How Disruptive are Fintechs?

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Abstract

Will the application of technological innovation to finance disrupt financial intermediation? Which are the foreseeable effects on financial markets efficiency, competition, organization of transactions and risks? Which are the challenges and opportunities facing prudential regulation and supervision? Based on the literature on Microeconomics of Banking, Industrial Organization and Transaction Cost Economics we discuss some potential impacts of the proliferation of fintechs.

Keywords: fintech, financial intermediation, efficiency and competition in financial markets, contractual risk, market-based and intermediary-based financial transactions, prudential regulation, supervision.

JEL classification: G10, G20, L10.

1. INTRODUCTION

The emergence of innovative technological platforms is challenging financial intermediation and financial markets practices through various modes and channels, as well as regulatory scopes and instruments not only in banking but also in other intermediaries. The Financial Stability Board defines fintech as a "technologically enabled financial innovation that could result in new business models, applications,

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processes, or products with an associated material effect on financial markets and institutions and the provision of financial services."

Fintech developments can be seen as disruptive innovations, particularly those which have the following sources: automated financial services that transform market liquidity and private markets that create alternatives for traditional financing and trading (for example: dark pools, trading platforms, crowdfunding websites, electronic networks, and so on). According to the World FinTech Report 2017 (Capgemini et al., 2017), the rise of fintech has been aided by a perfect storm, created by increasing customer expectations, expanding venture capital funding, reduced barriers to entry, and increased pace of technological evolution.

In order to analyze the potential impact of the fintech on banking, financial markets, and regulation, it is convenient to get back to conceptual fundamentals about the rationale for the existence of financial intermediaries, the reasons behind their coexistence with financial markets, and the justification of financial regulation and oversight. On those grounds, the microeconomics of banking literature may shed relevant light. Additionally, traditional industrial organization models may serve to foresee possible implications on the structure and efficiency of financial markets and intermediaries. Moreover, the transaction cost economics framework may be fruitful to contribute in the understanding of the process and the possible evolution of the governance structure of financial transactions. Issues such as asymmetric information and contractual risks, as well as the ability of adaptation by incumbent financial intermediaries, become crucial in the analysis.

Will the application of technological innovation to finance disrupt financial intermediation? Only time will tell. At this stage, however, one can stress that we are assisting to some kind of revolution in technological developments that may be applied to finance; mostly due to the speed of technical change and communication that are common to a more general digital

revolution. No doubt financial systems, intermediaries like banks and insurances companies in particular, but also security markets, would need to evolve more or less quickly in response to the challenges imposed by technical advance, as well as to profit from the opportunities for it generated. But, so far it is not obvious that some of the fundamental rationales behind the existence of financial intermediaries will be disrupted by the kind of fintech developments we are seeing.

Relative to traditional financial intermediaries, fintech platforms' heavy digitalization of processes and specialized focus may lower transaction costs and entail convenience for end users. It may also increase access to credit and investments for underserved segments of the population or the business sector, particularly in less developed countries, where traditional financial intermediation (for example: banking and insurance services) keep uncovered an ample range of potential customers. Other things equal, a continuous reduction in transaction costs may impose increasing competitive pressure on traditional financial intermediaries. Moreover, competitive pressure would increase dramatically if fintech companies manage to growth and develop new varieties of financial products which are closer to consumers' needs. And it would be particularly the case if these companies start doing financial activities which are at the core of financial intermediation. However, incumbent financial intermediaries would react to the challenges introduced by fintech, since technological innovation also embodies opportunities on transaction costs reduction, which may be profited by traditional financial intermediaries. Yet, other possible outcome on the changing market structure is that traditional financial intermediaries vertically integrate fintech startups. Indeed, incumbent financial intermediaries have good incentives in so doing, as well as information about customers and deep pockets.

Taking into consideration the effects on reducing information asymmetries in some cases and informational costs and entry barriers in others, we analyze the declining benefits for

conducting financial transactions with an intermediate level of contractual risk through traditional financial intermediaries and the increasing role of innovative financial arrangements which are closer to markets. Nevertheless, that does not necessarily imply that traditional intermediation (for example: banks, insurance or security markets) will reduce their participation in the financial arena, given their systematic ability to adapt to changing circumstances, particularly when driven by technological change. We also argue that those impacts will not be homogeneous among all kinds of financial activities, since the remaining contractual risk of some of them would be higher than others due to, for instance, the different needs for solving asymmetric information problems and monitoring different types of projects.

An additional relevant issue is related to financial regulation and supervision. Fintech poses several challenges to regulation and supervision of financial systems. But it may also represent opportunities for gaining efficiency on these activities. Among the main reasons why regulation and supervision in this new framework is particularly challenging are the high speed at which fintech developments occur and its experimental nature. A significantly large share of fintech activity in the financial system could present a mix of financial stability benefits and risks in the future. Hence, fintech regulation should adopt different forms in order to balance the potential tradeoffs between innovation, new products, new ways to deliver existing products, efficiency gains and financial inclusion in the one hand and, in the other hand, the market failures, externalities and systemic risk that justifies prudential regulation and supervision. The emergence of fintech challenges the scope and ability of regulatory frameworks and each new development has to be assessed from a regulatory standpoint; that is, understanding the object to protect, whether or not they constitute financial intermediation, and how they potentially affect systemic risk.

The rest of the paper is organized as follows. Section 2 presents a broad description of the most important fintech developments. In Section 3 we revise banking literature which is useful to assess whether fintech would or not disrupt financial intermediation. Section 4 analyses the potential impacts on the financial markets' efficiency and competition from an industrial organization perspective. Section 5 considers the financial transaction and its remaining contractual risk as the unit of analysis in order to foresee the fintech's effects from a transaction cost economics perspective. In Section 6, we discuss the challenges and opportunities in terms of risk management, financial regulation and supervision. Some concluding remarks are in Section 7.

2. FINTECH: WHAT ARE WE TALKING ABOUT?

Technologically enabled financial innovations (fintechs) are capturing large attention among practitioners, regulators and academics due to their material effect on financial markets and institutions. For centuries, technological progress has been an important force in the transformation and development of finance. For almost one thousand years technological innovation like bank deposits, double-entry book keeping, central banks and securitization have made finance to evolve. Nowadays, an apparent difference with previous processes is speed. Technological innovation has accelerated dramatically with the rapid advances in digital and communication technologies. As a result, the financial services landscape is transforming rapidly, which creates opportunities and challenges for consumers, service providers and regulators alike.[1]

[1] Total global investment in fintech companies reportedly increased from 9 billion dollars in 2010 to over 25 billion dollars in 2016 according to He et al. (2017). The phenomena is not only present in well stablished financial centers, like London, New York, and Singapore, but it is global. For example, a recent

Fintech activity varies significantly across and within countries do to heterogeneity in the business models of fintech platforms. Although fintech credit markets have expanded at a fast pace over recent years, they currently remain small in size relative to credit extended by traditional intermediaries. However, it may have much larger shares in specific market segments. For example, in the United Kingdom, fintech credit was estimated at 14% of equivalent gross bank lending flows to small businesses in 2015, but only 1.4% of the outstanding stock of bank credit to consumers and small and medium enterprises as of end-2016 (Zhang et al., 2016).

Recent years have witnessed a rise in automation, specialization, and decentralization, while financial firms have found increasingly efficient and sophisticated ways of leveraging vast quantities of consumer and firm data. Overall, the financial services sector is poised for change. However, it is hard to figure out whether the change will be disruptive, revolutionary or evolutionary. The final outcome would depend on the relative power of technological innovations not only to reduce transaction costs and improve efficiency in financial services, but also to challenge the fundamental rationales behind financial intermediation, risk management, and regulation.

