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FinTech and Financial Innovation: Drivers and Depth*

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Abstract: This paper answers two questions that help those analyzing FinTech understand its origins, growth, and potential to affect financial stability. First, it answers the question of why “FinTech” is happening right now. Many of the technologies that support FinTech innovations are not new, but financial institutions and entrepreneurs are only now applying them to financial products and services. Analysis of the supply and demand factors that drive “traditional” financial innovation reveals a confluence of factors driving a large quantity of innovation. Second, this paper answers the question of why FinTech is getting so much more attention than traditional innovation normally does. The answer to this question has to do with the ‘depth’ of innovation, a concept introduced in this paper. The deeper an innovation, the greater the ability of that innovation to transform financial services. The paper shows that many FinTech innovations are deep innovations and hence have a greater potential to change financial services. A greater potential to transform can also lead to a greater chance of affecting financial stability.

Keywords: FinTech, financial innovation

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FinTech and Financial Innovation: Drivers and Depth

Introduction

FinTech is a hot topic. The financial press reports on its disruptive potential on a seemingly daily basis, ‘Bitcoin’ has officially been made part of the English language¹, and global investment in FinTech exceeded \$20 billion last year.²

A crucial question is how FinTech will shape the financial landscape going forward. If we could answer that question, it would illuminate a path that regulators and supervisors could follow to ensure the safety and stability of the global financial system. Answering that question, however, is very difficult. Understanding some of the foundations of FinTech could prove useful for understanding its growth and the hype surrounding it.

This essay answers two questions that help those analyzing FinTech understand its origins and its growth. First, it answers the question of why “FinTech” is happening right now. Many of the technologies that support FinTech innovations are not new, but financial institutions and entrepreneurs are only now applying them to financial products and services. Why now? The answer to this question is not simple, but an analysis of some of the supply and demand factors that drive “traditional” financial innovation is useful here.

Second, this essay answers the question of why FinTech is getting so much more attention than traditional innovation. Financial innovation is a constant process, and yet now the financial industry has a set of innovations that share a common link of being enabled by technology and that have been given a special name. Why is this set of innovations getting so much more hype than traditional innovation normally does? The answer to this question has to do with the depth of the innovations, a concept that I will introduce.

¹ <http://www.coindesk.com/bitcoin-enters-oxford-dictionaries-online/>

² <https://newsroom.accenture.com/news/global-fintech-investment-growth-continues-in-2016-driven-by-europe-and-asia-accenture-study-finds.htm>

To answer these questions, I have to first offer a definition of FinTech. With that definition in mind, I will discuss the supply and demand drivers of financial innovation, then I will introduce the concept of the depth of a financial innovation, and finally I will illustrate how the drivers and depth on FinTech explain why the FinTech phenomenon occurred now and why hype surrounds everything related to FinTech.

Definition

People throw around the term FinTech too frequently without any commonly accepted definition. That can make it difficult to discuss at times because two people using the term may be referring to different things. For the purpose of this essay, I have adapted a definition used by the Financial Stability Board:

‘FinTech’ is technologically enabled financial innovation that could result in new business models, applications, processes, products, or services with an associated material effect on financial markets and institutions and the provision of financial services.

In my view, the advantage of this definition is that it captures only technology-enabled financial innovation with a ‘material effect’ on financial markets, institutions, and services – minor uses of technology are not counted. Where some tension may arise is that this definition capture things like high-frequency trading (HFT), but most people do not consider HFT part of FinTech, perhaps because it is not new enough.

By my own estimation, items that would be considered FinTech according to this definition include (but are not limited to): online marketplace lending (called peer-to-peer lending by some), equity crowdfunding, robo-advice, financial applications of distributed ledger technology, and financial applications of machine learning (also referred to as artificial intelligence and machine intelligence).

Supply and Demand Drivers of Financial Innovation

In order to explain why FinTech is happening now, I am going to describe a simple supply and demand framework for thinking about financial innovation³, and then later I will apply that framework to the items captured by the definition of FinTech given above.

Starting on the supply side, we need to think about what causes someone to supply an innovative financial product to the market. There are a number of factors including technology, regulation, innovation spirals, or changes to the macroeconomic or financial landscape. I will give some examples of how these factors have played a role in the genesis of various prior financial innovations.

