financial solutions. The term’s origin can be traced to the early 1990s and the Financial Services Technology Consortium, a project initiated by Citigroup to facilitate technological cooperation efforts.¹ The term now refers to a large and rapidly growing industry representing between \$12 billion² and \$197 billion³ in investment as of

1. See Marc Hochstein, *Fintech (the Word, That Is) Evolves*, AM. BANKER (Oct. 5, 2015, 7:12 PM), <http://www.americanbanker.com/bankthink/fintech-the-word-that-is-evolves-1077098-1.html>.

2. See Chloe Wang, *Financial Technology Booms as Digital Wave Hits Banks, Insurance Firms*, CHANNEL NEWS ASIA (May 28, 2015, 8:32 PM), <http://www.channelnewsasia.com/news/business/singapore/financial-technology/1875644.html>.

3. See Abstract of GARETH LODGE ET AL., CELENTM IT SPENDING IN BANKING: A GLOBAL PERSPECTIVE (Feb. 5, 2015), <http://www.celent.com/reports/it-spending-banking-global-perspective-2>.

2014, depending on whether one's industry measurement includes start-ups only (FinTech 3.0) or the full spectrum of applications, including traditional financial institutions (FinTech 2.0).⁴ It is only since 2014⁵ that the sector has attracted the focused attention of regulators, industry participants, consumers, and academics alike. Given the fundamental role FinTech plays in the functioning of finance and its infrastructure, greater regulatory attention is warranted.

FinTech today is often seen as a uniquely recent marriage of financial services and information technology. However, the interlinkage of finance and technology has a long history. In fact, financial and technological developments have long been intertwined and mutually reinforcing. The Global Financial Crisis (GFC) of 2008, in particular, was a watershed and is part of the reason FinTech is now evolving into a new paradigm.⁶ This evolution poses challenges for both regulators and market participants, particularly in balancing the potential benefits of innovation with the potential risks. The challenge of this balancing act is nowhere more acute than in the developing world, particularly in Asia, where we are now seeing the rapid emergence of new players from outside the financial sector applying technology to delivery of financial services.⁷

This article analyzes the evolution of, and outlook for, FinTech and considers the regulatory implications of its growth. It does so by first considering the interlinked evolution of financial services and technology, in particular information technology. The FinTech environment is then explored in the broader evolutionary context, which is necessary to understand its current status and possible future development (Parts II to V). In particular, Parts III, IV, and V use an evolutionary analysis to develop a topology of the FinTech landscape today, focusing on the impact of the GFC of 2008 and related post-crisis regulatory developments. Part VI considers the example of the developing world, particularly Africa and Asia Pacific, where FinTech developments have become a

4. The reason behind the range will be explained in the paper and comes from the distinction between FinTech 2.0 and FinTech 3.0.

5. A Google trend search reveals that the interest over time for the word "FinTech" increased exponentially in 2014. *Fintech: Interest Over Time*, GOOGLE TRENDS, <https://www.google.com/trends/explore?q=fintech> (last visited May 17, 2016) (parameters set at "Worldwide"; "2004-present"; "All categories"; "Web Search").

6. See Douglas W. Arner & Janos Barberis, Remarks at Regulating FinTech Innovation: A Balancing Act, (Apr. 1, 2015), <http://www.law.hku.hk/aiifl/regulating-fintech-innovation-a-balancing-act-1-april-1230-130-pm/>.

7. See Ray Chan, *Asian Regulators Seek Fintech Balance*, FIN. ASIA (Sep. 4, 2015), <http://www.financeasia.com/News/401588,asian-regulators-seek-fintech-balance.aspx>.

central feature of financial market development. Part VII highlights the necessity for regulators to interact proactively with the industry so as to perform and uphold their mandates, in particular through the development of “regulatory technology” or “RegTech.” This final section seeks to provide a framework to understand how a balance between financial technology and regulation can be achieved.

II. FINTECH: NEW TERM FOR AN OLD RELATIONSHIP

At the broadest level, FinTech refers to the application of technology to finance. This definition gives rise to three specific observations.

First, FinTech is not an inherently novel development for the financial services industry. Indeed, the introduction of the telegraph with its first commercial use in 1838⁸ and the laying of the first successful transatlantic cable in 1866⁹ by the Atlantic Telegraph Company provided the fundamental infrastructure for the first major period of financial globalization in the late 19th century. This period is usually seen as lasting from around 1870, with the laying of the transatlantic cable and other similar connections, to the onset of the First World War. Subsequently, the introduction of the Automatic Teller Machine (ATM) in 1967 by Barclays Bank¹⁰ arguably marks the commencement of the modern evolution of today’s FinTech. The ATM’s impact led Paul Volcker, former chairman of the US Federal Reserve (1979-1987), to famously comment in 2009 on the role of financial innovation in the GFC of 2008: “The most important financial innovation that I have seen the past 20 years is the automatic teller machine, that really helps people and prevents visits to the bank and it is a real convenience.”¹¹ At the same time, in a short span of approximately ten years, a new strand of digital financial services (DFS) in developing countries have transformed financial services availability and financial inclusion. Telecommunications companies have frequently led these developments, delivering, in particular, payment services over mobile telephone networks, with M-Pesa in Kenya being the leading example.

8. See GIANCARLO BARBIROLI, *THE DYNAMICS OF TECHNOLOGY: A METHODOLOGICAL FRAMEWORK FOR TECHNO-ECONOMIC ANALYSES* 58 (1997).

9. See JILL HILLS, *THE STRUGGLE FOR CONTROL OF GLOBAL COMMUNICATION: THE FORMATIVE CENTURY* 35 (2002).

10. See THOMAS LERNER, *MOBILE PAYMENT* 3 (2013).

11. See Paul Volcker, *The Only Thing Useful Banks Have Invented in 20 Years is the ATM*, N.Y. POST (Dec. 13, 2009 6:27 AM), <http://nypost.com/2009/12/13/the-only-thing-useful-banks-have-invented-in-20-years-is-the-atm/>.

Second, the financial services industry has been one of the prime purchasers of information technology (IT) products and services globally, with total spending of over \$197 billion in 2014.¹² This is not a recent trend. Since the late 1980s, finance has been an industry based upon transmission and manipulation of digital information. In the mid-1990s, the financial services industry became the single largest purchaser of IT, a position it retains to this day.¹³ Thus, for at least twenty years, traditional financial services have driven the IT industry, and this trend is not slowing. In fact, the industry is predicted to double its IT spending, at least partially as a result of the recent rapid evolution of FinTech.¹⁴ Today, the ATM is often the only point for most consumers at which finance transitions from a purely digital experience to one that involves a physical commodity (i.e. cash).

Third, the term FinTech is not confined to specific sectors (e.g. financing) or business models (e.g. peer-to-peer (P2P) lending), but instead covers the entire scope of services and products traditionally provided by the financial services industry, a topic discussed in greater detail in Part IV.

This historical perspective, however, does not explain the reason for the increase in recent activity emanating from policy-makers¹⁵ or industry players.¹⁶ As explained above, FinTech is not a new story, and likewise its opportunities, risks, and legal implications should not be novel.¹⁷ Rather, policy-makers' and industry's current concerns arise not from the technology itself, but from *who* is applying the technology

12. See GARETH LODGE ET AL., *supra* note 3.

13. See OLIVER WYMAN, *MANAGING COMPLEXITY: THE STATE OF THE FINANCIAL SERVICES INDUSTRY* 2015, at 4 (2015), http://www.oliverwyman.com/content/dam/oliver-wyman/global/en/2015/jan/SoFS-2015/State_of_the_Financial_Services_Industry_Report_2015.pdf.

14. See Elliott Holley, *Digitalisation Will Double Bank IT Spending in Next Four Years*, BANKING TECH. (Sept. 23, 2015), <http://www.bankingtech.com/374051/digitalisation-will-double-bank-it-spending-says-gartner/>.

15. The UK Government Chief Technology Advisor looking at the implications and benefits of FinTech from a regulatory standpoint; the Monetary Authority of Singapore (MAS) announcing a \$160 million investment for research into the topic. See Shiwen Yap, *MAS Commits \$225m to Fintech Growth in Singapore*, DEAL STREET ASIA (July 2, 2015), <http://www.dealstreetasia.com/stories/mas-commits-225m-to-fintech-growth-in-singapore-8637/>.

16. See Anna Irrera, *FN Fintech Focus: Disruptors' \$4trn Fortune*, FIN. NEWS (Mar. 20, 2015), <http://thetally.efinancialnews.com/2015/03/fn-fintech-focus-much-finance-incumbents-stand-lose-disruptors/> (the investment bank Goldman Sachs estimating FinTech industry puts \$4 trillion of revenues at risk).

17. See generally R. M. GOODE & INSTITUTE OF BANKERS (GREAT BRITAIN), *ELECTRONIC BANKING: THE LEGAL IMPLICATIONS* (1985) (discusses the legal consequences of the increased use of electronic payments and authentication in banking).

to finance and the *speed* of change.

It is important to distinguish three main eras of FinTech evolution. From around 1866 to 1967, the financial services industry, while heavily interlinked with technology, remained largely an analogue industry, at least in public perception; we characterize this period as FinTech 1.0. From 1967, the development of digital technology for communications and processing of transactions increasingly transformed finance from an analogue to a digital industry. By 1987 at the latest, financial services, at least in developed countries, had become not only highly globalized once again, but also digitalized. This period, which we characterize as FinTech 2.0, continued until 2008. During this period, FinTech was dominated by the traditional regulated financial services industry players that used technology to provide financial products and services to consumers. However, since 2008—the period we characterize as FinTech 3.0—this is no longer necessarily the case. New start-ups and established technology companies have begun to deliver financial products and services directly to businesses and the general public.¹⁸ A new synthesis may be emerging in developing countries, melding mobile-based payments with new technologies from FinTech 3.0 developments, and this FinTech 3.5 may herald the future development of FinTech around the world.

III. FINTECH 1.0 (1866-1967): FROM ANALOGUE TO DIGITAL

As noted at the outset, from their earliest stages of development, finance and technology have been interlinked and mutually reinforcing. Finance originates in the state administrative systems that were necessary to transition from hunter-gatherer groups to settled agricultural states. For example, in Mesopotamia, written records, the earliest form of information technology, facilitated management of administrative and economic systems, including through financial transactions.¹⁹ Thus, the mutually reinforcing process of the development of finance and written records, as one of the earliest forms of information technology, evidences the linkage between finance and technology. Similarly, the development of money itself, initially and finance are clearly intertwined. According to Mervyn King, former Governor of the Bank of England (2003-2013):

18. See David Gyori, *FinTech is the Future Itself*, in THE FINTECH BOOK 265 (Susanne Chishtî & Janos Barberis, eds., 2016).

19. MATTHEW ROWLINSON, REAL MONEY AND ROMANTICISM 7 (2010).

The history of money is . . . the story of how we evolved as social animals, trading with each other. It starts with the use as money of commodities—grain and cattle in Egypt and Mesopotamia as early as 9000 BC The cost and inconvenience of using such commodities led to the emergence of precious metals as the dominant form of money. Metals were first used in transactions in ancient Mesopotamia and Egypt, with metal coins originated in China and the Middle East and were in use no later than the fourth century BC. The earliest banknotes appeared in China in the seventh century AD.²⁰

Money is a technology evidencing transferable values²¹ and is one of the defining characteristics of a modern economy. Additionally, the emergence of early calculation technologies like the abacus greatly facilitated financial transactions. This evolutionary development can also be seen in the context of trade, with finance evolving from an early stage both to support trade (e.g. financing and insuring ships and infrastructure such as bridges, railroads, and canals), as well as to support the production of goods for that trade. Double entry accounting²²—another form of information technology and one fundamental to a modern economy—emerged from the intertwined evolution of finance and trade in the late Middle Ages and the Renaissance.

Many historians today share the view that the financial revolution in Europe in the late 1600s involving joint stock companies, insurance, and banking—all fundamentally based on double entry accounting—

20. MERVYN KING, *THE END OF ALCHEMY: MONEY, BANKING AND THE FUTURE OF THE GLOBAL ECONOMY* 55–57 (2016).

21. Indeed, one can make the argument that paper is a technology that allows us to store value. The same size bank note can “store” \$10 or \$100 and be worth this much as long as there is a state or central bank guaranteeing the bearer of the note to be paid. Thus, the amount written on the bank note itself has theoretically no limit: Zimbabwe is (in)famously known for having a Z\$100 trillion (100,000,000,000,000) bank note. See Patrick McGroarty & Farai Mutsaka, *How to Turn 100 Trillion Dollars Into Five and Feel Good About It*, WALL ST. J. (May 11, 2011, 12:01 AM), <http://www.wsj.com/articles/SB10001424052748703730804576314953091790360>.

22. On the accounting side, the blockchain technology is akin to the double entry bookkeeping system, as any transaction processed via the blockchain is registered and sent to the whole network, which can then be re-accessed for auditing purposes. Importantly, and unlike traditional bookkeeping, because blockchain accounting is decentralized, the capacity to fake a transaction is very complicated, as it would require the amendment of the record on the whole blockchain network, which is not only complicated, but very costly, and thus may remove the economic rationale of the fraud. See Matthew Spoke, *How Blockchain Tech Will Change Auditing for Good*, COIN DESK (July 11, 2015, 3:00 PM), <http://www.coindesk.com/blockchains-and-the-future-of-audit/>.

was essential to the Industrial Revolution.²³ In this context, finance and access to capital supported the development of technologies that underpinned industrial development. Thus, the relationship between finance and technology is clearly longstanding, with a long trajectory of development laying the foundations for the modern period. The increasing speed of development over the past one hundred years or so is striking compared to earlier periods. The following sub-sections now proceed to briefly outline financial technology developments in the late 19th and 20th centuries, which paved the way for the present-day foundations of FinTech.

A. *The First Age of Financial Globalization*

In the late 19th century, finance and technology combined to produce the first period of financial globalization, which lasted until the beginning of the First World War. During this period, technology such as the telegraph, railroads, canals, and steamships underpinned financial interconnections across borders, allowing rapid transmission of financial information, transactions, and payments around the world. The financial sector at the same time provided the necessary resources to develop these technologies.²⁴ J.M. Keynes, writing in 1920, provided a clear picture of the interlinkage between finance and technology in this first age of financial globalization:

The inhabitant of London could order by telephone, sipping his morning tea in bed, the various products of the whole earth, in such quantity as he might see fit, and reasonably expect their early delivery upon his door-step; he could at the same moment and by the same means adventure his wealth in the natural resources and new enterprises of any quarter of the world, and share, without exertion or even trouble.²⁵

From this description, it is clear that today's globalization is not new. The speed of technological development has however changed.