At the individual service provider's level, the outcome would also depend on how companies incorporate technology as a way to enhance their business and keep flexible. The case of Kodak in the photography industry may help to illustrate this point. Kodak was a company founded in 1888 and considered a synonymous with taking pictures. In 1996 it was ranked the fourth most valuable brand in the United States, behind Disney, Coca-Cola and McDonald's. In 2012, Kodak filed for bankruptcy. So, what happened? Paradoxically, what happens was that they had invented the digital camera in 1975. Kodak focused on the product, that is film, instead of on the value customers got

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survey by the Inter-American Development Bank (2017) identifies 703 fintech startups in Latin America and the Caribbean.

from that product. When a new technology, the digital camera, replaced film, Kodak was so focused on film that they failed to recognize the value of digital until they had no other choice.

The last decades have witnessed the development of a broad range of technological innovations with potential applications to finance:

- *Artificial intelligence and big data* refers to the creation and maintenance of huge databases containing the characteristics and transactions of billions of economic agents, and their use through advanced algorithms to derive patterns. In turn, these patterns may be used to predict behavior and prices, to target offers, and to mimic human judgment in automated decisions. Applications to finance would include a series of new, more efficient processes for credit allocation and risk management (for example: automated investment advice and credit decisions), algorithm-based asset trading, as well as facilitate regulatory compliance and fraud detection.
- *Distributed ledger technology*, also known as *blockchain,* allows that ledgers, like records of transactions or ownership of assets and liabilities, be maintained, validated and updated securely by network's users themselves rather than by a central repository. All changes are encrypted in such a way that they cannot be altered or deleted without leaving a record of the data's earlier state. Although the blockchain originally sought a foothold in financial services, and digital currencies attracted early attention from investors, now interest in using the technology in the public sector is growing. Potential uses of this kind of technology largely exceed financial systems and include, for example, personal data recording and digital government. At the present, Estonia is the only country in the world in which its residents carry a public key infrastructure card, which grants access to over 1,000 electronic government services, ranging from public notary services to electronic patient records. But other countries are also starting blockchain programs; some

examples are Dubai, Georgia, Honduras, Sweden, and Ukraine. The distributed characteristic of this technology makes it inherently resilient to cyberattacks because all the copies of the database would need to be simultaneously hacked for the attack to be successful. Overall, distributed ledger technology provides a framework to reduce fraud, operational risk, and cost of paper-intensive processes at the same time of enhancing transparency and trust. Related applications to finance could drastically reduce the cost of back-office and recording activities. Its use may also transform payment and securities settlement, and allow direct business-to-business transactions competing with traditional intermediaries. One well known application of this technology are digital-, crypto- or virtual-currencies, as for example the bitcoin.

- *Cryptography and smart contracts*, together with biometrics, have the potential to create more robust security systems. Smart contracts set a collection of promises in digital form to be executed following certain procedures once some conditions are met; for example, to buy an asset at a certain price. Working together, these technologies may allow the automatic realization of transactions at the same time that security and identity protection are preserved.
- *Internet access and platforms* have spread the gains in transactions cost reduction due to new communications technologies could provide access to a full range of financial services to billions of people through their mobile phones and computers. This massive decentralization is opening the door to direct person-to-person transactions (des-intermediation), and to the direct funding of firms, as *crowdfunding*. The use of these technologies may also have deep implications for financial inclusion of excluded-from-traditional-intermediaries consumers, especially in less developed countries.[2]

[2] Most of the fintech developments in Latin America and the Caribbean fall into this category of financial innovation. In

Fintech innovations are traditionally overlapping and mutually-reinforcing. For instance, distributed ledger technology relies on big data and smart contracts for effective validation and distribution of ledgers, which in turn are used by online applications, as digital wallets through smart phones, to settle payments in points of sale. This kind of complementarities, which are common to finance and communications technologies, imply network effects that, in turn, may determine a non-linear growth of new applications.

3. FINANCIAL INTERMEDIATION: DISRUPTION, REVOLUTION OR EVOLUTION?

Will the application of technological innovation to finance disrupt financial intermediation? No doubt financial systems would need to evolve more or less quickly but at the current stage it is not obvious that some of the fundamental rationales behind the existence of financial intermediaries will be disrupted by the kind of fintech developments we are seeing.

As is true with any other institution, the existence of financial intermediaries is justified by the role they play in the process of resource allocation, capital allocation in particular. Financial intermediaries specialize in the activities of buying and selling (at the same time) financial contracts and securities. A first justification to the existence of financial intermediaries is the presence of frictions, as for example the transactions costs, in transactions technologies. If we think of financial intermediaries as other retailers (perhaps brokers and dealers operating on financial markets are the closer example), then fintech applications will challenge this rationale by drastically reducing transaction costs. The closer comparison to figure out the potential impact on this kind of intermediation is with internet retailers and e-commerce. It is conceivable that the

particular, this is the particular case of Uruguay, where recently created fintech firms offer platforms for person-to-person lending and to online payment services.

full range of services currently offered by brokers and dealers could be at least partly supplanted by new technologies. It is also possible that new entrants increase competition in certain segments and even replace some of the incumbents.

However, the activities of other financial intermediaries are in general more complex. First, banks and insurance companies, for example, usually deal with financial contracts that cannot be easily resold as could be loans and deposits. Hence, these intermediaries must hold these contracts in their balance sheets until the contract expires. However, recent uses of securitization and structured products lead to an *originate and distribute* business model through which illiquid assets may be put off-balance sheet of financial intermediaries. Second, the characteristics of the contracts issued by borrowers are generally different from those of the contracts desired by depositors. Hence, financial intermediaries differ from common retailers because they also perform the transformation of financial contracts with regard to their denomination, quality and maturity.

According to Freixas and Rochet (2008), the simplest way to justify the existence of financial intermediaries is to emphasize the difference between their inputs and their outputs, and view their main activity as transformation of financial securities. Financial intermediaries can therefore be seen as coalitions of economic agents who exploit economies of scale or economies of scope in the transaction technology. The origin of these economies of scale and of scope may lie in the existence of transaction costs. For example, the management of deposits by banks starts in close relation to the more primitive activity of money changing. Having already a need for safekeeping places for their own money, old age bankers could easily offer the service to merchants and traders; that is, there are economies of scope between money-changing and safekeeping deposits. Economies of scale may be present because of fixed transaction costs, or more generally increasing returns in the transaction technology.

While transaction costs related to physical technologies may have played a historical role in the emergence of financial intermediaries, the progress experienced in digital technologies may deeply challenge this rationale for the existence of financial intermediaries. However, there is other form of transaction costs, maybe more fundamental, which are not clear to be reduced by fintech innovation to the point of disrupting financial intermediation. In finance, specific forms of transaction costs may stem from market imperfections generated by informational asymmetries; that is, adverse selection, moral hazard and costly state verification. Financial intermediaries may, at least partially, overcome these costs by exploiting economies of scope and of scale in information sharing, monitoring and providing liquidity insurance.

The existence of adverse selection, situations where borrowers are better informed than investors about the quality of the project they are looking to get financed, can generate economies of scale in the lending-borrowing activity. Leland and Pyle (1977) show that borrowers may partially overcome the adverse selection problem by self-financing part of the project. However, if borrowers are risk averse, this signaling is costly because they need to retain a substantial fraction of the risk. In this case, a financial intermediary under the form of a coalition of borrowers is able to obtain better financing conditions than individual borrowers by exploiting the economies of scale due to the transaction cost in information sharing: the signaling cost increases less rapidly than the size of the coalition. Still in the context of adverse selection, coalitions of heterogeneous borrowers can also improve the market outcome by providing cross-subsidization inside the coalition and exploit economies of scope in screening activities (Broecker, 1990). Some of the fintech developments we have been seeing to date may actually favor, rather than challenge, this view of financial intermediation by reducing the costs, in terms of time and money, of communication, information sharing and data verification. At the same time, it is difficult to visualize ways in which the

new technologies described in the previous section may serve to circumvent by themselves the adverse selection problem.