Technology frequently plays a role in financial innovations, and perhaps the most famous example is the automated teller machine (ATM). The first ATMs were developed in the late 1960s, and it was a technological development that enabled their creation. In particular, the British government issued a patent in 1966 for a technology that enabled a PIN code to be stored on a card. Before that, the ATM was impossible. Less than a year after the patent was issued, the first ATM opened in London.⁴ More recent examples of innovation where technology was an important supply factor include online banking, high frequency trading, and mobile payments.

Regulation is another supply factor that is frequently present. For example, in the wake of the global financial crisis, bank supervisors in a number of countries encouraged their banks to move away from short-term funding. At the same time, other reforms decreased demand by money market funds for instruments that had longer tenors, like longer-term repo contracts. In response, the banks created collateralized commercial paper (CCP).⁵ CCP is commercial paper issued by a special purpose entity with the proceeds of the issuance

³ I utilize the framework described in Kimbrough and Schindler (2014).

⁴ https://en.wikipedia.org/wiki/Cash_machine

⁵ <http://treasurytoday.com/2011/07and08/buyer-beware-does-collateralised-commercial-paper-have-a-future>

used by banks to enter repo contracts. Money market funds can purchase the CCP, which is considered ‘liquid’ by the relevant regulations, and the banks issuing the CCP get the repo funding they wanted in the first place. Other examples of regulation contributing to financial innovation include the futurization of swaps⁶, callable commercial paper⁷, and extendable repo⁸ and evergreen repo contracts⁹.

Some supply factors are more subtle. For example, it sometimes occurs that one innovation begets another innovation in a pattern that can lead to an ‘innovation spiral’. In practice, this means that there can be a natural sequencing of innovations. For example, you cannot market an index of credit default swaps until the credit default swap itself has been created and the market for the credit default swap has become liquid enough that you can accurately track the price. In other cases, it means you cannot even imagine a product until the ones that come before it exist. For example, until someone has created a credit default obligation (CDO), it is difficult to conceive of someone creating a CDO-squared. As a result, you can think of innovation itself as a supply factor; when you get some innovation, you increase the chance that additional innovation will follow.

Changes to the financial or macroeconomic landscape can also be supply factors. For example, following the collapse of the housing market in the United States that preceded the global financial crisis, there was a significant rise in the quantity of real estate owned by banks and other financial institutions. This unusual situation led to innovation, with some of the financial institutions securitizing the rental income from the real estate they owned.¹⁰ Financial institutions would have been much less likely to conceive of such a product if the housing market had not collapsed leaving them holding lots of real estate. Hence, the change

⁶ http://www.darrellduffie.com/uploads/policy/BGOV_FuturizationOfSwaps.pdf

⁷ <http://som.yale.edu/case/2014/basel-iii-f-callable-commercial-paper>

⁸ <http://www.ft.com/cms/s/0/976b7d08-24e8-11e1-8bf9-00144feabdc0.html#axzz4L49XnYNB>

⁹ <http://www.markit.com/Commentary/Get/18122015-Equities-The-rise-of-equity-evergreen-repos>

¹⁰ <http://www.wsj.com/articles/SB10001424052702303843104579170020082914900>

in the macroeconomy contributed to the introduction of the new product. Another example of a problem that was at least partly created as a result of macroeconomic or financial conditions is double and triple-decker hybrid bonds, which were first created in Japan in response to the very low interest rate environment there.¹¹

These examples of supply factors – technology, regulation, the development of other innovations, and changes in macroeconomic and financial conditions – do not represent an exhaustive list, but rather are intended to give you a flavor for the types of things that qualify as supply factors.

Turning to demand factors, financial institutions can offer an array of new products and services, but the products will fail if there is insufficient demand. For example, some of the products listed as examples above, such as triple-decker hybrid bonds, no longer exist or have very small markets because of a lack of demand. As with supply, there are a number of factors that contribute to demand for innovation products and services, including regulation and demographics.