23. CHARLES MORE, UNDERSTANDING THE INDUSTRIAL REVOLUTION 36 (2000).

24. Par Dipak Dasgupta, *Financial Innovation and the State: Lessons for 21st Century Climate Finance From the 19th Century Railway Era*, CEPII FRANCE: BLOG (Oct. 1, 2015), <http://www.cepii.fr/blog/bi/post.asp?IDcommuniqu=407>. See generally ROLF ROTH & GUNTER DINHOBL, ACROSS THE BORDERS: FINANCING THE WORLD'S RAILWAYS IN THE 19TH AND 20TH CENTURIES (2008); Warner Baer, *The Promoting and Financing of the Suez Canal*, 30 BUS. HIST. REV. 361 (1956).

25. JOHN MAYNARD KEYNES, THE ECONOMIC CONSEQUENCES OF THE PEACE 10–2 (1920).

EVOLUTION OF FINTECH

B. *The Early Post-War Period*

During the post-World War I period, while financial globalization was constrained for several decades, technological developments, especially in communications and information technology used in war, proceeded rapidly. In the context of information technology, firms such as International Business Machines (IBM) transitioned code-breaking tools into early computers, and Texas Instruments first produced the handheld financial calculator in 1967.²⁶ The 1950s were also the period when credit cards were first introduced—Diners' Club in 1950, Bank of America and American Express in 1958.²⁷ The development of what eventually would become a global consumer revolution in payment was further supported by the establishment of the Interbank Card Association (now MasterCard) in the United States in 1966.²⁸ By 1966, a global telex network was in place, providing the fundamental communications foundation on which the next stage of FinTech could develop. The Xerox Corporation introduced the first commercial version of the successor of the telex, the fax machine, in 1964 under the name of Long Distance Xerography (LDX).²⁹ As noted previously, in 1967 in the United Kingdom, Barclays deployed the world's first ATM. In our characterization, the combination of these developments marked the commencement of the era of FinTech 2.0.

IV. FINTECH 2.0 (1967-2008): DEVELOPMENT OF TRADITIONAL DIGITAL FINANCIAL SERVICES

The launch of the calculator and the ATM in 1967 began the modern period of FinTech 2.0. From 1967 through 1987, financial services transitioned from an analogue to a digital industry. Key developments set the foundations for the second period of financial globalization, which was highlighted by the global reaction to the 1987 U.S. stock market crash.

26. See Patrick Thibodeau, *TI's First Handheld Calculator Is Now a Museum Piece*, COMPUT. WORLD (Sept. 26, 2007, 1:00 AM), <http://www.computerworld.com/article/2541155/computer-hardware/ti-s-first-handheld-calculator-is-now-a-museum-piece.html>.

27. JERRY W. MARKHAM, *A FINANCIAL HISTORY OF THE UNITED STATES: FROM CHRISTOPHER COLUMBUS TO THE ROBBER BARONS* 306 (2002).

28. For a good recollection of the history of the credit card industry, see Ben Woolsey & Emily Starbuck Gerson in *The History of Credit Cards*, CREDIT CARDS, <http://www.creditcards.com/credit-card-news/credit-cards-history-1264.php> (last updated May 11, 2009).

29. Similarly, *The History of Fax: From 1843 to Present Day*, FAX AUTH., <http://faxauthority.com/fax-history> (last visited May 18, 2016) provides a comprehensive perspective on the origin and evolution of the technology.

A. *The Modern Foundations: Digitalization and Globalization of Finance*

In the late 1960s and 1970s, electronic payment systems—the basis of today’s internet and mobile payments systems—advanced rapidly, supporting both greater domestic and international payment and financial flows. The Inter-Computer Bureau was established in the United Kingdom in 1968, forming the basis of today’s Bankers’ Automated Clearing Services (BACS),³⁰ and the United States Clearing House Interbank Payments System (CHIPS) was established in 1970.³¹ Fedwire, originally established in 1918, became an electronic (instead of a telegraphic) system in the early 1970s.³² Reflecting the need to interconnect domestic payments systems across borders, the Society of Worldwide Interbank Financial Telecommunications (SWIFT) was established in 1973,³³ followed soon after by the collapse of Herstatt Bank in 1974,³⁴ which clearly highlighted the risks of increasing international financial interlinkages, particularly through the new payments system technology. This crisis triggered the first major regulatory focus on FinTech issues, with the establishment of the Basel Committee on Banking Supervision of the Bank for International Settlements (BIS) in 1975. This established the basis for a series of international soft law agreements on developing robust payments systems and related regulation.³⁵ The BIS Committee on Payment and Settlement was established in 1990, building on an earlier group established in 1980, and renamed the Committee on Payments and Market Infrastructures in 2016. The combination of finance, technology, and appropriate regulatory attention is the basis of today’s \$5.4 trillion-per-day global foreign exchange market, the largest, most globalized, and most digitized component of the global economy.³⁶

30. BRIAN WELCH, ELECTRONIC BANKING AND TREASURY SECURITY 48 (1999).

31. CHIPS, FED. RES. BANK OF N.Y. (Apr. 2002), <https://www.newyorkfed.org/aboutthefed/fedpoint/fed36.html>.

32. See *Fedwire® and National Settlement Services*, FED. RES. BANK OF N.Y. (Mar. 2015), <https://www.newyorkfed.org/aboutthefed/fedpoint/fed43.html>.

33. See *SWIFT History*, SOC’Y OF WORLDWIDE INTERBANK FIN’L TELECOMM., <https://www.swift.com/about-us/history> (last visited June 25, 2016).

34. *The Long, Dark Shadow of Herstatt*, THE ECONOMIST (Apr. 12, 2001), <http://www.economist.com/node/574236>.

35. See BANK FOR INT’L SETTLEMENTS, A BRIEF HISTORY OF THE BASEL COMMITTEE 1–5 (2015), <http://www.bis.org/bcbs/history.pdf>.

36. See Jessica Mortimer, *TABLE-Global FX Volume Reaches \$5.3 Trillion a Day in 2013*, REUTERS (Sep. 5, 2013, 9:00 AM), <http://www.reuters.com/article/2013/09/05/bis-survey-volumes-idUSL6N0GZ34R20130905>. By comparison, in Hong Kong at the same period, \$274.6 billion was exchanged every day on average. See *The Foreign Exchange and Derivatives Market in Hong Kong*, HONG

In the area of securities, the establishment of NASDAQ³⁷ in the United States in 1971, the end of fixed securities commissions, and the eventual development of the National Market System marked the transition from physical trading of securities dating from the late 1600s to today's fully electronic securities trading.³⁸ In the consumer banking sector, online banking was first introduced in the United States in 1980 (although it was abandoned in 1983) and in the United Kingdom in 1983 by the Nottingham Building Society (NBS).³⁹

Throughout this period, financial institutions increasingly used each new IT development in their internal operations, gradually replacing most forms of paper-based mechanisms by the 1980s as computerization proceeded and risk management technology developed to manage internal risks. One such FinTech innovation is very familiar today to financial professionals: Bloomberg terminals. Michael Bloomberg started Innovation Market Solutions (IMS) in 1981 after leaving Solomon Brothers, where he had designed in-house computer systems.⁴⁰ By 1984, Bloomberg terminals were in ever-increasing usage among financial institutions. Bloomberg is therefore one of the first FinTech startups and perhaps the most successful to date.

Traditional financial services firms are thus a central aspect of FinTech. As Yang Kaisheng, CEO of Industrial and Commercial Bank of China (ICBC), the largest bank in the world by asset size, has recently observed, "There is a perception that when banks develop internet technology, it is not regarded as FinTech. Some people say this is a new idea, a new ideology that will get rid of agents and intermediaries and that banks can't adapt."⁴¹

In 1987, a new period of regulatory attention to the risks of cross-border financial interconnections and their intersection with technology began. That same year, the stock market crashed on "Black Monday." The effects of the 1987 crash on markets around the world

KONG MONETARY AUTHORITY Q. BULL. 1 (Dec. 2013), <http://www.hkma.gov.hk/media/eng/publication-and-research/quarterly-bulletin/qb201312/fa2.pdf>.

37. Acronym for National Association of Securities Dealers Automated Quotations.

38. See *Celebrating 40 Years of NASDAQ: From 1971 to 2011*, NASDAQ (2011), <http://www.nasdaq.com/includes/celebrating-40-years-nasdaq40-from-1971-to-2011.aspx>.

39. HARRY CHORON & SANDY CHORON, *MONEY: EVERYTHING YOU NEVER KNEW ABOUT YOUR FAVORITE THING TO FIND, SAVE, SPEND & COVET* 22 (2011).

40. IMS was called a "Financial Information" company and not yet a "Financial Technology" company. See *Michael Bloomberg: Wall Street Data Pioneer and Ex-NYC Mayor*, CNBC (Apr. 29, 2014), <http://www.cnbc.com/2014/04/29/25-michael-bloomberg.html>.

41. See Jame DiBiasio, *ICBC Chairman Welcomes Fintech Regs*, FIN. ASIA (Aug. 17, 2015), <http://www.financeasia.com/News/400732,icbc-chairman-welcomes-fintech-regs.aspx>.

were the clearest indicator since the 1929 crash that global markets were interlinked through technology. Indeed, Hollywood's take on this era's financial services sector in Oliver Stone's 1987 film *Wall Street* produced one of the most iconic popular images from this period: an investment banker wielding an early mobile telephone, an IT innovation first introduced in the United States in 1983. While almost thirty years later there is still no clear consensus on what caused the crash, much focus at the time was placed on financial institutions' use of computerized trading systems that bought and sold automatically based on pre-set price levels ("program trading").⁴²

The reaction led to the introduction by exchanges and regulators of a variety of mechanisms, particularly in electronic markets, to control the speed of price changes ("circuit breakers").⁴³ It also led securities regulators around the world to begin working on mechanisms to support cooperation in respect of cross-border securities markets interconnections—both from the standpoint of volatility as well as market manipulation,⁴⁴ in the way that the 1974 Herstatt crisis and the 1982 developing country debt crisis triggered greater cooperation between bank regulators on cross-border issues.⁴⁵ In addition, the Single European Act of 1986 established the framework for what would become the single financial market in the European Union. That Act, in addition to the Big Bang financial liberalization process in the United Kingdom in 1986, the 1992 Maastricht Treaty, and an ever increasing number of financial services Directives and Regulations from the late 1980s, set the baseline for the eventual full interconnection of European Union financial markets by the early 21st Century.⁴⁶

Certainly, by the late 1980s, financial services had become largely a digital industry, relying on electronic transactions between financial institutions, financial market participants, and customers around the world. By 1998, this process had run its full course with financial services having become, for all practical purposes, a digital industry. This period also showed the initial limits and risks in complex computerized risk management systems (e.g. Value at Risk (VaR)), with the

42. See RICHARD BOOKSTABER, *A DEMON OF OUR OWN DESIGN* 7–32 (2007).

43. See Zack Guzman, *When Do Circuit Breakers Kick In?* CNBC EXPLAINS (Jan. 7, 2016, 9:48 PM), <http://www.cnbc.com/2015/08/24/>.

44. See generally MARC STEINBERG, *INTERNATIONAL SECURITIES LAW: A CONTEMPORARY AND COMPARATIVE ANALYSIS* (1999).

45. See generally JOSEPH NORTON, *DEVISING INTERNATIONAL BANK SUPERVISORY STANDARDS* (1995).

46. See generally GEORGE WALKER, *INTERNATIONAL BANKING REGULATION: LAW, POLICY AND PRACTICE* (2001).

collapse of Long-term Capital Management (LTCM) in the wake of the Asian and Russian financial crises of 1997-1998.⁴⁷

The advances through the mid 1990s certainly pushed FinTech forward. However, the emergence of the internet truly set the stage for the next level of development, beginning in 1995 when Wells Fargo began using the World Wide Web (WWW) to provide online consumer banking.⁴⁸ By 2001, eight banks in the United States had at least one million customers online, with other major jurisdictions around the world rapidly developing similar systems and related regulatory frameworks to address risk.⁴⁹ By 2005, the first direct banks without physical branches had emerged and gained wider public acceptance (e.g. ING Direct, HSBC Direct) in the United Kingdom.

By the beginning of the 21st century, banks' internal processes, interactions with outsiders, and an ever-increasing number of their interactions with retail customers became fully digitized. And as digitization became ubiquitous, IT spending by the financial services industry increased correspondingly. In addition, regulators began using new technology, especially in the context of securities exchanges, and by the late 1990s, computerized trading systems and records had become the most common source of information regarding market manipulation.

B. *Regulatory Approaches to Traditional DFS in FinTech 2.0*

As technology changed, so too did regulatory structure and strategies. As highlighted above, internationalization of finance from the late 1960s supported by new technologies such as electronic payment systems and securities exchanges underpinned major developments in cross-border regulatory cooperation, in particular through the Basel Committee and IOSCO. In addition, particularly in the United States and Europe, major efforts focused on regulating new risks emerging in electronic payment systems and exchanges across the 1980s and 1990s. As an example of regulatory interest in FinTech developments, David Carse, then Deputy Chief Executive of the Hong Kong Monetary Authority (HKMA), gave a keynote address in 1999 where he consid-

47. See Philippe Jorion, *Risk Management Lessons From Long-Term Capital Management*, 6 EUR. FIN. MGMT. 277, 278-284 (2000).

48. See Charles Riggs, *Wells Fargo: 20 Years of Internet Banking*, WELLS FARGO: 163 YEARS (May 18, 2015), <https://blogs.wellsfargo.com/guidedbyhistory/2015/05/internet-20-years/>.

49. See generally BANKING AND FINANCE ON THE INTERNET (Mary J. Cronin ed., 2001).

ered the new regulatory framework needed for e-banking.⁵⁰ It is important to note that this speech was given in 1999, while e-banking had been around since 1980. This time lag highlights the delay in regulatory reaction to technological changes. This lag is to be expected, and often welcomed, as it is consistent with effective market regulation.⁵¹ There is limited benefit in regulating *all* new innovations applicable to the financial sector.⁵² Pre-emptive regulation would not only increase the workload of regulatory agencies and tend to stifle innovation severely, but would also have limited benefits.⁵³

The regulatory view during FinTech 2.0 was that while e-banking was simply a digital version of the traditional brick and mortar banking model, it did create new risks. By providing direct and virtually unlimited access to their accounts, technology removed the need for depositors to be physically present at a branch to withdraw funds. Indirectly, the development of e-banking could facilitate electronic bank runs, as the lack of physical interaction removes the friction from a withdrawal. In turn, instant capacity of fund withdrawal can increase the stress on a financial institution that has liquidity problems during a banking crisis.⁵⁴

50. See David Carse, Deputy Chief Executive, Hong Kong Monetary Authority, Keynote Address at the Symposium on Applied R&D: Enhancing Global Competitiveness in the Next Millennium (Oct. 8, 1999), <http://www.bis.org/review/r991012c.pdf>.