Similar observation may follow when one considers other fundamental rationales for financial intermediation. For example, when borrowers are opportunistic agents, then moral hazard and costly ex post verification may be a concern. In this case, monitoring may be a solution. Monitoring activities typically involve economies of scale, which in turn imply that is more efficient that such activities be performed by specialized entities. Therefore, individual investors would like to delegate monitoring activities to such a specialized agency. The concern now is that, if monitors are self-interested, they have to be given incentives to do the job properly. Several explanations suggest that financial intermediaries provide solutions to this incentive problem. First, Diamond (1984) argue that the optimal arrangement will have the characteristics of a bank deposit contract and that, by diversifying the loan portfolio, the financial intermediary can make the cost of monitoring as small as possible, getting close to offering riskless deposits. Second, Calomiris and Kahn (1991) show that the potential of withdrawing demand deposits provides an adequate instrument for disciplining bankers. Third, Holmström and Tirole (1997) argue that there are informational economies of scope between monitoring and lending activities, which explain the role of bank capital. Diamond and Dybvig (1983) argue deposit contracts offered by a financial intermediary outperform the market allocation in an economy in which agents are individually subject to independent liquidity shocks.

Fintech developments may facilitate direct finance of firms, in particular small ones, and households, then increasing competitive pressure on financial intermediaries. It may also serve to incorporate to financial circles agents that were excluded to the moment. This may occur due to the reduction in costs of communication and data process, as well as record keeping. Big data and internet of things help providing targeted and differentiated financial product, making offers more attractive

and effective. However, opportunistic behavior reasons which prevent firms without enough assets or reputation to obtain direct finance will continue to hold and intermediate finance seems to be the available alternative. In spite of fintech developments, financial intermediation is likely to continue coexisting with direct finance.

To date, most of the developments introduced by fintech firms are related to payment systems, electronic money and wallets and peer-to-peer lending. The enormous reduction in communication costs, the huge networks of users of social nets (where users are more fans that customers), and the image created by some *tech* firms put them in a strategic position to offer this kind of *financial* products. Examples are money transfers through Facebook Messenger, the electronic payments through Amazon Pay, and the electronic wallet of Alibaba. Certainly, these services directly compete with similar ones historically provided by banks and other traditional financial companies. But the latter still have the advantage of being visualized as more secure and trustful –in part thanks to huge investments in cybersecurity–, while the former still need to reinforce this issue, in particular because they would be a profitable objective to hackers. And banks are using fintech developments to reduce the cost of money transfer. Barclays, for instance, uses *Bitcoin* subsidiaries to transfer money between different jurisdictions, reducing considerably the time and cost of the transactions.

Other financial intermediation activities, as deposit and lending, require financial resources and information. Both traditional banks and internet companies, as Google, have both types of resources; perhaps one group has different kinds of maybe complementary information with respect to the other group. For the moment Google is providing payment services through Google Wallet and Android Pay, but the company also holds bank licenses in several countries. Should Google starts banking operations will increase considerably competition to traditional banking. Certainly, the way in which information

is collected, processed and used to make financial decisions would change, the mechanisms through which the asymmetric information problems that justify financial intermediation are mitigated would be different, and the channels through which financial products are commercialize would be revolutionized. However, the rationales justifying the core banking activities seems not to be challenged by this evolution on banking practices and use of technology and information.

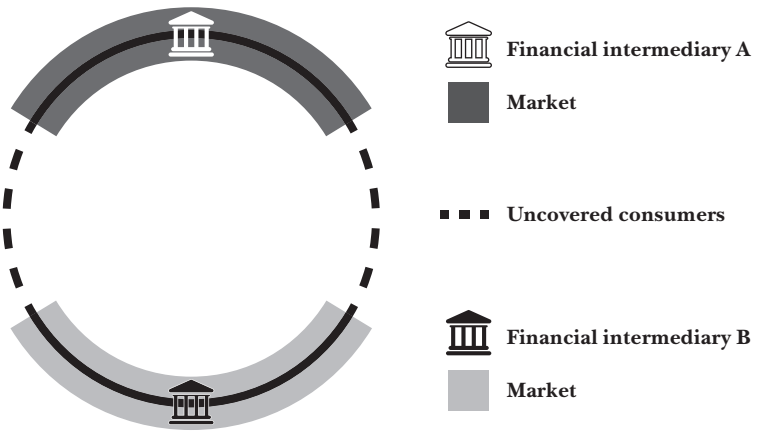
4. EFFICIENCY AND COMPETITION: AN INDUSTRIAL ORGANIZATION PERSPECTIVE

Relative to traditional financial intermediaries, fintech platforms' heavy digitalization of processes and specialized focus may lower transaction costs and entail convenience for end users. It may also increase access to credit and investments for underserved segments of the population or the business sector. Traditional financial intermediation –banking and insurance services, for example– keep uncovered an ample range of potential customers. This is particularly relevant in less developed countries. According to the Global Findex 2014 database of the World Bank, only 49% of the population holds bank accounts and other figures of bankarization fall considerably when bank credit and saving, as well as insurance instruments are considered. Costs, strategic decisions of financial services providers and market structure may explain the relatively low degree of financial inclusion. But preferences of potential customers and attitudes towards traditional banking and related financial services could also serve as explanation; sometimes, for instance, low income households perceive traditional financial services as being too far away of their needs or simply are unaware of their existence.

A modeling shortcut to represent this kind of situation is to assume that all customers get the same utility from consuming financial services but that customers are heterogeneous on the cost they borne to access the services. Hence, some customers

Figure 1

TRADITIONAL FINANCIAL INTERMEDIATION WITH UNCOVERED CUSTOMERS



are relatively closer than others to traditional financial services (although not necessarily in physical terms) in the sense that they have to pay lower transportation costs, or more generally, transaction costs. A simple way to graphically represent this situation is own to Salop (1979): an infinite number of consumers are uniformly distributed on a circle, while a finite number of traditional financial services providers are established equidistantly on the same circle, and the transaction cost of each customers to access financial services is proportional to the distance to the specific provider. Figure 1 represents a situation with two traditional financial intermediaries in a financial market where, as empirical evidence suggests, part of the market is uncovered.