Regulation was listed as a supply factor, but it can also contribute to demand for new products and services. For example, the liquidity coverage ratio requires banks to hold a sufficient quantity of high-quality liquid assets to cover net cash outflows over 30 days. So, if a bank has issued a bond or commercial paper that is coming due within 30 days, the bank will have to hold assets to cover the impending outflow. This created demand for products that would not trigger the requirements of the liquidity coverage ratio. One of the products created to meet that demand was a product called callable commercial paper. This is commercial paper that can be issued for a term, such as three months, but which the issuer can call before it hits 30 days of remaining maturity. That means the banks that issues it can call the paper rather than have to hold assets against the future outflow. In this case the

¹¹ <http://www.wsj.com/articles/SB10001424052702304441404577478663176793708>

regulation created demand for a new product. (It also led to someone supplying the new product.)

Another demand factor is demographics. For example, an important driver of the move toward the adoption of mobile financial services, including mobile banking and payments, has been demographics. A quarterly survey conducted by the Federal Reserve found that as of the third quarter of 2016 only 18 percent of survey respondents over the age of 60 had used mobile banking in the prior twelve months, but 67 percent of respondents under the age of 30 had done so.¹² This result surprises few people, as it fits with the stereotype of the younger generations that have come of age with mobile technology and that are much more comfortable using the technology than the older generation. Similarly, a Federal Reserve Bank of Boston study found that users of Bitcoin and other virtual currencies tended to come from the younger generations.¹³ Financial institutions are not blind to the demands of the younger generation, and they are responding to the demand with innovative products and services that the younger generation wants.

As with the supply factors, these two examples – regulation and demographics – do not represent an exhaustive list, but hopefully give you a sense for the types of things that qualify as demand factors.

Before discussing the depth of innovation, there are a few general observations that warrant attention. First, I presented a series of examples of innovations driven by particular factors, but it is important to remember that what drives an innovation is seldom simple. It is rare, if ever, that you find an innovation with a single supply and a single demand factor. Most products involve a combination of factors; two or more important factors might lead

¹² The Federal Reserve's <http://www.federalreserve.gov/econresdata/consumers-and-mobile-financial-services-report-201603.pdf>

¹³ <http://www.bankofcanada.ca/wp-content/uploads/2015/12/us-consumers-adoption.pdf>

someone to supply a particular product and as many or more factors might lead investors to demand the product.

Second, it is worth noting that this simple framework is micro-oriented, but it allows us to think about innovation in a macro sense as well. While I gave examples of how each factor contributed to a single product, from a macro perspective, one can imagine factors having broader effects. For example, during periods of rapid technological change you might expect increased financial innovation to follow. After periods of significant changes to the macroeconomic or financial landscape, you might also expect a period of rapid innovation. I will come back to both of these points when I talk about FinTech.

Depth of Innovation

To proceed further, I need to introduce the concept of the depth of financial innovation. I find this concept useful for getting a sense of how likely an innovation is to have a profound effect on financial markets. In particular, I think of three different depths of innovation: surface, genuine, and foundational.

Surface innovations

Surface innovations are innovations that do not change the fundamental nature of the product or service but perhaps a superficial element. By their nature, these innovations are not very deep. Most financial innovations occur at this level.

Earlier I mentioned callable commercial paper, i.e. commercial paper that could be called back by the issuer before it hit 30 days of remaining maturity. This is an example of a surface innovation. The innovation is the addition of a callability feature to commercial paper. The addition of callability does not change the underlying product, which is still commercial paper. The users and uses of the product are not likely to change significantly. The issuers are likely to remain the same. The overall risk profile of the product changes only slightly. Another example of a surface innovation might be a new securitization that changes

the structure of the securitization, but at its core, the underlying product is still a securitization.

Genuine innovations

A genuine innovation is one that changes the fundamental nature of a product and thus introduces a genuinely new product or service. This type of innovation is ‘deeper’ than surface innovations. Obviously the number of different financial products and services is relatively small, which suggests that genuine innovation occurs less often, or at the very least that it is not successful as often, than surface innovation.

Some historical examples of genuine innovation might include the first time a bond¹⁴ or a share of stock was issued¹⁵ or the first time a life insurance contract was written.¹⁶ At the time, these were new products that did not exist before and were not simply minor changes to existing products.