51. See discussion *infra* Section VI.2 for more details on this point.

52. In this respect, it is useful to compare Hong Kong to the Singaporean approach. Indeed, while the Hong Kong Octopus Card Network (contactless store value facility) has been mainly developed by the private sector, its Singaporean equivalent ENZ-Link was pushed as *the* standard by the government. In other words, while Hong Kong regulators tend to be more technology agnostic, Singapore seems to be driven more by a top-down vision on the use of technology within the country. See Norman Chan, Chief Executive, Hong Kong Monetary Authority, Speech at the Ming Pao Summit on New Opportunities for Hong Kong: the 13th Five-Year Plan (Mar. 21, 2016), <http://www.hkma.gov.hk/eng/key-information/insight/20160321.shtml>. This observation would also echo the current developments within FinTech, whereby Singapore has been much more public as to the government initiatives in that space (e.g., \$225 million to be invested in research, and seventy-five percent of the operating cost of FinTech accelerators subsidized). See Ravi Menon, Managing Director, Monetary Authority of Singapore, Keynote Address at Global Technology Law Conference 2015 (June 29, 2015), <http://www.mas.gov.sg/news-and-publications/speeches-and-monetary-policy-statements/speeches/2015/a-smart-financial-centre.aspx>.

53. See Ravi Menon, Managing Director, Monetary Authority of Singapore, Panel Remarks at FinTech: Harnessing its Power, Managing its Risks (Apr. 2, 2016), <http://www.mas.gov.sg/News-and-Publications/Speeches-and-Monetary-Policy-Statements/Speeches/2016/FinTech-Harnessing-its-Power-Managing-its-Risks.aspx>.

54. Indeed the head of HKMA pointed out that “[a]n internet-based bank is faced with the same types of banking risk as its traditional counterparties. In some ways, the internet may heighten these risks. For example, the ability to transfer funds between different bank accounts

Regulators also identified that online banking creates new credit risks. Through the removal of the physical link between the consumer and the bank, it was anticipated that competition would increase (e.g. borrowers would have access to a greater pool of lenders with the removal of geographical limits). On a large scale, though a *prima facie* positive for consumers, this competitive pressure may be problematic for the financial stability of the system. The United States' banking market deregulation of the 1980s provided an example of the systemic risks that follow from deregulation.⁵⁵ Second, on a smaller, individual scale, the constraints arising from being known personally by a loan officer are lost as the loan origination decision may be replaced by an automated system.

The benefits of online banking have, to date, outweighed the risks. Better-organized data can lead to an improved understanding of borrowers' true credit risk and thus allow financial institutions to offer products better aligned to the risk profile of the individual consumer. This insight pre-dated the emergence of big-data analysis, which provides more granular insights into consumers' profiles.⁵⁶ However, the comparison between the risk created by online banks and FinTech start-ups stops here because Carse's speech was built on the premise that these technological innovations would be used by licensed finan-

may increase deposit volatility and could, in extreme situations, lead to 'virtual bank runs'. Banks will need to build this possibility into their liquidity management policies." See Carse, *supra* note 50, at 4.

55. The preamble of the Depository Institutions Deregulation and Monetary Control Act, of 1980 "provide[s] for the gradual elimination of all limitations on the rates of interest . . ." Pub. L. No. 96-221, 94 Stat. 132 (codified as amended in scattered sections of 12 U.S.C.). In practice this meant that markets, not regulations, capped the interest payable on deposits. The purpose of this legislation was to allow for retail banks to compete more equally with Money Market Funds (MMF) that increasingly attracted consumers' deposits, given the better return. However, it also had the unintended consequence of removing the bank's guaranteed profit generated by the spread between interest payable (e.g. deposits) and chargeable (e.g. loans). In turn, this forced banks to make up for the loss in revenue, previously guaranteed by the cap of interest rates, by shifting towards higher risk activities (e.g. sub-prime lending), or moving away from interest-based income (e.g. fees generated by loan securitization). See Janos Nathan Barberis, *The 2007 Meltdown: A Legal Phenomenon* 22 (June 2012) (Bachelor of Laws Dissertation, University of Birmingham), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2296812.

56. This vision of a data-led regulatory system is not new. Back in 2009, the SEC created the division for Economic and Risk Analysis under the supervision of Henry Hu, which looked to improve regulation through data insight. However, it seems clear that since 2007 there has been an increase in activity emanating from regulators, industry, and academia alike on this topic. For more details on RegTech, please refer to Douglas Arner & Janos Barberis, *FinTech in China: From the Shadows?*, 3 J. FIN. PERSPECTIVES, Winter 2015.

cial intuitions only. This distinction is key to understanding the turning point between FinTech 2.0 and FinTech 3.0.

V. FINTECH 3.0 (2008–PRESENT): DEMOCRATIZING DIGITAL FINANCIAL SERVICES?

A mindset shift has occurred from a retail customer perspective as to *who* has the resources and legitimacy to provide financial services. While it is difficult to identify how and where that trend started, the 2008 GFC may represent a turning point and may have catalyzed the growth of the FinTech 3.0 era.⁵⁷ In parallel, the twenty-first century has so far been characterized by more rapid technological development and change than any previous period, highlighting the second feature of *speed*. The remainder of this section will show that an alignment of market conditions post-2008 supported the emergence of innovative market players to and novel applications of new technology to the financial services industry. Among these factors were: public perception, regulatory scrutiny, political demand, and economic conditions. Each of these points will now be explored within a narrative that illustrates how 2008 acted as a turning point and created a new group of actors applying technology to financial services.

Indeed, beginning in 2008, the brand image of banks and their perceived stability has been shaken to the core. A 2015 survey reported that American trust levels in technology firms handling their finances is not only on the rise, but exceeds their confidence in banks.⁵⁸ For example, the level of trust Americans have in CitiBank is thirty-seven percent, while trust in Amazon and Google is seventy-one percent and sixty-four percent respectively. Beyond well-established corporations like Amazon and Google, there is an increasing number of non-listed companies and young start-ups that are handling customers' money and financial data. China provides a clear illustration of this phenomenon,⁵⁹ with over 2000 P2P lending platforms operating outside of a

57. See discussion *infra* Part VI(C) on China's FinTech (FinTech) the development of which has a different origin.

58. See *Survey Shows Americans Trust Technology Firms More Than Banks and Retailers*, LET'S TALK PAYMENTS (June 25, 2015), <http://letstalkpayments.com/survey-shows-americans-trust-technology-firms-more-than-banks-and-retailers/>.

59. For a more in depth analysis of Financial Technology developments in China, see Weihuan Zhou, Douglas W. Arner & Ross P. Buckley, *Regulation of Digital Financial Services in China: Last Mover Advantage?*, 8 TSINGHUA CHINA L. REV. 25 (2015). For the more specific topics of shadow banking and P2P lending, see generally Arner & Barberis, *Fintech in China*, *supra* note 56.

clear regulatory framework.⁶⁰ This does not deter millions of lenders and borrowers, who are willing to place or borrow billions on these platforms due to the cheaper cost, apparently better potential return, and increased convenience. Likewise, the “reputational” factors that mean only banks can offer banking services are not relevant for a large proportion of people in the developing world. For 2 billion unbanked individuals, this factor is weak, because to them, banking may be a commodity that can be provided by any institution, whether regulated or not.⁶¹ In other words, in developing markets there may well be a lack of “behavioral legacies”⁶² such that the public does not expect that only banks can provide financial services. As described effectively over two decades ago, “banking is necessary, banks are not.”⁶³

A. *FinTech and the Global Financial Crisis: Evolution or Revolution?*

The financial crisis impacted the public perception of banks and the people that ran the financial services industry. First, as its origins became more widely understood, the public perception of banks deteriorated. For example, predatory lending methods directed at disenfranchised communities not only breached the consumer protection obligations of banks, but also severely damaged their standing.⁶⁴ Second, among others, two sets of individuals were impacted by the financial crisis. As the financial crisis morphed into an economic crisis, an

60. It is recognized that regulators in China (e.g., CBRC and PBOC) are due to announce new rules around the P2P industry, mainly around credit-worthiness checks and regulatory capital requirements. See JD Alois, *China Release Draft Peer to Peer Lending Rules. Asks for Comments*, CROWDFUND INSIDER (Dec. 28, 2015, 8:56 AM), <http://www.crowdfundinsider.com/2015/12/79400-china-releases-draft-peer-to-peer-lending-rules-asks-for-comment/>.

61. See Asli Demirguc et al., *The Global Findex Database 2014: Measuring Financial Inclusion Around the World VI*, World Bank Group Pol’y Res., Working Paper, No. 7255, 2015), http://www.wds.worldbank.org/external/default/WDSPContentServer/WDSP/IB/2015/10/19/090224b08315413c/2_0/Rendered/PDF/The0Global0Fin0ion0around0the0world.pdf#page=3.

62. The term “behavioral legacies” echoes the “IT legacy systems” of banks that prevent them from fully digitizing their processes given the fact that their systems are too-old-to-upgrade and too-expensive-to-replace. Indeed, until now, most of banks’ IT spending was in maintenance, as opposed to upgrades; however, this is gradually changing.

63. Described by Richard Kovacevich. See Bethany McLean, *Is This Guy The Best Banker In America?*, FORTUNE (July 6, 1998), http://archive.fortune.com/magazines/fortune/fortune_archive/1998/07/06/244842/index.htm. This quote is often wrongly ascribed to Bill Gates, but in fact, he seems to have said, “[b]anks are dinosaurs, we can bypass them.” *Culture Club*, NEWSWEEK: CULTURE CLUB (July 10, 1994, 8:00 PM), <http://www.newsweek.com/culture-club-189982>.

64. See generally Sumit Agarwal et al., *Predatory lending and the Subprime Crisis*, 113 J. FIN. ECON. 29 (2014).

estimated 8.7 million American workers lost their jobs.⁶⁵ Many financial professionals either lost their jobs in traditional institutions or were now less well compensated. Couple the downturn in employment prospects with the general public's developing distrust of the traditional banking system, and many financial professionals found a new industry, FinTech 3.0, in which to apply their skills.⁶⁶ In addition to traditional financial professionals, a newer generation of highly educated, fresh graduates faced entry into a difficult traditional job market.⁶⁷ Their educational background often equipped them with the tools to understand financial markets, and their skills found a fruitful outlet in FinTech 3.0.

Post-financial crisis regulation has increased banks' compliance obligations and altered their commercial incentives and business structures. In particular, the universal banking model has been directly challenged with ring-fencing obligations and increased regulatory capital changing the incentive or capacity of banks to originate low-value loans.⁶⁸ Furthermore, the (mis)use of certain financial innovations, such as collateralized debt obligations (CDOs), has been regarded as a contributor to the crisis by detaching the credit risk of the underlying loan from the loan originator.⁶⁹ Finally, the necessity to ensure orderly failure of banks has driven the implementation of financial institution resolution regimes across jurisdictions, which required banks to prepare Recovery and Resolution Plans (RRPs) and conduct stress tests to evaluate their viability.⁷⁰ As a result, since 2008, the business models and structures of banks have been reshaped.

B. *From Post-crisis Regulation to FinTech 3.0*

These regulatory responses to the GFC (e.g. Dodd Frank Act, Basel III) have clearly been necessary in light of the social and economic

65. See John Kell, *U.S. Recovers All Jobs Lost in Financial Crisis*, FORTUNE (June 6, 2014, 8:38 AM), <http://fortune.com/2014/06/06/us-jobs-may/>.

66. On that note, Mark Esposito and Terence Tse discuss the social impact of the crisis on the European young work force. See *The Lost Generation: What is True About the Myth . . .*, LONDON SCHOOL OF ECON. AND POL. SCI.: EUROCRISIS IN THE PRESS (Apr. 7, 2014), <http://blogs.lse.ac.uk/eurocrisispress/2014/04/07/the-lost-generation-what-is-true-about-the-myth/>.

67. See Quentin Fottrell, *Millennials are the Most Underemployed Generation*, MARKET WATCH (Nov. 19, 2014, 9:06 AM), <http://www.marketwatch.com/story/millennials-are-the-most-underemployed-generation-2014-11-19>.

68. See Roberto Ferrari, *FinTech Impact on Retail Banking—From a Universal Banking Model to Banking Verticalization?*, in THE FINTECH BOOK 238 (Wiley 2016).

69. Miguel Segoviano et al., *Securitization: Lessons Learned and the Road Ahead* 14–21 (IMF, Working Paper WP/13/255, 2013).

70. Barberis, *supra* note 55, at 60.

impact of the financial crisis and they may make it less likely that the next financial crisis will be prompted by the same causes and impact the public in comparable ways.⁷¹ Yet, these post-crisis reforms have had the unintended consequence of spurring the rise of new technological players and limiting the capacity of banks to compete. For example, Basel III translated into an upward revision of the capital adequacy requirements for banks.⁷² While this enhanced market stability and risk-absorbing capacity, it also diverted capital from Small and Medium Enterprises (SME) and private individuals. Many private individuals then turned to P2P lending platforms or other innovations to fulfill their need for credit.

During the FinTech 2.0 period, the expectation was that the providers of e-banking solutions would be supervised financial institutions. Indeed, the use of the term “bank” in most jurisdictions is restricted to companies duly authorized or regulated as financial institutions.⁷³ However, the FinTech 3.0 era has shown that financial services provision no longer rests solely with regulated financial institutions. The provision of financial services by non-banks may also mean that there are no effective home regulators to act on the concerns of host regulators, and thus whether the provider is regulated or not may make little difference. This means that the last safeguard may come from consumer education and the distrust of placing funds with an off-shore non-bank.

The public demand for greater access to credit was answered in part by the passage of the Jump Start Our Business Startups (JOBS) Act in the United States in 2012. The JOBS Act tackles these issues of unemployment and credit supply in two ways. On employment, the JOBS Act aims to promote the creation of start-ups by providing alternative ways to fund their businesses. The preamble of the Act states, “An Act: To increase American job creation and economic growth by improving access to the public capital markets for emerging

71. On what may cause the next crisis, and the inadequacy of regulatory reforms to date to avert it, see generally Ross P. Buckley, *Reconceptualizing Global Financial Regulation*, OXFORD J. LEGAL STUD. (2015), <http://ojls.oxfordjournals.org/content/early/2015/09/10/ojls.gqv023.abstract>.

72. See Press Release, Board of Governors of the Fed. Res. Sys., Federal Reserve Board Approves Final Rule to Help Ensure Banks Maintain Strong Capital Positions (July 2, 2013), <http://www.federalreserve.gov/newsevents/press/bcreg/20130702a.htm>.

73. See the sensitive words for U.K. company formations issued by the Companies House. The terms “banc”, “bank”, or “banking” are restricted unless authorized by the Financial Conduct Authority Sensitive Business Name team. See UK COMPANIES HOUSE, COMPANIES ACT 2006: INCORPORATION AND NAMES 33 (2016), https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/418150/GP1_Incorporation_names_v5_4-ver0.29-4.pdf.

growth companies.”⁷⁴ From a policy perspective, there is little downside to promoting entrepreneurship, as it has a direct impact on job creation.