Digital technologies applied to financial services reduce transactions costs. In particular, internet access and mobile technologies have spread the gains in transactions cost

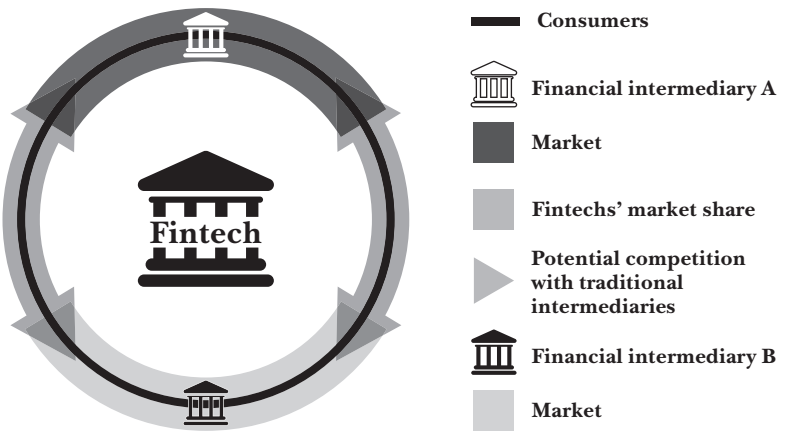
reduction due to new communications technologies to billions of people. Mobile phones users could now reach access to a full range of financial services directly from their own devices. The familiarity on the use of internet, social networks and e-commerce facilitate the offer of financial products through similar channels. Moreover, big data analysis and internet of things help fintech companies to tailor financial products in order to better fix potential customer's needs. All these factors imply that fintech's offers seem to customers much closer to their demands than the substitute products offered by traditional intermediaries; so, transactions costs fall. In turn, this may have deep implications for financial inclusion of excluded-from-traditional-intermediaries consumers, especially for products that are closely related to payment systems, but also on peer-to-peer lending. This kind of situation is exemplified in Figure 2 where the reduction on transaction costs allows a fintech company to financially include customers at the same time of competing with the existing offers by traditional intermediaries.

Through the world, we have been living in this scenario in recent years, which is likely to continue deepening. A clear example of this can be found in the segment of payment systems and remittances. WeChat Pay, the mobile payment platform which is an extension of the messaging app WeChat, is big in China. M-Pesa, a digital wallet, makes possible the financial inclusion of thousands of people in Kenya by allowing them to send and receive money, pay bills and transact easily through mobile phones. In Latin America, the segments of payments and remittances, lending, scoring, identity and fraud lead the offer of fintech.[3] In recent years, Latin American fintech entrepreneurship has grown at a rate of around 50% to 60% and has drawn the attention of international investors and corporates through investment rounds in startups or strategic partnerships.

[3] See Finnovista at <https://www.finnovista.com/fintechradar-foreignstartupslatam2018/?lang=en>.

Figure 2

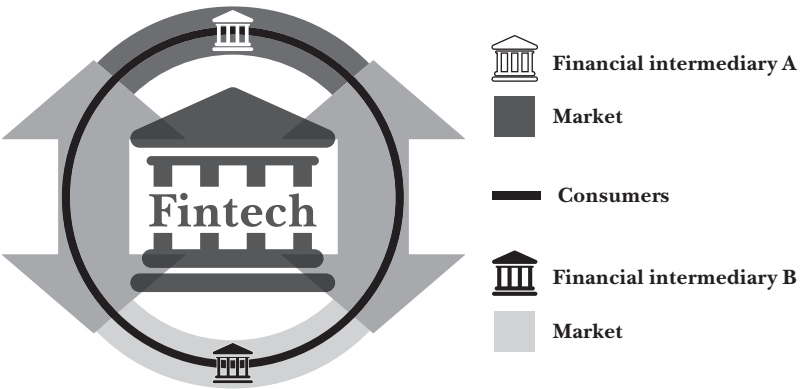
REDUCTION IN TRANSACTION COSTS DUE TO FINTECH ALLOWS FINANCIAL INCLUSION



Other things equal, a continuous reduction in transaction costs may impose increasing competitive pressure on traditional financial intermediaries. To start with, fintech innovation helps to reduce barriers to entry. Moreover, competitive pressure would increase dramatically if fintech companies manage to growth and develop new varieties of financial products which are closer to consumers' needs. And it would be particularly the case if these companies start doing financial activities which are at the core of financial intermediation. For instance, imagine that a company with access to large datasets about customers and technical capabilities to analyze this big data does enter in banking activities, for example: by granting loans financed with bank deposits. It is highly probable that the comparative advantage in the access and use of information determines a competitive advantage for this company due to a significant reduction on the transaction costs imposed by asymmetric information.

Figure 3

FINTECH'S ACTIVITIES MAY CHALLENGE TRADITIONAL INTERMEDIARIES

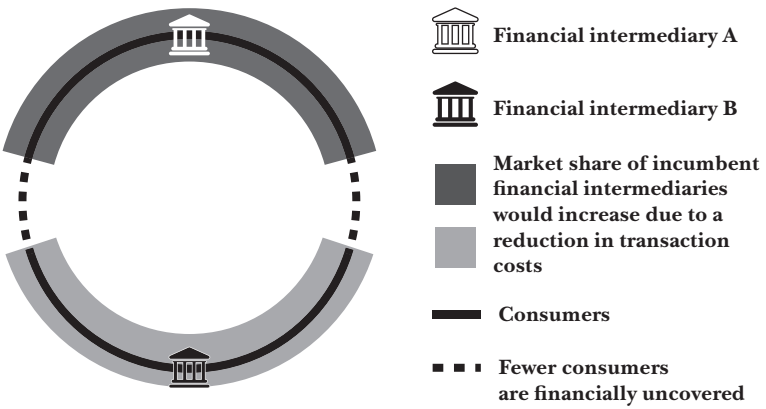


A situation like the detailed in the previous paragraph is represented in Figure 3. However, it is worth noticing that such a situation would challenge traditional intermediaries but not necessarily financial intermediation. In other words, we should assist to a different form of financial intermediation where the channels would be more digitally than physical, and the financial products more tailored than standard.

The world is not yet in this scenario of strong competition and big challenge to traditional intermediaries. Nevertheless, the rapid pace of financial innovation might imply the occurrence of a situation like this in the nearby future. Moreover, fully digital banks–that is, without physical branches– have started to appear in different jurisdictions recently, as in Argentina. This new form of financial intermediation plus new business models facilitated by fintech developments are starting to increase competitive pressure over traditional intermediaries.

Figure 4

TRADITIONAL FINANCIAL INTERMEDIARIES WOULD PROFIT FROM FINTECH INNOVATION



However, incumbent financial intermediaries would react to the challenges introduced by fintech companies. Technological innovation also embodies opportunities on transaction costs reduction, which may be profited by traditional financial intermediaries. For instance, distributed ledger technology offers a fast, reliable digital record keeping systems which may bring transformational change to the financial sector by: reducing the cost of small retail money transfer; improving financial inclusion and reducing the costs of remittances; improving back-office functions for securities transactions; and reducing settlement time and risks for securities transactions. In turn, lower transaction costs improve the competitive position of incumbent financial intermediaries. As a result, they would increase their market shares, instead of losing customers, when competition with the fintech companies becomes tougher; a situation represented in Figure 4.

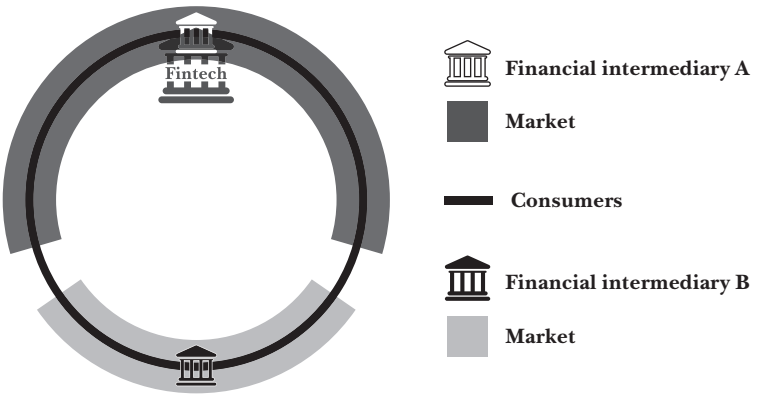
This is a scenario that we are also seeing in practice. Worldwide, traditional intermediaries like banks and insurance companies are incorporating technology and exploiting potential uses of digital innovation. More and more apps, online transactions, new digital products and client tailored offers are improving traditional intermediaries' customer experience.