More recent examples of genuine innovation exist. For example, credit default swaps were the first product that allowed investors to value and hedge the credit default risk of a company.¹⁷ While the underlying product was a swap, it was significantly different from other swaps, which were used to trade different income streams. The concept of swapping the credit risk of a company was a genuinely new concept. As another example, the first time someone pooled and securitized a group of assets, the result was a genuinely new product.

¹⁴ Historians report that the first recorded bond issuance occurred over 4000 years ago. Bonds that might be recognizable by modern financiers began to emerge in the 12th century, and the first official government bond issuance was conducted by the Bank of England in 1693.

¹⁵ The first share issues in joint-stock companies were conducted in the late 16th and early 17th centuries by the English East India Company and the Dutch East India Company.

¹⁶ The first life insurance contracts were written in the early 18th century by the Amicable Society for a Perpetual Assurance Office.

¹⁷ https://en.wikipedia.org/wiki/Credit_default_swap

Foundational innovation¹⁸

The deepest level of financial innovation is significant innovation to the infrastructure and other underpinnings of the financial system. I refer to this as foundational innovation, and it occurs extremely rarely. If such innovation occurred frequently it would be hard for financial markets to operate, because markets need stable underpinnings for normal functioning.

Historically, examples of foundational innovation might include the creation of banks and the banking system, the introduction of double entry bookkeeping, or the formation of a corporation. Each of these changed something fundamental about the way the financial system was structured. None of these innovations were financial products themselves, but rather were the foundation on which products and services were built.

More recently, changes to the central clearing process that occurred in the 1970s and 1980s might qualify as foundational innovation. Until that time, many exchanges did their own clearing, but as the volume of transactions grew, dedicated organizations took over clearing and settlements of many products.

General remarks on the depth of innovation

I have described three levels of innovation: surface, genuine, and foundational. I have presented them as distinct categories, but in actuality it is probably more a continuum. We can often argue about whether an innovation is a surface innovation or a genuinely new product. For example, were the changes to clearing and settlement in the 1970s really a change to the foundation of the financial system? Did the introduction of credit default swaps represent a surface innovation to a traditional swaps contract or were they a change in the nature of a swap and hence a genuine innovation.

¹⁸ In the work on which this essay was founded, I referred to this as infrastructure innovation.

The point of this discussion is not to categorize every innovation into exactly one of the three buckets, but rather to think about how deep an innovation is. I argue that the deeper an innovation is, the more likely it is to have a profound effect on the financial system. One reason for that is because the deeper an innovation is, the more likely that further innovation can be built on top of it.

To see this, take the example of commercial paper. Earlier I mentioned the introduction of callable commercial paper. It is possible that someone could add another feature to callable commercial paper, like put-ability. It is not clear that the addition of a feature makes the product more or less desirable, and hence its market may get smaller.

On the other hand, if you have a genuinely new product, further innovation can more easily be built on top of it. For example, following the first securitizations, we had securitizations of different types of assets, we had indexes of securitizations, we later had securitizations of securitizations, options on securitizations, etc.

Now, if you change the underlying foundations of the financial system, then you can expect a much broader range of possibilities. The foundation supports all of the different products and services. When you change the foundation, you change all of the possibilities. With the creation of the first bank, the possibility of saving accounts, checking accounts, home mortgages, and bank notes were also introduced, and then surface innovations were made on top of those products.

Why did the FinTech phenomenon occur now?

Now I will turn to the first question that I said I would address in this paper, “Why is FinTech happening now?” To do this, let’s think about FinTech in terms of its supply and demand drivers.

When we consider the supply factors that have allowed firms to introduce FinTech innovations, the first thing that comes to most people’s minds is technology. The word itself

(Fin-TECH) and the definition I gave make this obvious. With most FinTech innovations, the use of technology allows firms to offer new products and services that were not possible before (or were possible but no one had thought to use them yet). However, the application of technology to financial services is not new. Automated teller machines were introduced in the 1960s and they fit the definition of FinTech, even though it's likely no one used that term at the time. More recently, high frequency trading (HFT) is an innovation that was driven in part by technology.