On financing, the JOBS Act assisted start-ups to by-pass the credit contraction caused by banks’ increased costs and limited capacity to originate loans. The JOBS Act made it possible for start-ups to directly access the capital needed to support their business by raising funds in lieu of equity on P2P platforms. Figure 1 below shows the sharp increase in financing availability on online platforms:

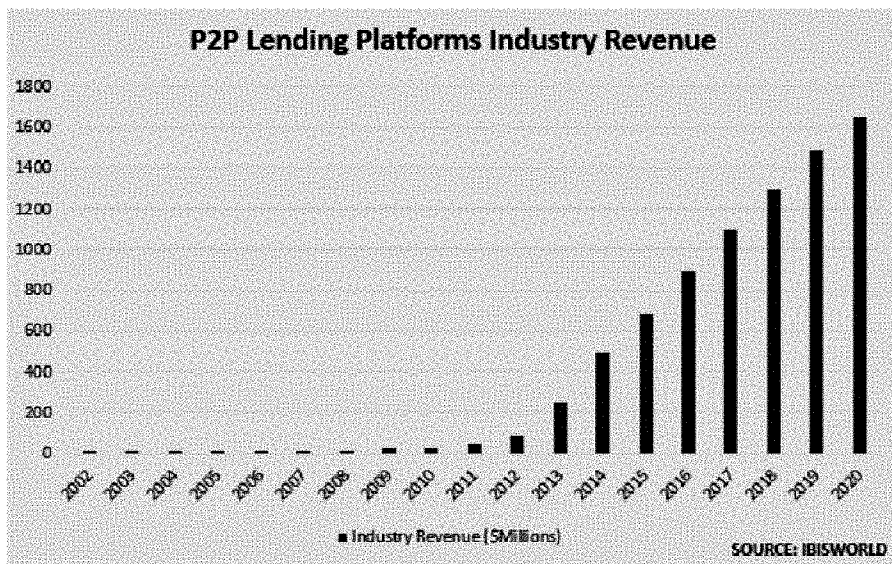


FIGURE 1. P2P Lending Platforms Industry Revenue Graph⁷⁵

The JOBS Act was not specifically intended to support FinTech 3.0 because it applied to start-ups in general. But it bolstered FinTech 3.0 because these alternative funding sources became available at a time that coincided with increased regulatory pressures that limited banks’ capacity to innovate, a souring public perception of traditional banks, and human talent outflow, which provided the necessary market and knowledge for new FinTech start-ups to emerge.

74. Jump Start Our Business Startups Act, Pub. L. No. 112-106, 126 Stat. 306 (2012).

75. See Omar Khedr, *Peer-to-Peer Lending Industry to Grow 37.7% in 2015*, IBIS WORLD (May 12, 2015), <http://media.ibisworld.com/2015/05/12/peertopeerlendingrevenueetogrow/>.

In summary, the financial services industry since 2008 has been affected by a “perfect storm,” financial, political, and public in its source, allowing for a new generation of market participants to establish a new paradigm known today as FinTech.

C. *The FinTech Industry Today: A Topology*

On the basis of this evolutionary analysis, it is possible to develop a comprehensive topology of the FinTech industry. FinTech today comprises five major areas: (1) finance and investment, (2) internal operations and risk management, (3) payments and infrastructure, (4) data security and monetization, and (5) customer interface. In addition to these is the use of technology in regulation itself, the subject of Section 6 below.

Finance and investment: Much of the public, investor, and regulatory attention today focuses on alternative financing mechanisms, particularly crowd funding and P2P lending. However, FinTech clearly extends beyond this narrow scope to include the financing of technology itself (e.g. via crowd funding, venture capital, private equity, private placements, public offerings, listings, etc.). From an evolutionary perspective, the 1990s tech bubble is a clear example of the intersection of finance and technology, as is NASDAQ, the dematerialization of the securities industry which has followed over the succeeding decades, and the advent of program trading, high frequency trading, and dark pools. Looking forward, in addition to continuing development of alternative financing mechanisms, FinTech is increasingly involved in areas such as robo-advisory services.⁷⁶

Internal financial operations and risk management: These have been a core driver of IT spending by financial institutions, especially since 2008, as financial institutions have sought to build better compliance systems to deal with the massive volume of post-crisis regulatory changes. As one example, approximately one-third of Goldman Sachs’ 33,000 staff are engineers, more than LinkedIn, Twitter or Facebook.⁷⁷ Paul Walker, Goldman Sachs’ global technology co-head, has stated that they “were competing for talents with start-ups and tech companies.”⁷⁸

76. See, e.g., CHAPPUIS HALDER & CO., INVESTMENT ADVISORY: THE RISE OF ROBOTS? (2015), <http://investglass.com/images/press/Investment-Advisory-The-rise-of-the-Robots-Chappuis-Halder-InvestGlass.pdf>.

77. See Jonathan Marino, *Goldman Sachs is a Tech Company*, BUS. INSIDER AUSTRALIA (Apr. 13, 2015, 4:20 AM), <http://www.businessinsider.com/goldman-sachs-has-more-engineers-than-facebook-2015-4>.

78. *Id.*

From an evolutionary perspective, the development of finance theory and quantitative techniques of finance and their translation into financial institution operations and risk management was a core feature particularly of the 1990s and 2000s, as the financial industry built systems based upon VaR and other systems to manage risk and maximize profits.⁷⁹ This area is likely to continue to grow, as is considered further in Section 6 below.

Payments and infrastructure: Internet and mobile communications payments are a central FinTech focus and have been a driving force particularly in developing countries, an issue discussed further in Part V as underpinning FinTech 3.5. Payments have been an area of great regulatory attention since the 1970s, resulting in the development of both domestic and cross-border electronic payment systems that today support the \$5.4 trillion per day global foreign exchange markets. Likewise, infrastructure for securities trading and settlement and for OTC derivatives trading continues to be a major aspect of the FinTech landscape, and are areas where IT and telecommunications companies are seeking opportunities to disintermediate traditional financial institutions.

Data security and monetization: These are key themes in FinTech today, especially as both FinTech 2.0 and FinTech 3.0 start to exploit the monetary value of data. Following the GFC, it has become clear that the stability of the financial system is a national security issue. The digitized nature of the financial industry means it is particularly vulnerable to cybercrime and espionage, both increasingly important in geopolitics. This digitization and consequent vulnerability is the result of decades of development, highlighted in previous sections and, going forward, will remain a major concern for governments, policy-makers, regulators, and industry participants, as well as customers.⁸⁰ Nonetheless, FinTech innovation is clearly present in the uses to which “big data” can be applied to enhance the efficiency and availability of financial services.

Consumer interface, particularly online and mobile financial services: This will continue to be a major focus of traditional financial

79. See, e.g., ROGER LOWENSTEIN, WHEN GENIUS FAILED: THE RISE AND FALL OF LONG-TERM CAPITAL MANAGEMENT (2000).

80. Moody's, a credit rating agency, made clear that threats of cyberattack can negatively affect the credit profile of countries and institutions alike. See Global Credit Research, *Moody's: Threat of Cyber Attack on US Utilities Cushioned by Likelihood of Government Support*, MOODY'S (Oct. 15, 2015), https://www.moody's.com/research/Moodys-Threat-of-cyber-attack-on-US-utilities-cushioned-by—PR_336640.

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services and non-traditional FinTech developments. This is another area in which established and new IT and telecommunications firms are seeking to contest directly with traditional financial services firms. Interestingly, it may well be in developing countries where factors increasingly combine to support the next era of FinTech development. The consumer interface offers the greatest scope for competition with the traditional financial sector, as these tech companies can leverage off their pre-existing large customer bases to roll out new financial products and services.⁸¹

A visual illustration of this is provided in the table below, as each of these names are regarded as FinTech companies in their own right:

TABLE 1. RANKING OF FINTECH 2.0 AND 3.0⁸²

Rank	FinTech 2.0		FinTech 3.0
	<u>Banks by market cap</u> (2015)	<u>IT Companies</u> <u>by revenue</u> (2014)	<u>Start-ups by</u> <u>valuation</u> (2015)
1 st	Wells Fargo & Co (US)	FIS (US)	LuFax (CN)
2 nd	ICBC (CN)	Tata (IN)	Square (US)
3 rd	JP Morgan (US)	Fiserv (US)	Markit (US)
4 th	CCB (CN)	Cognizant (US)	Stripe (US)
5 th	Bank of America (US)	NCR Corp (US)	Lending Club (US)
6 th	Bank of China (CN)	Infosys (IN)	Zenefits (US)
7 th	ABC (CN)	Diebold (US)	Credit Karma (US)

81. For example, Facebook holds forty-nine Money Transmitter Licenses that would allow it to provide direct payment services to its 213 million active users across the United States. To view the list of states where Facebook holds these licenses, see *Money Transmitter Licenses*, FACEBOOK, https://www.facebook.com/payments_terms/licenses (last visited June 14, 2016). A similar case can be made about Tencent and its social network platform that has over 500 million users. Likewise, WeChat recently made available “in-app” loan applications up to \$30,000. See Juro Osawa, *Tencent’s WeChat App to Offer Personal Loans in Minutes*, WALL ST. J. (Sep. 11, 2015, 3:21 AM), <http://www.wsj.com/articles/tencent-to-add-personal-loan-feature-to-wechat-app-1441952556>.

82. This table was compiled by the authors, the sources for which can be found at *World’s Largest Banks 2015*, BANKS AROUND THE WORLD, <http://www.relbanks.com/worlds-top-banks/market-cap-2015>, (last visited June 25, 2016); *Top 100 Companies in FinTech*, AM. BANKER (Nov. 12, 2014), <http://www.americanbanker.com/news/bank-technology/top-100-companies-in-fintech-1071192-1.html>; Oscar Williams-Grut, *The 24 Fintech ‘Unicorns’ Worth Over \$1 Billion Ranked by Value*, BUS. INSIDER AUSTR. (Aug. 21, 2015, 3:43 AM), http://uk.businessinsider.com/the-25-fintech-unicorns-ranked-by-value-2015-7?utm_content=buffer05d0a&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer.

Rank	FinTech 2.0		FinTech 3.0
	<u>Banks</u> by market cap (2015)	<u>IT Companies</u> by revenue (2014)	<u>Start-ups</u> by valuation (2015)
8 th	Citi Group (US)	Sungard (US)	Powa (UK)
9 th	HSBC (UK)	Nomura (JP)	Klarna (SWE)
10 th	Mitsubishi (JP)	CA Tech (US)	CommonBond (US)

On the one hand, as explained in Parts II and III, that financial institutions are digitizing their processes and services is a well-understood market trend with defined regulatory implications and obligations flowing from the new use of digital technology. Established financial actors, technology companies, and regulators work with each other to develop market standards and regulations through a well-defined process of market consultation. On the other hand, new technology players (FinTech 3.0) are entering the financial industry with limited or no pre-existing interaction with financial regulators. These businesses tend to lack a financial compliance culture that identifies providers' prudential or consumer protection obligations when delivering financial services.⁸³

As a result, the non-traditional business models or financial products that are the hallmark of FinTech 3.0 companies may not comply with applicable financial regulations. This lack of regulatory compliance may be active, as when a technology company does not believe it should be subject to rules and regulations meant for banks, or passive, as when a technology company is not aware of the rules and regulations that may apply.

83. The counterargument is that if FinTech start-ups are created by ex-finance professionals, they should understand regulated markets with compliance cultures. This is highlighted by looking at where FinTech companies are founded. See Brian Dally, *So You Want To Build A Full Stack Startup in Fintech?*, TECHCRUNCH: CRUNCH NETWORK (June 18, 2015), <https://techcrunch.com/2015/06/18/so-you-want-to-build-a-full-stack-startup-in-fintech/>. Start-ups close to financial centers such as New York, London, or Hong Kong tend to have stronger compliance cultures than those in other locations, such as Silicon Valley, where the founders are more likely to be engineers than finance professionals. See ACCENTURE, NEW YORK'S OPPORTUNITY FOR TECH LEADERSHIP 8 (2014), <http://pfny.org/wp-content/uploads/2014/06/NY-FinTech-Report-2014.pdf>; see also Roger Cheng, *New York's Tech Scene: More Melting Pot, Less Silicon Valley*, CNET (Aug. 10, 2015, 5:00 AM), <http://www.cnet.com/news/new-yorks-tech-scene-more-melting-pot-less-silicon-valley/>.

VI. FINTECH 3.5: A NEW SYNTHESIS IN EMERGING MARKETS: THE EXAMPLES OF ASIA AND AFRICA

FinTech 3.0 emerged as both as an evolution of previous technological application in financial services in developed countries and also as a reaction to the GFC in the West, but in Asia and Africa, recent FinTech developments have been primarily prompted by the pursuit of economic development. We characterize the era in these two regions as FinTech 3.5. While developments in Asia, particularly China but also increasingly India, are the best examples to this new FinTech 3.5, these developments emerged earlier in the context of Africa.

A. *Africa: Greenfield Opportunities for FinTech*

While Africa shares many FinTech development characteristics with the Asia-Pacific (APAC) region, the nature and direction of the primary FinTech developments in Africa have been somewhat different and generally have preceded developments in APAC. In particular, FinTech in Africa emerged at the beginning of the twenty-first century largely on the back of two factors: first, the generally underdeveloped level of banking and other financial services in Africa; and second, the very rapid spread of mobile telephone use. These two factors combined have provided the necessity for the development of alternatives to traditional finance in Africa as well as the technological basis for these to develop and spread very widely and rapidly.

The reach of banks in Africa is very circumscribed, generally much more circumscribed than in Asia. At most, twenty percent of African households have access to formal or semi-formal financial services as compared to some sixty percent of households in Asia.⁸⁴ As a result, telecommunications companies, rather than banks, have tended to take the lead in FinTech developments in the region. Mobile money—that is, the provision of basic payment and savings services through the creation of e-money recorded on a mobile phone—while initially pioneered in the Philippines, has achieved its greatest success in Kenya and, more recently, Tanzania.⁸⁵ In both of these countries, the rise and

84. See *Financial Services in Africa*, KPMG 4 (2013), <https://www.kpmg.com/Africa/en/IssuesAndInsights/Articles-Publications/Documents/KPMG%20Financial%20Services%20in%20Africa.pdf>.