The final outcome in terms of market structure is hard to anticipate because it will depend of the relative strength of all these competitive forces. Market competition will surely increase (as represented in Figure 3) but the reaction of traditional financial intermediaries may determine that the new market equilibrium will be some combination of the situations depicted in Figures 2 and 4. Overall, more users would be financially included, new digital forms of financial intermediation and new digital products will be available. Hence, new forms of prudential regulation and supervision may be necessary in order to control excessive risk taking that may harm financial customers and the entire financial system, a topic we will consider in Section 6.

Other possible outcome on the changing market structure is that traditional financial intermediaries vertically integrate fintech startups. Indeed, incumbent financial intermediaries have both information about customers and deep pockets. They should also be getting good incentives to change business models and to incorporate digital technologies to their offers. In addition to that, most of them also have long experience on cybersecurity. All these things put them in a very good position to support fintech innovation and to capture its profits through subsidiaries or associated *tech* companies; a situation represented in Figure 5. Indeed, Kelly et al. (2017) report that the relation between fintech and banks is more symbiotic than combative. With partnerships, fintech get to scale their technology and access capital to grow, while financial institutions gain assistance in their efforts to improve product offerings, increase efficiency, and lower costs.

Figure 5

INCUMBENT INTERMEDIARIES WOULD VERTICALLY INTEGRATE FINTECH



In practice, traditional intermediaries are following this way of vertically integrate fintechs. From a policymaker viewpoint, this process opens questions about competition policy and potential new forms of barriers to entry. Fintech's platforms interoperability with the systems of traditional intermediaries, and access and use of customers' information become extremely relevant in order to ensure a fear competitive field that fosters financial innovation in benefit of overall welfare. We will come back over this issue in Section 6.

The financial market landscape is in a state of flux. The final outcome in terms of the financial market structure and competition is certainly difficult to anticipate. However, as long as market power does not rise considerably, the reduction in transaction costs should translate into a more efficient financial system which, in turn, would provide financial services to a large number of customers. All in all, financial inclusion and transaction costs reduction due to fintech innovation would add efficiency and welfare to a larger number of customers.

5. CONTRACTUAL RISK: A TRANSACTION COST ECONOMICS PERSPECTIVE

In the previous section we analyze the financial market from an industrial organization perspective. In this section we consider financial transactions as the unit of analysis and assess the potential effects of fintech through the lens of a Transaction Cost Economics (TCE) perspective.

As developed by Williamson (1996), TCE adopts a contractual approach to the study of economic organization and makes transactions the basic unit of analysis. Refutable implications are derived from the discriminating alignment hypothesis: transactions, which differ in their attributes (frequency, uncertainty, and contractual risk), are assigned to governance structures (firms, markets and hybrid arrangements), which differ in their costs and competencies (incentive intensity, administrative control, use of contract law, and adaptation abilities) in a transaction cost economizing way. TCE places the principal burden of analysis on comparisons of transaction costs–which, broadly, are the "costs of running the economic system" (Arrow, 1969).

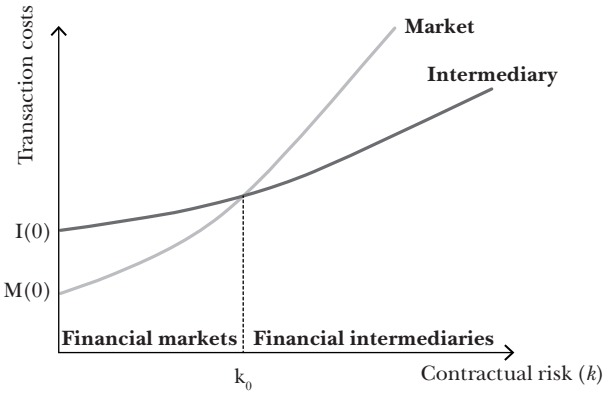
Taking the transaction as the unit of analysis, TCE constitutes an effort to identify, explicate, and mitigate contractual risks, which can be attributed to the twin behavioral assumptions: bounded rationality and opportunism. Both assumptions serve to refocus attention on distinguishing feasible and infeasible modes of contracting, since all contracts within the feasible set are inherently incomplete. In particular, bounded rationality (related to costly information) precludes the capacity to engage in comprehensive ex ante contracting, due to specification, monitoring and enforcement costs. Accordingly, the ex post side of a contract takes on special economic importance: governance responses to mitigate contractual hazards will be guided by the trade-offs between alternative mechanisms of governance with respect to their capacities for autonomous and cooperative adaptation, gap filling and dispute settlement.

Following Coase (1937), firm and markets are alternative forms of organization for managing the same transaction. A variety of factors support firms and markets as discrete structural forms of organizing transactions as opposed to a continuous variation over a spectrum. Williamson (1996) maintains that firms (that is, hierarchies) are not merely a contractual act but also a contractual instrument, a continuation of market relations by other means. The challenge to comparative contractual analysis is to discern and explicate the different means. In the case of financial transactions, whether the transaction is processed through a firm (a financial intermediary) or directly between agents in a financial market (although matched by a fintech) turns largely on the transaction costs of managing the transaction in the financial intermediary, as compared with mediating the transaction through the fintech. This analysis entails an examination of the comparative costs of planning, adapting and monitoring task completion under alternative governance structures. Which transactions go where depends on the attributes of transactions, on the one hand, and the costs and competence of alternative modes of organization, on the other. We will analyze these two dimensions in turn in a simple model inspired by Williamson (1996, Chapter 4).

Financial transactions may differ in several dimensions (for example, in frequency and uncertainty), but maybe the most relevant dimension is their relative contractual risk. Williamson (1996) assumes a reduced form and focus on this differential attribute of transactions. Its immediate consequence related to financial transactions is that a condition of bilateral dependency between lenders and borrowers builds up as contractual risk deepens. The ideal transaction–whereby the identities of lenders and borrowers are irrelevant–is obtained when contractual risk is zero. Identity matters as risk increases, since this determines that the financial assets involved in the transaction lose productive value when redeployed to best alternative uses and by best alternative users. Bounded rationality and opportunistic behavior in financial markets imply

Figure 6

FINANCIAL MARKETS AND INTERMEDIARIES COEXISTENCE AS A FUNCTION OF CONTRACTUAL RISK



a direct relationship between the contractual risk of financial transactions and the importance of asymmetries of information. The more important the problems of adverse selection and moral hazard are, the more important the contractual risk of the financial transaction will be.

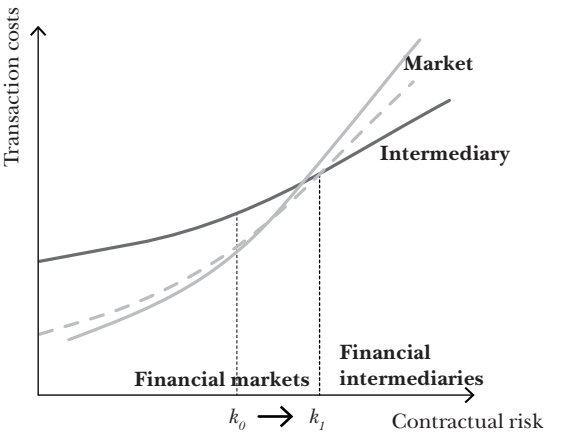
Following Williamson's analysis of the comparative forms of organizing transactions, when the contractual risk (k) of a financial transaction is low (assume it is nil to fix ideas) the bureaucratic costs of the internal organization of a financial intermediary, *I(0),* exceed those of the market, *M(0),* because the latter is superior in autonomous adaptation. Imagine a perfect information world where a potential lender knows exactly the type of each potential borrower. In this perfect information world, the contractual risk of lending transactions is negligible, so that the autonomous adaptation of the market through the high-powered incentives provided by the price– the interest rate– mechanisms will imply lower transactions