Importantly, FinTech innovations are not the first innovations or set of innovations that involved technology. What is different, however, is the cluster of innovations at the present time that are utilizing technology. That volume of technology-enabled innovation is what has drawn attention to itself and has resulted in us assigning a word to it – FinTech. So, to answer the question of why FinTech is occurring now, we need to look beyond just technology as a driver of supply. I will not attempt to enumerate every supply factor that played a role in the emergence of Fintech, but I will offer up some candidates.

First, following the global financial crisis, the financial landscape changed quite a bit. Regulatory burdens were increased and risk aversion rose. In response, banks pulled back from some lending activities. With banks pulling back, some entrants entered the marketplace with innovative products that used technology to overcome some of the advantages that incumbent banks had – like their network of branches. For example, it was this mix of factors that helped peer-to-peer lenders get a foothold, as some of the earliest peer-to-peer lenders catered specifically to borrowers that banks were pulling back from, like small businesses and riskier consumers.

Another supply factor that contributed to the development and adoption of FinTech innovations was macroeconomic conditions, and specifically the low interest rate environment. That environment put downward pressure on profits and increased the

incentives of financial institutions to cut costs. Technology can often be a way to help cut costs, and FinTech entrepreneurs have focused on this.¹⁹ For example, blockchain companies have attempted to offer solutions that will speed clearing and settlement and therefore reduce costs²⁰, and online marketplace lenders have streamlined traditional loan underwriting processes in order to reduce costs.²¹

Turning to demand factors, I will again mention just a few. One of those factors is the increasing prevalence of mobile technology. The advent of smartphone technology created demand for new products and services to match the increasingly mobile lifestyle that smartphones enabled. Mobile payment technologies, online banking, and online brokerage products are all FinTech innovations that fill that new demand.

Another demand factor is demographics. An important driver of demand for FinTech innovations are millennials who demand convenient access to their financial accounts, assets, and services. For example, surveys show that millennials are far more likely to use nontraditional financial service providers (for example Apple and Google), to get online financial advice, or to use a digital currency like Bitcoin.²²

With this very brief review of some of the supply and demand factors that are driving FinTech, I hope that two things are clear. First, the fact that technology is a driver of FinTech does not make FinTech different. Technology has been a part of financial innovation for a long time. Second, FinTech is driven by a collection of supply and demand factors. What made FinTech occur was the combination of a number of supply and demand factors at the same time. First, there was new technology, like smartphones and the internet, that was not

¹⁹ A frequently cited report on the potential cost savings of FinTech is a joint report by Santander InnoVentures, Oliver Wyman, and Anthemis Group: <https://www.finextra.com/finextra-downloads/newsdocs/the%20fintech%20%20%20paper.pdf>

²⁰ There are many examples of these claims. Here is one: https://ripple.com/files/xrp_cost_model_paper.pdf.

²¹ There are many examples of these claims. Here is one: <http://www.morganstanley.com/ideas/p2p-marketplace-lending/>.

²² See for example: <http://www.fico.com/millennial-quiz/pdf/fico-millennial-insight-report.pdf> and <https://www.telstraglobal.com/millennials/assets/gated-content-millennials-mobiles-money.pdf>.

yet fully utilized by financial services providers. Second, we experienced a period of significant changes in the global financial system and macroeconomy. Third, in response to the changes to the financial landscape and the macroeconomy, new regulation was implemented and financial institutions changed their business models. Because so many factors came together in a relatively small period of time, we got a cluster of financial innovations and we gave that cluster of innovations a name – FinTech.

Why is there so much hype around FinTech?

Now I will turn to the second question that I said I would address in this paper, “Why is there so much hype around FinTech?” Innovation is a constant process, so there are always innovations people could get excited about. However, in the case of the FinTech phenomenon, people are excited because of the potential for these innovations to transform the financial system.²³ To understand this transformative ability, and hence the hype about FinTech, let’s think about FinTech in terms of the depth of the innovations that comprise it.

Financial institutions regularly offer new products and services. For the most part, the new products offered arise from surface innovations. The underlying product is the same, but some of the features of the product are changed slightly. Even some of the earlier FinTech innovations could be viewed as surface innovations. For example, online banking was not a new product, but rather a new feature added to existing bank accounts.