85. In the Philippines, SMART Money was launched in 2001 while GCASH was launched in 2004. See *Mobile Money in the Philippines—The Market, the Models and Regulation*, GROUPE SPÉCIAL MOBILE ASS'N 4 (2012), <http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/06/Philippines-Case-Study-v-X21-21.pdf>. In Kenya, the M-Pesa has seen success. See M-Pesa

extent of mobile money has significantly spurred economic development by providing customers with a means to save funds, remit money safely to their families, pay bills, and receive government payments safely and securely. The most well-known success story in Africa is that of M-Pesa, the mobile money product of Safaricom, which was launched by Vodafone in 2007.⁸⁶ In under five years, payments made through the platform surpassed forty-three percent of Kenya's gross domestic product (GDP).⁸⁷ The central bank now has to supervise the provider carefully as the payments platform has become systemically significant.

Africa's FinTech journey to date has mostly consisted of providing mobile money services permitting the core functions of payments and savings, and relatively recently, the higher order services of credit and micro-insurance. The typical African provider of DFS is a telecommunications company that encourages customers to purchase e-money and use financial services on their mobile phone, usually in the same way and place as buying airtime (i.e. by paying cash to a retail agent). The agent is typically a small shopkeeper who sells e-money, airtime, soft drinks, snacks and the like. This profile is rather similar to mobile money developments in some Asian nations, such as Cambodia, Laos, and others, but dramatically different than the profile of DFS in China or India. With that said, we expect to see increasing South-South technology transfers within FinTech.⁸⁸

Indeed, M-Pesa's wild success has caused excessive optimism elsewhere. Companies in other countries offering mobile money services have needed screen savers on every corporate computer warning, "Be aware—we are not in Kenya now," for in many other countries providers have had to learn that merely replicating what was done in Kenya will not necessarily lead to similar customer take-up of digital financial

timeline *infra* note 85. Tanzania, in turn, saw the launch of Z-PESA and TigoPesa, among others. *Infographic: Tanzania's Mobile Money Revolution*, Consultative Group to Assist the Poor (2014), <http://www.cgap.org/data/infographic-tanzanias-mobile-money-revolution>.

86. See M-Pesa Timeline, SAFARICOM (2016), http://www.safaricom.co.ke/mpesa_timeline/timeline.html.

87. See Daniel Runde, *M-Pesa And The Rise Of The Global Mobile Money Market*, FORBES (Aug. 12, 2015, 4:06 PM), <http://www.forbes.com/sites/danielrunde/2015/08/12/m-pesa-and-the-rise-of-the-global-mobile-money-market/>.

88. See Gulveen Aulakh, *Alibaba, Ant Financial Invest About \$680 Million in Paytm, Up Stake to 40%*, ECON.TIMES (Sep. 30, 2015, 1:21 AM), <http://economictimes.indiatimes.com/industry/banking/finance/banking/alibaba-ant-financial-invest-about-680-million-in-paytm-up-stake-to-40/articleshow/49148651.cms>.

services.⁸⁹ For DFS to prosper, the services offered have to be tightly tailored to local needs.⁹⁰ Meeting the needs of the local consumers, whatever they may be, is the key to successfully providing DFS. However, this is not the starting point for many of the people designing the DFS products who come, as they most often do, from an IT background.

While FinTech in the form of DFS has transformed financial inclusion in Africa, this has been largely at a fairly simple level. It is in Asia where we are now seeing the intertwining of African DFS and Western FinTech. This combination we term FinTech 3.5 and it is this evolution, first in Asia but also increasingly in developed and developing countries around that world, that signals the possible future of financial services and technology, the next era of FinTech.

B. *FinTech Opportunities and Limitations in the Asia-Pacific Region*

Accenture estimated that out of the \$12 billion in investment in FinTech startups in 2014, only \$700 million was invested in the APAC region.⁹¹ However, in order to appreciate Asian FinTech developments, one must look beyond this narrow context and limited set of reported investment figures.

The growth of the APAC FinTech market is attributable to various factors. On the institutional side, IT spending by APAC traditional banks has lagged behind levels in Europe and the United States.⁹² This can be explained by the slightly less competitive regional market, still heavily controlled and distorted by state-owned banks. Public distrust of the state-owned banking system (due to corruption and inefficiency) means the public is quick to accept alternatives provided by non-banks. In terms of infrastructure, the branch network distribution in the APAC region is far less extensive than in Europe and the United States. There are 62.5 branches per 100,000 people in Europe, but only 12.5

89. See Anna Leach, *Mobile Money: Why isn't M-Pesa Effect Hitting More Countries?*, THE GUARDIAN (Apr. 23, 2015, 11:02 EDT), <http://www.theguardian.com/global-development-professionals-network/2015/apr/16/mobile-money-m-pesa-india-kenya-development>.

90. See Gabriella Mulligan, *Can M-Pesa Travel Outside Kenya?*, AFRICAN BUS. (Dec. 2, 2014), <http://africanbusinessmagazine.com/sectors/technology/can-m-pesa-travel-outside-kenya/>.

91. See Melissa Volin & Farrell Sklerov, *Fintech Investment in U.S. Nearly Tripled in 2014, According to Report by Accenture and Partnership Fund for New York City*, BUS. WIRE (June 25, 2015, 9:05 AM), <http://www.businesswire.com/news/home/20150625005146/en/Fintech-Investment-U.S.-Tripled-2014-Report-Accenture#.VgqX2nqqpBc>.

92. See Keiichi Aritomo et al., *More Bank for Your IT Buck*, MCKINSEY & COMPANY (June 2014), http://www.mckinsey.com/insights/business_technology/more_bank_for_your_it_buck.

branches per 100,000 in APAC.⁹³ As a result, mobile-based financial services and products are comparatively more attractive.⁹⁴ At the same time, Asia has some of the highest mobile telephone penetration rates in the world, often as a result of the later development of many economies in the region and the resulting possibility of mobile communications to leapfrog highly inefficient and/or underdeveloped land-based systems. Importantly, not only does Asia have high mobile penetration rates, many economies also have very high smartphone penetration rates, a feature central to many of the development now taking place not only in Asia but also in the West. This provides an illustration of the impact of the speed of technological development and spread in the twenty-first century, given that Apple only introduced the iPhone in 2007—less than ten years ago.

Hong Kong and Singapore have seen the creation of numerous FinTech accelerator programs that allow start-ups to speed their growth and product development. In Australia, a dedicated FinTech co-work space named Stone and Chalk received over 350 applications for 150 spaces.⁹⁵ Korea is set to open an expanded version of Level 39 (London's prominent FinTech co-working space).⁹⁶ On the regulatory side, most Asian regulators have initiated a FinTech strategy and met in Kuala Lumpur to discuss this alongside the World Capital Market Symposium in 2013.⁹⁷

For China, the above analysis is supported by the government market reform process initiated in the late 1970s. In less than thirty years, China has gone from a mono-banking model⁹⁸ to a largely commercialized financial system.⁹⁹ Since 2009, over 2000 P2P lending platforms have emerged. These figures do not include the additional five new

93. Janos Barberis, *Getting Hong Kong to Lead the Digital Financial Transition in APAC*, PRESENTATION TO INVESTHK (FINTECH HK) 13, (Nov. 2014), http://www.fintech.hk/media/uploads/resources/reports/fintech.hk/2015/07/14/05_30_48/The%20Rise%20of%20FinTech%20-%20Nov%20'14.pdf.

94. *Id.*

95. See Simon Thomsen, *Fintech Hub Stone & Chalk is Moving to Bigger Premises Before it's Even Opened*, BUS. INSIDER AUSTRALIA (June 10, 2015, 12:04 PM), <http://www.businessinsider.com.au/fintech-hub-stone-chalk-is-moving-to-bigger-premises-before-its-even-opened-2015-6>.

96. *British Fintech Investor to Set Up S. Korean Unit*, KOREA TIMES (Oct. 22, 2015, 6:23 PM), http://www.koreatimes.co.kr/www/news/nation/2015/10/116_189263.html.

97. See Chan, *supra* note 7.

98. See CHINA'S DEVELOPMENT AND HARMONIZATION: TOWARDS A BALANCE WITH NATURE, SOCIETY AND INTERNATIONAL COMMUNITY 171 (Bin Wu et al. eds., Routledge 2013).

99. See ROSS P. BUCKLEY, EMILIOS AVGOULEAS & DOUGLAS W. ARNER, RECONCEPTUALISING GLOBAL FINANCE AND ITS REGULATION 328 (2016).

private banks (e.g. Mybank, Webank) and the additional forty private banks that are expected.¹⁰⁰ To put this in perspective, it took over 150 years for a new retail banking license to be issued in the United Kingdom (Metro Bank in 2010).¹⁰¹ Furthermore, we should not expect growth to slow in China, especially with the government's recent internet Finance Guidelines issued in July 2015.¹⁰²

FinTech 3.5 in the developing world is supported by a strong underlying rationale, including, but not limited to, the following characteristics: (1) young digitally-savvy populations equipped with mobile devices; (2) inefficient financial and capital markets creating opportunities for informal alternatives; (3) a shortage of physical banking infrastructure; and (4) less stringent data protection and competition.¹⁰³ In addition, particularly in India and China, there are very large numbers of engineering and technology graduates.¹⁰⁴

These trends are further reinforced by the interaction of a dynamic private sector looking to expand into financial services, and a public sector welcoming market reform and diversification to drive economic growth. The implication of all this is that FinTech development in Asia is not driven exclusively by essentially post-crisis forces, but by a combination of entrepreneurial and regulatory forces.

Though the potential for opportunity in the APAC region is great, it is tempered by the challenges specific to the market and the region. Investors and networks in APAC are less sophisticated than in developed Western markets. As a result, there are large information asymmetries in market activity.¹⁰⁵ Second, financing is not readily attainable, as there are high barriers to entry to retail banking (e.g., regulatory

100. See Kevin Yao & Matthew Miller, *China Encourages Privately-Owned Banks, Allows More Foreign Participation*, REUTERS (June 26, 2015, 7:06 AM), <http://www.reuters.com/article/2015/06/26/china-economy-banks-idUSL3N0ZC2LA20150626>.

101. See Jill Treanor, *UK Challenger Banks Aim to Loosen Grip of Big Four*, THE GUARDIAN: BANKING BUS. BLOG (June 2, 2015, 1:55 PM), <http://www.theguardian.com/business/2015/jun/01/uk-challenger-banks-aim-to-loosen-grip-of-big-four>.

102. For a more in depth analysis of Financial Technology developments in China, see generally Zhou, Buckley & Arner, *supra* note 59.

103. See Zhang Yuzhe & Wang Ling, *Alibaba Firm Rules Gov't with Promotions for Credit Services*, CAIXIN (Sep. 28, 2015, 6:09 PM), <http://english.caixin.com/2015-09-28/100859064.html>.

104. See *China and India to Produce 40% of Global Graduates by 2020*, ORG. FOR ECON. COOPERATION AND DEV. [OECD] (July 16, 2012), <http://monitor.icef.com/2012/07/china-and-india-to-produce-40-of-global-graduates-by-2020/>.

105. See THOMAS CLARKE, INTERNATIONAL CORPORATE GOVERNANCE: A COMPARATIVE APPROACH 200 (2007). See also ASIA-PACIFIC FINANCIAL MARKETS: INTEGRATION, INNOVATION AND CHALLENGES 308–309, 379 (Michael McKenzie & Suk-Joong Kim eds., 2007) (on the Chinese market specifically).

capital requirements, ownership structures, and market restrictions).¹⁰⁶ Furthermore, as companies scale, the fragmented regulatory regime puts Business-to-Consumer (B2C) FinTech companies at a disadvantage compared with Business-to-Business (B2B) companies, as B2B partially shift the compliance burden to their banking client.¹⁰⁷ The fragmented regime in APAC, consisting of twenty-four countries, is also apparent when compared to the single, harmonized market in Europe. Finally, financial engineering in APAC is less sophisticated than in the EU and U.S. markets, thus constraining certain FinTech companies.¹⁰⁸ For example, robo-advisory platforms on wealth management build portfolios for clients with small amounts of money. However, the tranching of financial products in the region is not yet at a level that allows for algorithm-driven efficient “micro-portfolio” creation.

Despite these limitations, it is clear that APAC governments are beginning to adapt their policies and regulatory regimes to foster the development of FinTech companies. They sense that efficient financial markets are directly linked to an increase in economic output, a key motivator for developed and developing countries.¹⁰⁹

C. China: Transitioning its Financial Market for the 21st Century

In China specifically, technology has already blurred customer perceptions of who can deliver a financial service. At the same time, the speed of FinTech evolution and development in China has been nothing short of astounding, having gone from almost nothing in less than a decade. China’s AliPay processes over one million transactions each day by means that resemble a traditional bank—payments can be made using deposits held in a Yu’E Bao account, which yields an interest rate and is redeemable on-demand¹¹⁰—without being a

106. See generally Qiao Liu, Paul Lejot & Douglas Arner, *FINANCE IN ASIA: INSTITUTIONS, REGULATION AND POLICY* (Routledge 2013).

107. See Arner & Barberis, *supra* note 6.

108. *Id.*

109. Indeed, the announcement of the Payment System Directive 2 (PSD2) in Europe has been justified, amongst other reasons, by the fact that the fragmented rules in the payment industry in the European Union cost up to one percent of its GDP. If gained back following the implementation of PSD2, this could boost the European economy. See European Commission Press Release IP/13/730, *New Rules on Payment Services for the Benefit of Consumers and Retailers* (July 24, 2013).

110. Yu’E Bao is a service that offers AliPay customers the possibility of investing their idle cash in money market funds. Those accounts are redeemable on demand and pay higher interest on “deposits” held. John Foley, *Lend and Pretend*, *BREAKING VIEWS* (Feb. 12, 2014), <http://www.breakingviews.com/alibaba-tests-the-limits-of-non-bank-banking/21131591.article>.

bank.¹¹¹ Therefore depositing money for payments is no longer limited to deposit accounts at banks. Holding client deposits traditionally means an institution is a bank and thus attracted the concomitant licensing and regulatory obligations.

Regulators and legislators must face this fast-changing environment. Banks should be allowed¹¹² to respond directly to the competitive challenges of less regulated internet finance companies that can gain significant market share¹¹³ by offering close substitutes for certain financial services. Unlike in the West, internet companies in China are a real threat to the market share of banks.

The benefits of internet finance companies require consideration. Alibaba has fulfilled two main government policy objectives by creating 2.87 million direct and indirect job opportunities, and providing over 400,000 SMEs with loans ranging from \$3000 to \$5000.¹¹⁴ Regulatory policies need to strike a difficult but important balance in the current competitive dynamic between banks and internet finance companies.

China has been gradually reforming its financial system since 1978. However, the 2008 GFC slowed politicians' and regulators' appetite for further large-scale reform because the crisis deeply shook the understanding of what constitutes an effective financial system and how institutions should be regulated. Indeed, legislation since 2008 has reversed the trend towards a free market by tightening the regulatory environment for banks in China.¹¹⁵ In the West, this is reflected by ever-increasing compliance costs from post-crisis national laws such as Dodd-Frank or international standards such as Basel III.