costs than a financial intermediary. However, that changes as asymmetric information are relevant, and contractual risks implies that bilateral dependency sets in. Situations for which coordinated responses are required become more numerous and consequential as contractual risk deepen. The high-powered incentives of markets here impede adaptability, since each party to an autonomous exchange that has gotten out of alignment, and for which mutual consent is needed to do an adjustment, will want to appropriate as much as possible of the adaptive gains to be realized (formally $M'(k)>I'(k)$: transaction costs increase quicker with contractual risk in markets than in intermediaries). When bilaterally dependent parties are unable to respond quickly and easily, because of disagreements and self-interested bargaining, maladaptation costs are incurred. Although, the transfer of such transactions from market to financial intermediaries creates added bureaucratic costs, those costs may be more than offset by the bilateral adaptive gains that result. Figure 6 shows this situation where low contractual risk transactions are organized through financial markets whereas high contractual risk ones are canalized through financial intermediaries.

As we highlight in Section 2, fintech activity varies significantly across and within countries but the common pace is characterized by a rise in automation, specialization, decentralization, and the use of increasingly efficient and sophisticated ways of leveraging vast quantities of consumer and firm data. Internet platforms, smart contracts and blockchain, as well as other technological developments, facilitate matching among market participants and reduce considerably the relative cost of market transactions (that is, it reduces $M'(k)$). Big data and other data mining techniques reduce asymmetries of information. In turn, this makes possible the existence of peer-to-peer lending and other market-based transactions, even for some with intermediate levels of contractual risk that were previously carried out by financial intermediaries (from k_0 to k_1 in Figure 7).

Figure 7

THE EFFECT OF FINTECHS ON MARKETS

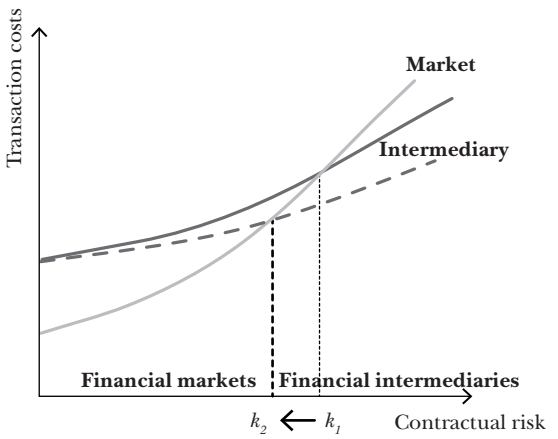


This scenario is consistent with the practical observation that the most active areas of fintechs are related to payments and remittances, peer-to-peer (P2P) lending, scoring, identity, and fraud control. In all these activities fintech innovation reduced transaction costs considerably, allowing that more of them may be conducted directly through markets (as P2P lending) instead of via financial intermediaries. From a regulatory viewpoint, this change on the institution through which transactions are conducted should not imply big challenges but, potentially, a stronger focus on customer protection (see Section 6).

This raise in the threshold value for the contractual risk that separates transactions organized through financial markets from those conducted by financial intermediaries due to the effects of fintech assumes a passive behavior of incumbent financial intermediaries. However, technological developments may also be incorporated by financial intermediaries, which

Figure 8

THE EFFECT OF INTERMEDIARIES' ADAPTATION



adapt their business models to the emerging competitive environment. In turn, the reduction in the transaction costs of incumbent financial intermediaries (the reduction in $I'(k)$) put them in a better position to be the cost minimizing organizational option for some intermediate levels of contractual risk (from k_1 to k_2 in Figure 8). As a result, the market's gain of terrain due to the effects of fintech would be (at least partially) offset by the adaptation of financial intermediaries to the new market conditions.

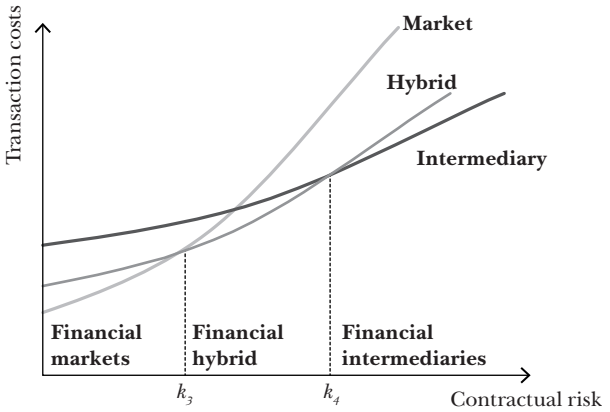
In practice, incumbent financial intermediaries have been incorporating new digital products, new channels to commercialize traditional ones, using data intensive techniques in order to tailor offers to customers, provide a better experience to them, and attract new ones. Otherwise stated, we are also seeing this scenario in the real world, which implies that competition between intermediaries and fintechs becomes stronger for intermediate levels of transaction risk.

The effect of fintech on the reduction of transaction costs seems particularly relevant on those that are associated with ex ante asymmetries of information, that is, adverse selection. The transactions costs that are implied by ex post asymmetry of information problems–costly state verification–could be (at least partially) reduced by technologies like the blockchain. In this case, the reduction of auditing costs, for example, may imply similar effects to the ones discussed in Figure 7. However, for interim asymmetry of information problems–like moral hazard–it is still not clear whether current technological developments could reduce the costs of, for instance, monitoring borrowers (but possibly through the development of internet of things). If this is the case, financial intermediaries would continue being the transaction costs minimizing option for transactions that embody large contractual risk due to moral hazard threats.

Williamson (1996) also describes a hybrid model, which is located between market and intermediaries with respect to incentives, adaptability, and bureaucratic costs: $M(0) < H(0) < I(0)$ and $M'(0) > H'(0) > I'(0)$. As compared with the market, the hybrid sacrifices incentives in favor of superior coordination among the parts. As compared with the intermediary, the hybrid sacrifices cooperativeness in favor of greater incentive intensity. The provision of credit by market, intermediary, and hybrid–where fintech startups developed under the same holding company of an incumbent bank is an example of the last one–illustrates the argument. Transactions for which the requisite adaptations to disturbances are neither predominantly autonomous nor bilateral, but require a mixture of each, are candidates to be organized under the hybrid mode, which has its parallels with the vertical integration of fintech by incumbent financial intermediaries described in Section 4. Over some intermediate range of contractual risk (between k_3 to k_4 in Figure 9), the mixed adaptation that hybrids afford could well be superior to the autonomous-favoring or cooperative-favoring adaptations supported by markets and intermediaries, respectively.

Figure 9

HYBRID FINTECH-INTERMEDIARY



In this scenario, which is the most likely to occur in the long-run, low contractual risk transactions previously organized through financial markets will continue to be conducted through them, but in new digital, fintech, forms. High contractual risk transactions will continue being conducted through financial intermediaries which may perform these activities by using financial innovations. Finally, new activities and products (like for example bundles of banking, insurance and other financial services) will emerge for intermediate levels of contractual risk through the association of traditional intermediaries with new forms of fintech institutions in hybrid models.

6. RISKS, REGULATION AND SUPERVISION: CHALLENGES AND OPPORTUNITIES

Fintechs pose several challenges to regulation and control of financial systems. But it may also represent opportunities for gaining efficiency on these activities. Fintech can improve both financial stability and access to services, but this requires

significant changes in the focus of regulation (see Philippon, 2017, and the references therein).