More recent FinTech innovations, on the other hand, have consisted of many more offerings that were truly genuine. For example peer-to-peer lenders allow investors to invest directly in the businesses or personal loans of other people. Prior to this, it was difficult or impossible for a retail investor to lend money directly to someone, except through informal channels. With equity crowdfunding, a retail investor can now directly invest in a small

²³ Some people use the term ‘disrupt’ instead of ‘transform’. This term comes from the business literature on innovation, but it carries with it a negative connotation for most economist. I prefer the term ‘transform.’

company. While the underlying concept of a loan or an equity investment is not new, offering these products directly to a retail customer is new, and I would argue that these represent genuine rather than surface innovations. Privately issued digital currencies, like Bitcoin, are another example. These currencies are not just a slight change to an existing method of payment. Instead, they offer people the ability to make transactions without a government-backed currency and without a trusted third party. This seems, at the very least, to be a genuine innovation.

Some of the FinTech innovations go deeper. Distributed ledger technology is the technology that underlies bitcoin. At its heart, it is a secure way of storing data that makes it largely unchangeable (or immutable in the language of blockchains). With this technology, we can store information about a history of transactions in a decentralized way. If we think about distributed ledger technology in terms of the depth of the innovation, I think most people will agree that it is a foundational innovation.

Like double-entry bookkeeping and other foundational innovations, distributed ledger technology is not a product on its own, but rather it forms the underpinning on which products and services are built. Bitcoin was the first product built on top of it, but many companies are currently developing products and services on a distributed ledger foundation. One company built and is operating a blockchain platform that NASDAQ is using to issue non-public shares.²⁴ Another company has used the blockchain to issue corporate bonds.²⁵ Many FinTech startups and incumbent financial institutions are developing proofs of concept for additional products and services that can be built on top of a distributed ledger foundation.²⁶

²⁴ <http://ir.nasdaq.com/releasedetail.cfm?releaseid=948326>

²⁵ <http://www.nasdaq.com/article/overstocks-t0-reconciling-fiat-currency-and-the-bitcoin-blockchain-cm555617>

²⁶ There are many examples of this. Here are a few examples: repo (<https://www.cryptocoinsnews.com/digital-asset-dtcc-partner-form-blockchain-repo-clearing/>), FX swaps (<https://www.finextra.com/pressarticle/64233/opengamma-and-clearmatics-demo-blockchain-poc>), trade

In addition to some of these traditional products being developed using distributed ledger technology, other more novel products, that would themselves be genuine (or perhaps foundational) innovations, are also being considered. Smart contracts are computer programs that can automate the execution and enforce the satisfaction of the conditions of a contract. If distributed ledger technology becomes prevalent, smart contracts could be written onto distributed ledgers, thus automating a significant portion of the financial system. Smart contracts, like distributed ledgers, are not really a product on their own but a foundation on which you can build other products. Once you introduce smart contract, you open up the possibility of other innovations, like organizations run by a set of rules written into smart contracts (known as decentralized autonomous organizations (DAOs)).

Summary and Conclusion

When thinking about financial innovation, it is useful to think about the factors that are driving it. This is particularly useful when you think about innovations in a macro sense and not just on an individual micro basis. On a micro basis, individual FinTech innovations do not appear to be much different from other financial innovations. However, on a macro basis, looking at the drivers of FinTech helps us understand why there has been this cluster of technology enabled innovations that we call FinTech.

Thinking about the depth of innovation is important if you want to get a sense for how profound the effect of the innovation may be. By thinking about the depth of innovation, we can better understand why there is so much hype surrounding FinTech. Because much of FinTech represents deeper innovations – innovations that are genuine or even infrastructure innovation – their potential to have transformational effects on the financial system are much greater.

finance (<https://www.ida.gov.sg/About-Us/Newsroom/Media-Releases/2016/BofAML-HSBC-IDA-Singapore-Build-Pioneering-Blockchain-Trade-Finance-App>), and syndicated loans (<https://www.credit-suisse.com/us/en/about-us/media/news/articles/media-releases/2016/09/en/blockchain-demonstration-shows-potential-loan-market-improvements.html>).

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