111. Leesa Shrader & Eric Duflos, *China: A New Paradigm in Branchless Banking?* 37 (Consultative Group to Assist the Poor, Working Paper, 2014), http://www.cgap.org/sites/default/files/Working-Paper-China-A-New-Paradigm-in-Branchless-Banking-March-2014_0.pdf.

112. For example, by simplifying and changing certain regulatory constraints under which they operate (or alternatively by bringing internet finance companies under the same set of rules). However, the latter option might decrease the financial efficiency and inclusion gains brought by technology, as compliance costs will increase.

113. In that respect, McKinsey & Company expect that banks failing to digitize themselves face the possibility of having a twenty-nine percent to thirty-six percent negative impact on their profits. Joe Chen et al., *How to Prepare for Asia's Digital-Banking Boom*, MCKINSEY & COMPANY (Aug. 2014), www.mckinsey.com/insights/financial_services/How_to_prepare_for_Asias_digital_banking_boom.

114. Shrader & Duflos, *supra* note 111, at 42.

115. See Janos Barberis, *A Crack In the Great Wall: Too-Big-to-Fail Them a Societal Perspective* (June 2013) (unpublished Master of Laws dissertation, University of Hong Kong) (on file with the authors).

There is a unique opportunity in the technologically-driven financial transition currently underway in China. In addition to learning from regulatory mistakes in Western countries, China could leapfrog financial regulation standards by establishing a regulatory framework that promotes and controls the use of FinTech and internet finance companies.¹¹⁶

In many ways the leadership of China in FinTech is already happening at the industry level with developments in China now leading innovation in the financial sector and being replicated globally. For example, AliPay's introduction of facial recognition payment in March 2015¹¹⁷ was followed by MasterCard in July 2015.¹¹⁸ Similarly, SME lending by Alibaba in 2010 using alternative credit-scoring data from its e-commerce platform was introduced in the United States and Japan in 2012 and is now being undertaken by Amazon in Europe.¹¹⁹

These market developments echo the wider government objective to reform the financial sector and promote opportunities offered by digital financial services. The latest development in furthering these objectives was in July 2015 when then ministries and commissioners issued the *Guidelines on the promotion of the healthy development of internet Finance (The internet Finance Guidelines)*.¹²⁰

China's transition from a brick and mortar towards a digital financial system is both demand-driven and policy-driven. In addition, certain characteristics of the Chinese market make it particularly fertile ground for FinTech. World Bank statistics show how China differs from the United States and the United Kingdom on by whom and via what channels banking is delivered:

116. Arner & Barberis, *FinTech in China*, *supra* note 56, at 9 (illustrating how China went from innovation to duplication and the broader (inter)national consequences of this). *See also* Zhou, Arner & Buckley, *supra* note 59, at 28.

117. *See* Geoffrey Smith, *Alibaba's Jack Ma Shows Off New 'Pay With a Selfie' Technology*, FORTUNE (Mar. 17, 2015, 7:39 AM), <http://fortune.com/2015/03/17/alibabas-jack-ma-shows-off-new-pay-with-a-selfie-technology/>.

118. *See* Jose Pagliery, *MasterCard Will Approve Purchases by Scanning Your Face*, CNN (July 1, 2015, 3:03 PM), <http://money.cnn.com/2015/07/01/technology/mastercard-facial-scan/>.

119. *See* Oliver Smith, *Looking For a UK Business Loan? Amazon Might Be the Answer*, THE MEMO (June 29, 2015), <http://www.thememo.com/2015/06/29/looking-for-a-uk-business-loan-amazon-might-be-the-answer/>.

120. *Guideline on the Promotion of the Healthy Development of Internet Finance*, MINISTRY OF FIN. OF THE PEOPLE'S REPUBLIC OF CHINA (July 20, 2015), http://www.mof.gov.cn/zhengwuxinxi/zhengcefabu/201507/t20150720_1332370.htm.

EVOLUTION OF FINTECH

TABLE 2. BANKING DEMOGRAPHIC AND DELIVERY CHANNELS¹²¹

	China	USA	UK
Population without a bank account in the last 12 months (nominal in million)	432	10	1
Population without a bank account (percentage)	36%	2.7%	2.5%
Commercial bank branch per 100,000 people ¹²²	7.7	35.2	24.2
Bank ATM per 100,000 people ¹²³	37.51	173.43	124.28

China has not had time to develop Western levels of physical banking infrastructure, and the rise of FinTech means it probably never will need to do so. This is particularly so because technology is well-developed in China:

TABLE 3. TECHNOLOGY PENETRATION IN CHINA¹²⁴

Number of SIM cards	1,104 million
Percentage of mobile subscribers with 3G/4G access	28.9%
Internet users	721 million
Online banking penetration	57%

121. See *Data on Commercial Bank Branches (Per 100, 000 Adults) for Select Countries*, WORLD BANK, <http://data.worldbank.org/indicator/FB.CBK.BRCH.P5> (last visited June 18, 2016).

122. Data displayed for China, USA and UK are respectively from 2012, 2012 and 2011.

123. Data displayed for China, USA and UK are respectively from 2012, 2009 and 2011.

124. Compilation of data by authors from Shrader & Duflos, *supra* note 111, at 19 (China has more than 1.104 billion total registered mobile subscribers as of 2012 among the three major MNOs, with an estimated 84 percent mobile penetration rate[.]”) (internal citations omitted); *id.* at 16 (“as of 2013, 28.9 percent of China’s population had 3G and 4G connections, higher than the world average of 26 percent.”) (internal citations omitted). *China Internet Users*, INTERNET LIVE STATS <http://www.internetlivestats.com/internet-users/china/> (last visited June 25, 2016) (estimating the total number of internet users in China to be 721,434,547 as of the date the site was visited); *Digital Banking in Asia: What Do Consumers Really Want?* 2, ex. 1 MCKINSEY & COMPANY (Mar. 2015), <http://www.mckinseychina.com/wp-content/uploads/2015/01/mckinsey-china-pfs-survey-2014.pdf?bd0bde> (estimating the “Digital-banking penetration,” which McKinsey defines as “the number of users of internet or smartphone banking divided by total [urban] banking consumers”, in China to be 57% in 2014). See also *The Everyday Bank: A New Vision for the Digital Age*, ACCENTURE (2015), http://www.accenture.com/t20150714T065456_w_/sk-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Strategy_6/Accenture-The-Everyday-Bank-A-New-Vision-for-the-Digital-Age.pdf.

The result of this mismatch between physical and digital infrastructure means the future for digital financial services in China is particularly bright. Indeed, China UnionPay already has become, in under fifteen years, the world's largest payments provider.¹²⁵

The lack of physical infrastructure and of traditional customer banking expectations creates an opportunity for the development in China of a new banking paradigm. The trend toward digital banking is already underway. Over the past three years in China, there have been 111 million new internet banking customers, a nineteen percent increase in new personal bank accounts, and a twenty-four percent increase in online payments.¹²⁶ In addition, it is expected that by 2020 there will be 900 million digital banking customers, compared to 380 million in 2012.¹²⁷ Likewise, it is expected that by 2017 over 900 million Chinese will be credit-scored by the new credit bureau, Sesame Credit Management, part of Alibaba, using alternative data points.¹²⁸

Going forward, one should expect that the tension between traditional digital financial services and FinTech 3.0 providers will be greatest around the following three areas: (1) payments, (2) financing, and (3) deposits, with deposits being the strongest contention point (and perhaps the main threshold for strong regulation).¹²⁹

To support this digital financial transition, a framework must achieve various goals for each actor in the financial sector. Regulators must

125. See *China UnionPay Overtakes Visa to Become the World's Most used Debit Card*, FINEXTRA (Apr. 10, 2014), <http://www.finextra.com/news/announcement.aspx?pressreleaseid=54849>.

126. *FinTech Innovators Champion Hong Kong as Asian Hub*, JUMPSTART MAG. (Nov. 17, 2015), <http://jumpstartmag.com/news/hong-kong-fintech-ecosystem/>.

127. See Sonia Barquin & Vinayak H.V., *Capitalizing on Asia's Digital-Banking Boom*, MCKINSEY & COMPANY (Mar. 2015), http://www.mckinsey.com/insights/financial_services/capitalizing_on_asias_digital-banking_boom.

128. See Andrew Foxwell, *Asia Loses out as Fintech Start-Ups Head to the West*, ASIAN INV. (June 2, 2015), <http://www.asianinvestor.net/News/397928,asia-loses-out-as-fintech-start-ups-head-to-the-west.aspx>. It is important to note that these individuals may have already been credit scored by traditional credit bureaus. However, their true risk might not have been fully assessed, due to the lack of sufficient data points (e.g., financial transactions performed within the formal banking sector). These are called "thin credit files" by the industry and provide FinTech 3.0 companies with large opportunities; the U.S. and E.U. equivalent of Sesame Credit Management being Credit Karma and Kreditech respectively.

129. To date, deposit-taking activities have not been approached by FinTech 3.0 start-ups due to the fact that it is one of the most regulated activities within the financial services industry (it requires a banking license). In turn, this removes much of the economic rationale behind performing this function, because the act of holding deposits on its own generates little to no return. This would push start-ups to create two products from day one so as to up-sell products and services to make up for the cost generated by their deposit business.

secure the necessary understanding and scope of operations to oversee the use of technology within the financial industry. Banks should compete equally in terms of regulatory burden with FinTech 3.0 companies that offer exact or close substitutes for regulated products. At the same time, start-ups need to operate within a regulatory framework that allows them to develop their business before becoming subject to expensive compliance costs.

Thus, the way forward may not necessarily lie in setting rules for financial products, but instead in establishing threshold levels for when institutions need to comply with market conduct rules and prudential rules (that seek to ensure the safety and stability of financial entities). A proportionate regime may avoid burdensome regulation with heavy compliance costs and limited benefits for financial stability. Identifying the right risk threshold (e.g., market or consumer risk) would also help establish a boundary of operation between banks and internet finance companies and determine whether the distinction is based on products or transaction size.

On that issue, it seems that China's current Internet Finance Guidelines and the consultation on third party payments, which is due to be released before this year's end, are pointing towards a two-tiered market, defined by transaction values.¹³⁰ This is an imperfect solution because it caps the growth of internet finance providers, but it also may introduce a measure of regulatory harmony between traditional financial institutions (FinTech 2.0) and new start-up participants (FinTech 3.0).

Jack Ma, founder and CEO of Alibaba, rightly captured this difference when he said, "There are two big opportunities in future financial industry. One is online banking, all financial institutions go online; the other one is internet finance, which is purely led by outsiders."¹³¹

Other Asian countries are already developing a tiered licensing systems in Asia. Governments in the region are developing "light license" models that aim to minimize regulatory and compliance costs for firms seeking to deliver specific banking activities to certain population segments. For example, South Korea is developing a specific

130. See *China Headlines: New Regulation on Third-Party Payments Stirs Controversy*, XINHUA FIN. AGENCY (Aug. 3, 2015, 3:54 PM), <http://en.xinfinance.com/html/Industries/Finance/2015/125158.shtml>.

131. Lydia Guo, *Alibaba: Shaking Up Chinese Finance*, FIN. TIMES (July 1, 2013, 8:36 PM), <http://blogs.ft.com/beyond-brics/2013/07/01/alibaba-shaking-up-chinese-finance/>.

regime for online-only banks;¹³² India has created a new license type for payment banks¹³³ and has recently issued 11 new banking licenses;¹³⁴ and China is introducing new private banks to cater for market sectors traditionally underserved by state-owned banks.¹³⁵

These developments matter because they reflect the FinTech dynamic of the region and indicate a regulatory policy that favors the development of specific sub-sectors to promote national policy objectives.

VII. REGULATORY INNOVATION AND THE IMPORTANCE OF REGTECH

This Article has illustrated the application of technology to finance and its consequences over three major eras of FinTech. Between FinTech 2.0 and FinTech 3.0, the type of entity that uses the technology to deliver a financial product or service changed; FinTech is no longer the preserve of traditional financial institutions. This becomes even more challenging in the context of FinTech 3.5 in emerging markets, in which technology companies are increasingly playing a more important role in financial services than the often inefficient and underdeveloped traditional financial institutions.

This is precisely where the current debate and discussion around FinTech regulation lies. Right now there is uncertainty as to what laws and procedures are applicable to new FinTech companies and their products. The solution is to devise an approach that balances the views of the technology industry, financial actors, and regulators, and is proportionate to their obligations towards protecting consumers and market stability. Striking the proper balance requires understanding regulators' *raison d'être* and the reasons behind the rules they enforce, and providing education for start-ups on their regulatory obligations.

132. See Steven Denney, *South Korea's Next Growth Frontier: Fintech*, THE DIPLOMAT (Aug. 13, 2015), <http://thediplomat.com/2015/08/south-koreas-next-growth-frontier-fintech/>.

133. See *Some New Banking Licences by August, says Raghuram Rajan*, TIMES OF INDIA (June 2, 2015), <http://timesofindia.indiatimes.com/business/india-business/Some-new-banking-licences-by-August-says-Raghuram-Rajan/articleshow/47516988.cms>.

134. See Bernard Lunn, *11 New Banking Licenses Approved in India Show the Future of Banking*, DAILY FINTECH (Sep. 29, 2015), <http://dailyfintech.com/2015/09/29/11-new-banking-licenses-approved-in-india-show-the-future-of-banking/>.

135. See *Mainland's 1st Private Bank Services Niche Markets*, SHANGHAI DAILY (Mar. 27, 2015), <http://www.shanghaidaily.com/business/finance/Mainlands-1st-private-bank-services-niche-markets/shdaily.shtml>.

A. *Regulatory Objectives and Thresholds*

Regulators' objectives can be understood by their key mandates. In no specific order, these are: (1) financial stability, (2) prudential regulation, (3) conduct and fairness, and (4) competition and market development. Deciding when to regulate can be as important as deciding what to regulate, so some rules may not be enforced until certain specific thresholds are met.¹³⁶

Early regulation may well represent substantial wasted effort because some innovations do not pan out to become paradigm shifting or at the very least take a long time to catch on. For example, e-banking was introduced in the 1980s in the United States but stopped shortly thereafter, before being successfully launched in 1995 in both the United States and the United Kingdom.¹³⁷ Thus it would have been inefficient for regulators to divert resources to understand and regulate e-banking in 1980. This shows that regulators should move cautiously in regulating financial innovations.

Diverting resources to understand every new technological innovation could result in inefficient outcomes for regulators and industry for three reasons. First, technology needs time to find its final use and applicability, and the market may need to settle before regulatory intervention. Second, the availability of a technology alone does not mean it will be widely adopted.¹³⁸ Third, there may be a strong benefit in regulatory measures *not* influencing market innovation or technological standards.¹³⁹ Indeed, regulators should remain technology-neutral.¹⁴⁰

In practice, this means regulators need to categorize and understand the benefits and applicability of a technology. For example, the reliance of banks and start-ups on new biometric identification mechanisms entering the market (e.g., fingerprint and iris scanning, voice and heartbeat recognition) raise different case-specific issues, but are

136. See *supra* Section III.B on the regulation of e-banking, which existed for about twenty years before it was properly regulated.