One of the main reasons why regulation and supervision in this new framework is particularly challenging is because of the high speed at which fintech developments occur. Regulatory frameworks, including the legal support for these activities, generally take time to be built and adapted to changing circumstances. Indeed, even in the nonobvious case when the rationale for regulating is clear, to delegate authority to some agency generally involves a somewhat long process. For example, several of the new regulations introduced after the global financial crisis of 2007-2008–as Basel III–, are still under debate in the process to be implemented.

A second challenge comes from the experimental nature of fintech innovation. It may also represent a risk for financial systems to which financial supervisors need to be particularly attentive. Like the internet in the 1980s, now fintech developments embody innovation and give rise to more of it. They are experiments in themselves of, for instance, how to maintain a public database (the *blockchain*) without anybody in particular, a bank, say, being in charge. This may seem like a dangerous way to generate innovation in financial markets. A crash in some part of the experiment could spread from one asset to others, creating wobbles in the financial system.

However, the associated systemic risk will keep under control as long as the innovation does not spread too much, nor too rapidly, and market participants understand the risk they are taking; as opposed to what happened with securitization, structured products and special conduits before the 2007-2008 financial crisis. This seems to be the case with cryptocurrencies nowadays. It is hard to argue that those buying cryptocurrencies are unaware of the risks. Moreover, authorities in several jurisdictions have been recently issuing alerts about the riskiness of buying and selling cryptocurrencies in an attempt to protect consumers and keep risks under control. In addition to that, since this business is still a fairly self-contained system,

contagion is unlikely. But if the analogies of fintech with the internet are right, financial authorities should remember the dotcom boom and bust it created in the late 1990s. In the case that fintechs expand rapidly and imposing huge competitive pressure on traditional intermediaries (as we discuss in Section 4), then financial authorities should be ready to act in order to control systemic risk. Nevertheless, financial authorities should think twice before coming down hard. Being too spiky would not just prick a bubble, but also prevent a lot of the useful innovation that is likely to come about at the same time.

A significantly large share of fintech activity in the financial system could present a mix of financial stability benefits and risks in the future. Among potential benefits are effects associated with financial inclusion, access to alternative funding sources in the economy, lower concentration of credit in the traditional banking system, more diversity in credit provision and efficiency pressures on incumbents (see Section 4). Among the risks are a disorderly impact on traditional intermediaries, a potential deterioration in lending standards and increased procyclicality of credit provision.

Fintech credit poses challenges to the regulatory perimeter and authorities' monitoring of credit activity. From a microprudential perspective, the financial performance of fintech activities could be substantially buffeted by swings in investor confidence, given their agency lending models. Moreover, financial risk in platforms may be higher than that at banks due to greater credit risk appetite, untested risk processes and relatively greater exposure to cyberattacks. And some factors that contribute to increased financial inclusion associated with fintech credit could also lower lending standards in countries where credit markets are already deep. Conceptually, we have shown in Figure 7 (see Section 5) that fintechs may process transactions with higher contractual risk than the maximum accepted by nonfintech financial markets.

Nevertheless, by the moment, the small size of fintech credit relative to credit extended by traditional intermediaries limits

the direct impact on financial stability across major jurisdictions. However, fintech credit provision could be relatively procyclical and there is the potential for a pullback in credit to certain parts of the economy because of a loss of investor confidence during times of stress. Incumbent banks might take on more credit risk in response to increased lending competition (something we have discussed in Section 4), while an abrupt erosion of their profitability could generate broader difficulties for the financial system, given banks' provision of a range of systemically important services.

Fintech regulation should adopt different forms in order to balance the potential trade-offs between innovation, efficiency gains, and financial inclusion in the one hand and, on the other hand, the market failures, externalities, and systemic risk that justifies prudential regulation and supervision (see Sections 3, 4 and 5). Licensing and conduct regulation are generally applied to financial services providers to promote the fairness and efficiency of financial markets. In many jurisdictions, these rules can differ across financial markets depending on the potential for, and impact of, market failure. For example, markets interacting with consumers and retail investors may be subject to a specific set of rules aimed at protecting against the establishment of inappropriate financial contracts. More intense prudential regulation, as in the banks' case, aims to ensure that small and nonsophisticated investors are protected, or that certain financial functions are delivered with a much greater degree of safety. This reflects the concern for the negative externalities that the failure of a critical financial service could impose to the economy. In general, a convenient regulatory principle is to apply the same regulation to the same kind of risks regardless of whether they are intermediated by traditional banks or new fintech developments. However, the challenge to regulators is to promptly identify risks when traditionally regulated activities (financial intermediation, for instance) are done through new fintech channels as well as when new business models appear.

Fintech and other forms of nontraditional intermediation in financial markets should also be considered seriously when designing regulation for traditional intermediaries. For instance, requirements for traditional intermediaries have become higher recently, and those more stringent regulation has been identified as one of the factors favoring shadow banking activities and fintech developments. In a setting where traditional/regulated financial intermediaries coexist with unregulated competitors, Martínez-Miera and Schliephak (2017) show that optimal capital regulation will depend on the degree of current bank competition. If bank competition is low and part of the market is uncovered, then capital requirements should be higher and unregulated lending would provide loans to uncovered market participants (a situation we have exemplify in Figure 2). This will be welfare improving. But, if banks are already covering most of the market, then rent seeking of banks would push borrowers to unregulated lending, which in turn reduces social welfare. In this case, capital requirements should be lower.

As we argue in the previous section, fintech may foster competition or not on financial markets. Following Sutton (1991), industries where innovation and quality production imply important investments and sunk costs, like it is the case in fintechs, tend to concentration with few and big participants. Hence, competition policy should be a matter of particular concern of financial authorities. Absent of an increase in market power, the reduction in transaction costs due to financial innovation should translate into a more efficient financial system and the inclusion of currently excluded financial customers. In doing this competition policy work, it is particularly important to consider the potential changes to the structure of financial markets. Network economies, infrastructures and two-sided market platforms would become particularly relevant in the nearby future of financial markets. In these market structures, the traditional tools to determine the relevant market, the abuse of market power and the corrective measures might be

different from those in traditional market structures. Moreover, incumbent financial intermediaries may like to prevent entry of fintech participants in order to abuse of their dominant position. Again, competition policy ensuring the access of startups to basic financial infrastructures, and even to certain information, which is managed by traditional intermediaries may be deemed necessarily.

Fintech may also imply changes on financial risks, risk management, and hence on regulation and supervision. For instance, the network nature of financial innovation combined with automated transactions might increase correlation among financial assets. In turn, financial cycles might be amplified and systemic risk mounted. In addition to that, a disruption in some parts of the financial network would imply immediate contagion to other parts of the financial system. Financial regulators and supervisors would have an important task on anticipating and controlling systemic risk creation and its propagation in financial markets. They would also care about facilitating the reduction of operational risk and mounting contingent plans for business continuity by market participants.

Trust is crucial for the well-functioning of financial markets and especially of those that are based on networks. Trust in financial networks is an asset that should be preserved by all market participants. Supervisor would play an important role, for example, by keeping the experiments under control on the innovation stage, but also when fintech matures. For instance, blockchain would serve as a device to provide trust on financial transactions. The growth of transaction with cryptocurrencies, which are based on this digital technology, in recent years, may be considered as indicator for that. To be sure, regulators should watch out that cryptocurrencies do not become even more of a conduit for criminal activity, such as drug dealing, money laundry, or financing of terrorist activities. Consumer protection policies, information privacy, and transparency are particularly relevant areas for supervisors' action. For example, authorities in several jurisdictions have

been issuing alerts to customers about the high risk of cryptocurrency transactions.