137. "Home banking" using a PC was introduced in the early 1980s by several banks in the US. This was an early rendition of e-banking which failed to gain popularity. See BANKING AND FINANCE ON THE INTERNET, *supra* note 49, at 29.

138. The example of blockchain technology illustrates this point, as it still lacks an example of consumer-facing solutions adopted by the public. The laser was similar, in that it was a "solution in search for a problem" for decades before it was widely-used in multiple industries. See MARIO BERTOLOTI, THE HISTORY OF THE LASER 263–95 (2004).

139. See Menon, *supra* note 53.

140. See Chan, *supra* note 52.

all used for the same purpose of customer identification. Fingerprint scanning appears to be the simplest and most widely used biometric identification method. However, it raises issues of “biometric data theft” where a fingerprint can be replicated using a simple high-resolution photograph.¹⁴¹ This risk recently materialized, when 5.6 million fingerprints were stolen from the U.S. Department of Defense.¹⁴² A case can thus be made against using fingerprints due to the security risk.¹⁴³

However, the decision to allow or ban a technology is perhaps best not left to regulators because until a specific technology becomes widely used, risks of biometric data-theft and unauthorized transactions are limited. Instead, in most instances, regulators should remain technologically neutral and focus on the outcome of a technology.¹⁴⁴ This kind of wait-and-see approach allows the regulator to learn whether the market will adopt the technology and draw on historical data as to the risks a specific technology creates in order to appropriately tailor regulations.

This efficiency-based analysis of regulators’ time, given their limited resources, highlights the benefits of supervising and regulating only a limited number of large players. In FinTech 2.0, generally, established actors with well-developed compliance cultures drove technological innovations, and thus it was seen as more efficient to let a market self-regulate until it became worthy of regulators’ time.¹⁴⁵ In other words, while the innovations were by definition new, the actors deploy-

141. See Alex Hern, *Hacker Fakes German Minister’s Fingerprints Using Photos of Her Hands*, THE GUARDIAN (Dec. 30, 2014, 6:43 EST), <http://www.theguardian.com/technology/2014/dec/30/hacker-fakes-german-ministers-fingerprints-using-photos-of-her-hands>.

142. See David Alexander, *5.6 Million Fingerprints Stolen in U.S. Personnel Data Hack: Government*, REUTERS (Sep. 23, 2015, 3:50 PM), <http://www.reuters.com/article/2015/09/23/us-usa-cybersecurity-fingerprints-idUSKCN0RN1V820150923>.

143. This raises important questions and potential risks in the context of China. Indeed, the Chinese data privacy regime being less strict than those of Western countries allows private companies to store and share biometric data in ways that would be prohibited in Europe or the United States. Thus, there is a potential cybersecurity risk of private companies losing the biometric data of their consumers following a cyber attack, especially if these are used as an identification token for financial transactions (e.g., fingerprints to authorize payments).

144. However, this is not the case for all regulators, as discussed with the Singaporean example. See generally *supra* note 52.

145. Sharon Chen & Chanyaporn Chanjaoren, *Singapore to Regulate Fintech Firms Only When They Pose Risk*, BLOOMBERG TECH. (updated Apr. 12, 2016, 11:42 PM), <http://www.bloomberg.com/news/articles/2016-04-13/singapore-to-regulate-fintech-firms-only-when-they-pose-risks>. This is not to say that actors within the financial sector have a flawless track record of compliance, as was shown with the various fraud cases emerging out of the GFC. See, e.g., M.S., *Maybe It Was Fraud After*

ing them were not (e.g. Barclays' ATM, Bank of America's credit card, investment banks' VaR models), and thus regulators could take comfort from knowing that they had a familiar point of contact for when they decided to look at the legal implications of specific technologies. This same approach can be cost-effective for regulators and industry if applied to FinTech 3.0. It gives innovative experiments the chance to grow in use without the burden of regulations; and it allows regulators to keep their attention focused on the established financial mechanisms that touch the lives of many more people than the financial innovations, and are thus sufficiently important to attract regulatory scrutiny.

From an industry and regulatory perspective, the pharmaceutical industry perhaps offers a blueprint for regulating innovation. This industry is, similarly to financial services, highly regulated. Breakthroughs are allowed to enter the market via a clear and gradual path of clinical trials and authorizations. Large groups are increasingly outsourcing this research and development stage of the process by acquiring the start-ups and university spin-offs that are developing the new drugs.¹⁴⁶ We are now seeing a similar trend of approach in established financial institutions—which traditionally have not been major spenders on research and development (except for research to support transactional business lines, e.g. analysts). In this way, successful FinTech startups today are often acquired by existing financial institutions, which have also often been involved in their earlier development through incubators, angel investment and venture capital (through which established financial institutions gain not only the potential option to purchase attractive startups to incorporate into their own business but also the possibility of profiting if the startup successfully develops as a standalone firm).

There are also benefits for regulators from the wait-and-see approach because their previous method, whereby they only looked at established financial institutions that started to deploy products or services on a significant scale, is poorly adapted to the FinTech 3.0 world. While pre-2007 regulators could take some comfort that regulated financial institutions with which they already had a relationship

All, THE ECONOMIST (Oct. 13, 2016, 7:06 PM), http://www.economist.com/blogs/democracyinamerica/2010/10/financial_crisis_0.

146. See Samuel Wendel, *Hikma Pharmaceuticals Launches \$30m Digital Health Venture Fund in Aman*, WAMDA (Apr. 24, 2016), <http://www.wamda.com/memakersge/2016/04/hikma-pharmaceuticals-launches-30m-digital-health-venture-fund-amman>.

would handle innovations responsibly, this is no longer necessarily the case.

Money market funds (MMF) offer an example. Three of the largest players in this sector (Vanguard, Fidelity, and Schwab) were established in 1975,¹⁴⁷ 1946,¹⁴⁸ and 1963,¹⁴⁹ respectively. In 2014, Alibaba started to offer a new MMF that was fully online and available to its pre-existing customer base. Within nine months, Yu'E Bao became the world's fourth largest MMF, on par with decade-old players such as Vanguard or Fidelity.¹⁵⁰

Yu'E Bao shows how a non-traditional financial institution went from "too-small-to-care" to "too-big-to-fail"¹⁵¹ within the space of nine months. This exponential growth represents a direct challenge to the otherwise more gradual approach towards regulating innovations and stakeholders because it has skipped the "too-large-to-ignore" phase when regulators would have started to contact and request compliance of said entity.¹⁵² Yu'E Bao and M-Pesa also serve as the best examples of the role of speed in the context of FinTech 3.0 and 3.5, both of technological development (e.g., the iPhone was launched less than 10 years ago, in 2007) and also of growth of firms and new ways of undertaking financial transactions.

In other words, if primarily regulating actors with a significant impact on financial markets remains the correct approach, which we submit is the case, what needs to change in extraordinary cases may be the methods used to identify the future systemically important actors.¹⁵⁴

147. See *A Remarkable History*, VANGUARD, <https://about.vanguard.com/who-we-are/a-remarkable-history/> (last visited June 14, 2016).

148. See *Our Heritage*, FIDELITY, <https://www.fidelity.com/about-fidelity/our-heritage> (last visited June 14, 2016).

149. See *Company History*, SCHWAB, <https://aboutschwab.com/about/history> (last visited June 14, 2016).

150. See Bill Powell, *Alibaba: The \$200 Billion 'Open Sesame'*, NEWSWEEK (Sept. 8, 2014, 10:54 AM), <http://www.newsweek.com/2014/09/19/alibaba-200-billion-open-sesame-268937.html>.

151. The concept of from "too-small-to-care to too-big-to-fail" was initially developed by Arner & Barberis, *A Balancing Act*, *supra* note 6.

152. Following the fingerprint example, one can also use the fact that Apple sold over 10 million iPhone 6 units, which were all pre-loaded with a mobile wallet and fingerprint scanner to identify transactions. See *First Weekend iPhone Sales Top 10 Million, Set New Record*, APPLE (Sep. 22, 2014), <http://www.apple.com/pr/library/2014/09/22First-Weekend-iPhone-Sales-Top-10-Million-Set-New-Record.html>.

153. Arner and Barberis: "FinTech Regulation Recent Developments and Outlook" AIIFL (Apr. 1, 2015).

154. It is accepted that not all companies will become "too-big-to-fail" and reach the scale of Yu'E Bao, but most have the aspiration of being billion dollar companies. Furthermore, in an

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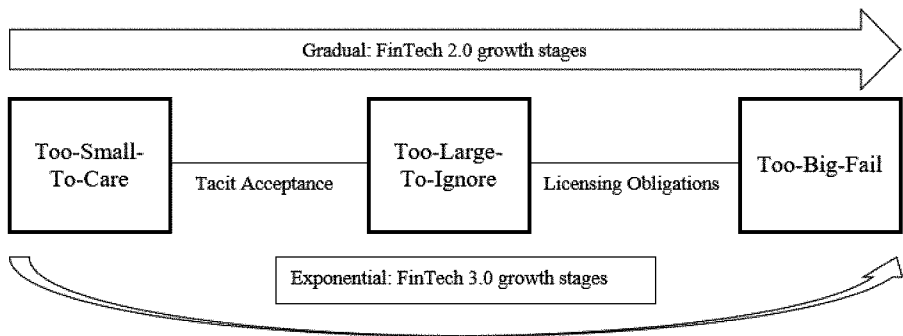


FIGURE 2: Regulatory Threshold Approaches Compared to Growth Models¹⁵³

Given the size of investment made into new start-ups and the competitive implications stemming from the arrival of these new players in the financial services industry, regulators in various jurisdictions also need to review the best approaches to support FinTech and adjust their methods towards regulation.¹⁵⁵

B. Adapting Regulatory Methods in a Digital Age

From an industry perspective and from a regulatory perspective alike, an attitude change is needed on how FinTech products and services should be regulated. However, as pointed out above, there is currently difficulty in accurately representing the hardship faced by the industry as a whole because it is comprised of the established FinTech 2.0 players and the emerging FinTech 3.0 players.

The difference in stakeholders creates two sets of distinct expectations and needs for industry supervision. For start-ups, the high cost of regulation is incompatible with their lean business model. Early on, start-ups need to defer expenses as much as possible to focus on building a viable product with business potential. The group of early-stage companies that emerged during FinTech 3.0 prefers the more flexible compliance obligations of a principle-based regulatory regime. Under this approach, more focus is given to the spirit of a regulation

ever-interconnected financial system, market size and systemic risk are not necessarily correlated. The Dow Jones flash crash in May 2010 illustrated that smaller players can also produce systemic impacts when they are not identified in advance by regulatory authorities.

155. The advantages and disadvantages of each method are well covered in: Chris Brummer & Daniel Gorfine, *FinTech: Building a 21st-Century Regulator's Toolkit*, MILKEN INST. (Oct. 2014), <http://assets1c.milkeninstitute.org/assets/Publication/Viewpoint/PDF/3.14-FinTech-Reg-Toolkit-NEW.pdf>.

rather than solely following the rules and procedures by the letter “box ticking.” Private parties subject to this regime may have a certain degree of discretion in implementing the regulations.

Principle-based regulatory regimes differ from rule-based regimes. The latter create clear rules and processes. For a start-up, rule-based regimes are expensive as each rule and process needs to be identified and complied with. That may consume significant portion of a startup’s financial resources that could instead be used to build the business.¹⁵⁶

The benefits of principle and rule-based approaches are not clear from the perspective of start-ups and large financial institutions. The flexibility of a principle-based model creates a level of uncertainty as to what exactly is expected in terms of compliance.¹⁵⁷ As for the rule-based approach, the fact that the compliance obligations are clearly set out can limit the incentive of the supervised entity to do more because the obligations are perceived as sufficiently comprehensive.

There is nonetheless a way of resolving the differences between not only principle and rule-based regulatory approaches, but also between traditional financial institutions (FinTech 2.0) and start-ups (FinTech 3.0). The solution may lie in going beyond an “either or” attitude between rule-based or principle-based; instead these should not be seen as mutually exclusive. The regulatory obligations of a company should be dynamic in the sense that they need to adapt to the size and activity of a business as it grows and changes.¹⁵⁸ For example, while a principle-based approach may provide a start-up with the benefit of flexibility at an early stage, such regulations may limit a business’ scalability. Investors may prefer the regulatory clarity and certainty that comes with the rules-based model.¹⁵⁹ Thus for start-ups, the legal predictability and higher compliance costs associated with a rule-based model may be balanced by being more attractive to investors. Then, as the start-up matures, so does its compliance culture and capacity as it develops increasing access to sufficient financial resources. The higher costs and complexity associated with a rule-based approach can thus be understood as benefits, both for the company and the investor. Indeed, rule-based regulatory approaches are more likely to create a barrier to

156. Brummer & Gorfine, *supra* note 155, at 7.

157. *Id.*

158. For more detail on real-time regulation, see Tim O’Reilly, *Open Data and Algorithmic Regulation*, in *BEYOND TRANSPARENCY: OPEN DATA AND THE FUTURE OF CIVIC INNOVATION* (Brett Goldstein & Lauren Dyson eds., 2013).

159. See generally *Project Innovate: Call for Input*, FIN. CONDUCT AUTH. (Oct. 2014), <https://www.fca.org.uk/static/documents/feedback-statements/fs-14-2.pdf>.

entry for subsequent new competitors.¹⁶⁰

FinTech 3.0 thus needs a framework that is both balanced and dynamic, simultaneously benefiting private stakeholders (e.g., institutional or start-ups) and regulators.

C. *A Case for the Development of RegTech*

While previous sections have considered the evolution of FinTech and its challenges for traditional regulation, this section turns to the application of technology to regulation itself: Regulation Technology (RegTech). The increased use of technology within the financial services industry gives regulatory bodies an opportunity to access a level of granularity in risk assessments that did not previously exist. Indeed, Andy Haldane, Chief Economist of the Bank of England, when discussing the future of regulation shared his vision:

What more might be feasible? I have a dream. It is futuristic, but realistic. It involves a Star Trek chair and a bank of monitors. It would involve tracking the global flow of funds in close to real time (from a Star Trek chair using a bank of monitors), in much the same way as happens with global weather systems and global internet traffic. Its centre piece would be a global map of financial flows, charting spill-overs and correlations.¹⁶¹

This vision of a data-led regulatory system is not new. Since 2007 there has been increased focus on leveraging the market data held to better regulate and supervise financial markets.¹⁶² In 2009, the SEC created the Division for Economic and Risk Analysis to look at using data insights for better regulation, and Scott R. Peppet, Professor of Law at the University of Colorado, published a paper on “smart mortgages”

160. See Julia Groves, *Crowdfunding—Regulations are Now the Biggest Barrier to Entry*, UK CROWDFUNDING (May 30, 2014), <http://www.ukcfa.org.uk/crowdfunding-regulations-are-now-the-biggest-barrier-to-entry/news>.

161. Andrew G. Haldane, Chief Economist, Bank of England, Speech on Managing Global Finance as a System 10 (Oct. 29, 2014), <http://www.bankofengland.co.uk/publications/Documents/speeches/2014/speech772.pdf> (internal citation omitted).

162. See *RegTech, The New Magic Word in FinTech*, BBVA DIGITAL REG. UNIT (Feb. 2016), https://www.bbvaresearch.com/wp-content/uploads/2016/02/DEO_Feb16-EN_Cap1.pdf; *RegTech is the New FinTech: How Agile Regulatory Technology Is Helping Firms Better Understand and Manage their Risks*, DELOITTE (2015), <http://www2.deloitte.com/content/dam/Deloitte/ie/Documents/FinancialServices/ie-regtech-pdf.pdf>.

that use data to limit the default risks.¹⁶³ As discussed below, caution is in order; one needs to balance the opportunities technology presents with practical barriers to actual and successful implementation.

Regulatory interest in the FinTech sector represents a turning point. No longer are regulators solely seeking to prevent the previous crisis; they are instead looking at how to support future market developments while maintaining financial stability. There are benefits for a regulator to interact early with new FinTech start-ups, even if they are not yet significant or able to (currently) comply with the rules. This provides regulators with the capacity to understand from early on the business models of FinTech 3.0 start-ups and the teams behind them so as to see whether they are fit and proper for that role. This has been the approach in various jurisdictions. For example, the United Kingdom's Financial Conduct Authority (FCA) not only initiated a consultation to understand the regulatory hurdles faced by FinTech 3.0 companies,¹⁶⁴ but also complemented it with an innovation hub to interact with and support innovative start-ups from a nascent stage.¹⁶⁵

This awareness phase is also seen in Asia. The Securities and Futures Commission of Hong Kong is part of the Hong Kong government's FinTech Steering Group;¹⁶⁶ ASIC in Australia has open hours in a co-working space;¹⁶⁷ the Monetary Authority of Singapore has made SG\$225 million investment in research;¹⁶⁸ and southeast Asian countries have implemented new rules on alternative finance (debt or equity), with Malaysia being the first ASEAN country to have crowd funding laws.¹⁶⁹

The effort and resources regulators are putting into understanding the FinTech sector is perhaps surprising, particularly as they are, to

163. Scott R. Peppet, *Smart Mortgages, Privacy and the Regulatory Possibility of Infomediation* (Aug. 22, 2009) (unpublished research paper, University of Colorado Law School), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1458064.

164. See FIN. CONDUCT AUTH., *supra* note 159.

165. See Martin Wheatley, *Innovation: The Regulatory Opportunity*, FIN. CONDUCT AUTHORITY (Oct. 28, 2014), <http://www.fca.org.uk/news/innovation-the-regulatory-opportunity>.

166. See Press Release, H.K. Gov't News, Steering Group on Fintech Established (Mar. 30, 2015), <http://www.info.gov.hk/gia/general/201503/30/P201503300535.htm>.

167. See Michael Saadat, *Facilitating Innovative Fintech Businesses: a Regulator's Perspective*, CRITERION CONFERENCES: TECH. BLOG (Apr. 29, 2015), <https://www.criterionconferences.com/blog/socialtech/facilitating-innovative-fintech-businesses-regulators-perspective/>.

168. See Menon, *supra* note 52.

169. See J.D. Alois, *Malaysia is First ASEAN Country with Crowdfunding Laws*, CROWDFUND INSIDER (July 1, 2015, 11:06 PM), <http://www.crowdfundinsider.com/2015/07/70514-malaysia-is-first-asean-country-with-crowdfunding-laws/>.

some extent, revisiting the same questions and risks identified over fifteen years ago with e-banking. Furthermore, apart from specific products (e.g., robo-advisory), the business models of FinTech companies are not radically different from their traditional counterparts.¹⁷⁰ At most, the efficiency is driven by lower overhead costs or disintermediation. To some extent, FinTech is going full circle and providing only incremental changes, both from industry and regulatory perspectives.

D. *Real-time Compliance and RegTech*

As mentioned in the introduction, the financial sector has been the largest spender on IT systems for decades, a trend likely to continue, especially in regulatory and compliance spending. In the wake of the 2008 GFC, the regulatory onus and level of scrutiny by regulators has dramatically increased. Indeed, regulators have moved towards a risk-based approach where access to data is key to prudential supervision. Daniel Gutierrez, a Data Scientist at Amulet Analytics and Managing Editor of Inside Big Data, has analyzed how data is playing an increasing role in ensuring financial institutions are held accountable for their actions and that their responsibility is quickly established.¹⁷¹ This appears to be a laudable development.¹⁷²

For financial institutions, all of this regulatory activity has meant cost increases, whether in terms of capital (e.g., Basel III), operations (e.g., human resources), or penalties (e.g., HSBC, UBS, etc.). On the last point alone, since 2008, banks in the West have been fined over \$242 billion.¹⁷³ Arguably, both industry and regulators share an interest in reducing fraud. A range of stakeholders are interested in increasing transparency and creating monitoring processes. In June 2015, the Bank of England issued its *Fair and Effective Markets Review*, looking at the role that technology may play in compliance, noting that, “Firms have started to make progress in response to the limitations of existing surveillance solutions, including the use of new technology and analyt-

170. For more details as to how P2P lending can be seen as an emanation of Chinese shadow banking see Arner & Barberis, *supra* note 56.

171. Daniel Gutierrez, *Big Data for Finance—Security and Regulatory Compliance Considerations*, INSIDE BIG DATA (Oct. 20, 2014), <http://insidebigdata.com/2014/10/20/big-data-finance-security-regulatory-compliance-considerations/>.

172. Data transparency allows regulatory bodies to supervise firms without having to ask for specific reports (e.g., stress tests on liquidity and capital). Direct data access therefore prevents the regulated subject from changing its behavior and data in reaction to the asked questions.

173. Michael Mainelli, *RegTech—Worthy Of Investment?*, IGTB (June 24, 2015), <http://igtb.com/article/regtech-%E2%80%93-worthy-investment>.

ics which go beyond the key-word surveillance and simple statistical checks previously used by firms to detect improper trading activity and discussed earlier in this section.”¹⁷⁴

In particular, the Bank of England highlighted the following added values for regulation of specific technologies:

- ‘Pattern analysis,’ which can be used to identify unusual patterns of activity, such as “spoofing” (i.e., placing an order and then cancelling it seconds later to encourage others to drive up the price of a particular asset), front running, and wash trades, using predefined patterns of trading behaviour.
- ‘Big data’ techniques, which typically use a far larger number of inputs than standard surveillance techniques, helping to straddle information silos. The algorithms used have the potential to detect a wider range of suspicious activity than pattern analysis, and can also be used to identify networks of trading and communications activity that may themselves identify vulnerabilities;
- ‘Predictive coding’, which looks to identify patterns of activity, such as unusual use of communication, non-routine patterns of leaving the office, non-completion of training, or missing mandatory leave, which may flag potential conduct concerns; and
- Digitalization of voice communications, which some firms claim has the potential to be more effective than analysing written communications.¹⁷⁵

As a result, the argument for cost reduction within the compliance sector is very strong, and RegTech has never looked so beneficial for firms. Yet, balance is needed in assessing what is currently feasible when it comes to fully automating regulatory and compliance systems.¹⁷⁶

Before looking at the conversion of compliance obligations into IT processes, the first question is more fundamental: how should financial technology itself be regulated?¹⁷⁷ To date the debate, especially in Asia, seems to be more on understanding what framework provides the right balance between market innovation and market confidence.¹⁷⁸

174. CHARLES ROXBURGH ET AL., BANK OF ENG., FAIR AND EFFECTIVE MARKETS REVIEW: FINAL REPORT 89 (June 2015), <http://www.bankofengland.co.uk/markets/Documents/femrjun15.pdf>.

175. *Id.* at 90.

176. See generally Vytautas Čyras & Reinhard Riedl, *Formulating the Enterprise Architecture Compliance Problem* 142-153 (Sun SITE Cent. Eur. Workshop Proceedings 2009), <http://ceur-ws.org/Vol-924/paper14.pdf>.

177. See discussion *supra* Section VI.

178. *Some Chinese Are Taking 22% Margin Loans to Finance Stock Purchases*, BLOOMBERG (July 1, 2015, 5:00 PM), <http://www.bloomberg.com/news/articles/2015-06-30/hidden-china-stock-debt-revealed-in-online-loans-at-22-interest>.

Furthermore, while in the West RegTech has been developed much more by regulators (the U.K. government dedicated a chapter of the *Blackett Review* to the topic and Europe is pushing towards increased data transparency with PSD2¹⁷⁹), in practice there are still uncertainties, as reported by Chris Brummer, Professor of Law at The Georgetown University Law Center, and Daniel Gorfine, adjunct fellow at the Milken Institute, as to whether or not principle-based approaches are better suited than rule-based approaches.¹⁸⁰

To understand regulators' activity, one needs to look at two factors. First, at the macro level, their interest reflects the need to guide the transition occurring in financial markets. Just as an abrupt transition towards liberalized financial markets can be detrimental for participants and consumers, so can a fast technological transition create new risks. For example, the simplification and automation of wealth management services into color-coded advisers provides a simpler and cheaper solution for end-users.¹⁸¹ However, this also creates new risks as it moves away from a full disclosure regime and threatens jobs within the industry.

At the micro level, the increasingly data-driven aspects of FinTech 3.0, and the fact that these young companies rely on new and transparent IT systems, allows them to explore new compliance mechanisms.¹⁸² For example, real-time compliance systems could be requested as part of the licensing process. This would provide regulators and the company with a way to monitor in quasi-real time the actions of its staff and identify any non-compliant behavior. In that scenario, the firm wins because it limits its risk of misconduct, and the regulator wins with better regulatory outcomes.¹⁸³

From a market perspective, the capacity to analyze in real-time the solvency, liquidity, and risk of a financial institution promotes both market stability and competition. Regulatory models, where access to real-time data is traded off for regulatory capital, could provide a more

179. See *FinTech Futures: The UK as a World Leader in Financial Technologies*, CHIEF SCI. ADVISOR, UK GOV'T OFF. FOR SCI. (Mar. 18, 2015), <https://www.gov.uk/government/publications/fintech-blackett-review>.

180. Brummer & Gorfine, *supra* 155, at 8.

181. For example, a "green portfolio" would be properly balanced to the risk appetite of the user, but gives no exact details as to the content of the portfolio itself (and its re-adjustment in the future). This simplification seems to be at the opposite side of the spectrum in relation to the full disclosure regime that creates information overload to the client buying a financial product.

182. See generally Arner & Barberis, *supra* note 56.

183. More broadly, this refers to the theme of RegTech. For more details, see generally CHIEF SCI. ADVISOR, *supra* note 179.

appropriate cost of market entry for new companies. Their level of regulatory capital and scrutiny could then gradually increase with their business growth, as opposed to fall under the current blanket licensing system.¹⁸⁴

VII. CONCLUSION

This article has illustrated the evolution of FinTech through three major eras, culminating in today's FinTech 3.0, which is characterized by new competition and diversity, thus highlighting the need to carefully consider both opportunities and risks.

In developed markets, this shift to FinTech 3.0 has emerged out of the GFC of 2008 and been driven by public expectations and demands, the movement of technology companies into the financial world, and political demands for a more diversified banking system. In contrast, in developing countries and particularly in Asia, a corollary to FinTech 3.0, FinTech 3.5, has been driven by the needs of development and the inefficiencies in the existing financial system, combined with the rapid introduction and reach of new technology, particularly mobile communications.

In both cases, the development of the FinTech sector is attracting the interest of regulators who are currently evaluating the best ways to support market developments while ensuring the development of the sector contributes to, and does not threaten, core mandates such as systemic stability, consumer protection, and market competition. The challenge lies in resolving the tension between having a flexible, forward-looking framework that promotes innovation, and the framework being clear enough to maintain market, consumer, and investor confidence.

184. In the United Kingdom, there is a new regime for challenger banks to obtain a license for the Prudential Regulation Authority (PRA) and Financial Conduct Authority (FCA). If a new entrant qualifies as a Small Specialist Bank, the minimum capital required is GBP£1.2 million, as well as any costs to wind down the bank. This is a much lower threshold, which sets a level of capital proportionate to the actual loan book and risk of the bank. For more details about entry requirements and developments within the challenger banking space in the United Kingdom, see *A Review of Requirements for Firms Entering Into or Expanding in the Banking Sector: One Year On*, BANK OF ENG., <http://www.bankofengland.co.uk/prd/Documents/publications/reports/2014/barriers2014.pdf> (last visited May 18, 2016). By comparison, in Hong Kong the minimum capital requirement for a bank, irrespective of its loan book size and consumer number, is HK\$300 million. See *Licensing Requirements for Banks* 21, HONG KONG MONETARY AUTHORITY, http://www.hkma.gov.hk/media/eng/publication-and-research/background-briefs/bank_sup/licensing_requirements_for_banks.pdf (last visited June 15, 2016).

There seem to be three approaches in that respect. The United States, as evidenced by the JOBS Act, is implementing formal changes to its existing regulatory system in order to both support innovation while at the same time maintaining an appropriate focus on regulatory objectives. The United Kingdom, in the wake of the GFC, has changed its regulatory structure, moving away from a product-based to a principle-based approach, focusing on prudential regulation and consumer protection. China has maintained product-based principles, but is gradually introducing a two-tiered system where small-to-medium sized transactions can be handled by internet finance companies, while larger transactions remain the remit of (state-owned) institutional players.

In each case, the shift by regulators to a forward-looking (from a retrospective) approach is to be welcomed as it should allow markets to become more efficient and competitive, ultimately yielding benefits for consumers and the economy. While different approaches are being employed, this raises the potential for common international approaches to FinTech regulation that maximize market opportunity while at the same time setting best practices for managing risks to financial stability and consumer protection, similar to those that have been applied in the context of payment systems and other forms of regulation by the international standard setters.¹⁸⁵ Such a common approach, if implemented, could open the stage for a new era in FinTech. However, the issue of when to regulate new technology can be as important as how to regulate it, and, in our view, the time has not yet come to move to internationally standardized regulatory approaches in this sector. More experimentation and innovation is needed in regulatory approaches and in RegTech before the time will be ripe to seek their standardization.

185. Such as the Financial Stability Board, Basel Committee on Banking Supervision, and International Organization of Securities Commissioners.