Cybersecurity is another important field to which to contribute. Unfair lending practices related to unmonitored use and analysis of big data and increased systemic vulnerabilities due to threats to cybersecurity should be on between the main concerns of financial supervisors.

A clear legal and regulatory framework for the sustainable development of fintech may be deemed necessarily. Authorities in several jurisdictions are devoting efforts on this although there is not an emerging consensus on the recommendations yet. In some jurisdictions the current legal framework seems to be enough in order to provide a fair field for fintech innovation and risk control. Other jurisdictions, like for example Mexico, are issuing new and specific legislation for fintechs.

Digital technologies themselves could facilitate regulatory compliance and increase efficiency in financial regulation and supervision. They may also enhance financial control to avoid money laundry and other illegal activities. The automation of manual processes (for example, by using artificial intelligence), new capacities to aggregate, share and store data (for example, through cloud-computing), enhancements in security (like using blockchain), and in identifying suspicious transactions (by incorporating biometrics and using big data analysis, for instance) could facilitate the interaction of financial intermediaries with their supervisors, as well as improve the efficiency of the latter to perform their mandates.

7. FINAL REMARKS

In this paper we analyzed the potential impact of the fintech on banking, financial markets, and regulation based on conceptual fundamentals about the rationale for the existence of financial intermediaries, the reasons behind their coexistence with financial markets, and the justification of financial regulation and oversight. On those grounds, the microeconomics of

banking literature, traditional industrial organization models and the transaction cost economics framework shed relevant light. Issues such as asymmetric information and contractual risks, as well as the ability of adaptation by incumbent financial intermediaries, become crucial in the analysis.

At this stage, one can stress that we are assisting to some kind of revolution in technological developments that may be applied to finance; mostly due to the speed of technical advance and communication that are common to a more general digital revolution. No doubt financial systems would need to evolve more or less quickly in response to the challenges imposed by technical advance, as well as to profit from the opportunities for it generated. But, at the current stage, it is not obvious that some of the fundamental rationales behind the existence of financial intermediaries will be disrupted by the kind of fintech developments we are seeing.

The financial market landscape is in a state of flux. The final outcome in terms of the financial market structure and competition is certainly difficult to anticipate. However, as long as market power does not rise considerably, the reduction in transaction costs should translate into a more efficient financial system which, in turn, would provide financial services to a large number of customers. All in all, financial inclusion and transaction costs reduction due to fintech innovation would add efficiency and welfare to a larger number of customers.

Considering the effects on reducing information asymmetries in some cases and informational costs and entry barriers in others, we identify declining opportunities for profitability in traditional financial intermediation activities and the increasing role of innovative financial arrangements closer to markets rather than financial intermediaries. Nevertheless, that does not necessarily imply that banks and other intermediaries will reduce their participation in the financial arena, given their systematic ability to adapt to changing circumstances, particularly when driven by technological change. Moreover, the impacts are not homogeneous among all kinds of financial

transactions due to different needs for solving asymmetric information problems; for example: monitoring different types of projects according to their remaining contractual risks.

Fintech poses several challenges to the regulation and supervision of financial systems. But it may also represent opportunities for gaining efficiency on these activities. A significantly large share of fintech activity in the financial system could present a mix of financial stability benefits and risks in the future. Hence, fintech regulation should adopt different forms in order to balance the potential trade-offs between innovation, efficiency gains and financial inclusion in the one hand and, in the other hand, the market failures, externalities and systemic risk that justifies prudential regulation and supervision. The emergence of fintech challenges the scope and ability of regulatory frameworks, and each new development has to be assessed from a regulatory standpoint–understanding the object to protect–, whether it constitute financial intermediation or not, and if it potentially affect the systemic risk.

References

Arrow, Kenneth J. (1969), "The Organization of Economic Activity: Issues Pertinent to the Choice of Market Versus Nonmarket Allocation," in *The Analysis and Evaluation of Public Expenditure: The PPB System*, Vol. 1, US Joint Economic Committee, 91st Cong., 1st sess, Washington, D. C., US Government Printing Office, pp. 59-73.

Broecker, Thorsten (1990), "Credit-Worthiness Tests and Interbank Competition," *Econometrica*, Vol. 58, No. 2, pp. 429-452, <DOI: 10.2307/2938210>.

Calomiris, Charles W., and Charles Milton Kahn (1991), "The Role of Demandable Debt in Structuring Optimal Banking Arrangements," *American Economic Review*, Vol. 81, No. 3, June, pp. 497-513, <http://www.jstor.org/stable/2006515>.

Capgemini, LinkedIn, and Efma (2017), *World FinTech Report 2017*.

Coase, Ronald H. (1937), "The Nature of the Firm," *Economica*, Vol. 4, issue16, November, pp. 386-4054, < https://doi.org/10.1111/j.1468-0335.1937.tb00002.x>.

Diamond, Douglas W. (1984), "Financial Intermediation and Delegated Monitoring," *The Review of Economic Studies*, Vol. 51, No. 3, July, pp. 393-414, < DOI: 10.2307/2297430>.

Diamond, Douglas W., and Philip H. Dybvig (1983), "Bank Runs, Deposit Insurance and Liquidity," *Journal of Political Economy*, Vol. 91, No. 3, pp. 401-419.

Freixas, Xavier, and Jean-Charles Rochet (2008), *Microeconomics of Banking*, second edition, The MIT Press.

He, Dong, Ross Leckow, Vikram Haksar, Tommaso Mancini-Griffoli, Nigel Jenkinson, Mikari Kashima, Tanai Khiaonarong, Céline Rochon, and Hervé Tourpe (2017), "*Fintech and Financial Services: Initial Considerations*," IMF Staff Discussion Note, No. 17/05, June.

Holmström, Beng, and Jean Tirole (1997), "Financial Intermediation, Loanable Funds, and the Real Sector," *The Quarterly Journal of Economics*, Vol. 112, issue 3, August, pp. 663-691, <https://doi.org/10.1162/003355397555316>.

Inter-American Development Bank (2017), *FINTECH: Innovaciones que no sabías que eran de América Latina y el Caribe,* mayo, < http://dx.doi.org/10.18235/0000703#sthash.QxTHNLE9.dpuf>.

Kelly, S., D. Ferenzy, and A. McGrath (2017), *How Financial Institutions and Fintechs Are Partnering for Inclusion: Lessons from the Frontlines*, Working Paper, July, Institute of International Finance.

Leland, Hayne E., and David H. Pyle (1977), "Informational Asymmetries, Financial Structure, and Financial Intermediation," *The Journal of Finance*, Vol. 32, No. 2, May, pp. 371-387, <https://doi.org/10.1111/j.1540-6261.1977.tb03277.x>.

Martínez-Miera, David, and Eva Schliephake (2017), *Bank Capital Regulation in the Presence of Unregulated Competitors*, Working Paper, Carlos III University.

Philippon, Thomas (2017), *The FinTech Opportunity*, BIS Working Papers, No. 655.

Salop, Steven C. (1979), "Monopolistic Competition with Outside Goods," *The Bell Journal of Economics*, Vol. 10, No. 1, Spring, pp. 141-156, <DOI: 10.2307/3003323>.

Sutton, John (1991), *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*, The MIT Press.

Williamson, Oliver E. (1996), *The Mechanisms of Governance*, Oxford University Press.

Zhang, Bryan, Peter Baeck, Tania Ziegler, Jonathan Bone, and Kieran Garvey (2016), *Pushing Boundaries: The 2015 UK Alternative Finance Industry Report*, Cambridge Centre for Alternative Finance and Nesta.