DOCUMENTOS DE POLÍTICA ECONÓMICA

FinTech y el Futuro de la Banca Central

Pablo Furche
Carlos Madeira
Mario Marcel
Carlos A. Medel

N.º 63 Agosto 2017

BANCO CENTRAL DE CHILE

BANCO CENTRAL DE CHILE
CENTRAL BANK OF CHILE

La Serie de Documentos de Política Económica, del Banco Central de Chile, divulga el pensamiento de las autoridades de la institución sobre la economía chilena y la conducción de la política monetaria. Esta Serie es una instancia de difusión y discusión de tópicos relevantes para los objetivos y el accionar del Banco Central, dirigida a un público más amplio que el de los especialistas.

The Series of Economic Policy Papers of the Central Bank of Chile presents views and analyses of the Chilean economy and the conduct of monetary policy prepared by Bank authorities. This series, aimed at the general public, disseminates and discusses topics that are relevant to the goals and operations of the Central Bank.

Documentos de Política Económica del Banco Central de Chile
Economic Policy Papers of the Central Bank of Chile
ISSN 0717-7151

Agustinas 1180, Santiago, Chile
Teléfono: +56 2 26702475 – Fax: +56 2 26702331

FinTech y el Futuro de la Banca Central[*]

Pablo Furche
Financial Regulation and Infrastructure
Central Bank of Chile

Carlos Madeira
Financial Research Area
Central Bank of Chile

Mario Marcel
Governor
Central Bank of Chile

Carlos A. Medel
Economic Adviser to the Governor
Central Bank of Chile

Resumen

Este documento esboza parte de la evolución reciente de FinTech—innovación en servicios financieros facilitada por la tecnología—, en particular, cómo puede afectar la provisión de servicios financieros en economías en desarrollo, y el rol de los bancos centrales. Una parte significativa de la población en países de bajos ingresos aún carece de acceso a servicios casi universales en economías de altos ingresos, como el ahorro formal en instituciones financieras, tarjetas de débito y crédito, y los seguros. Por lo tanto, FinTech pueden tener un impacto positivo en varios aspectos de la inclusión financiera, incluyendo los préstamos y las calificaciones crediticias de los hogares y empresas no bancarizados. Sin embargo, la innovación financiera puede afectar la transmisión de la política monetaria cambiando el rol de los agregados monetarios y el sistema bancario, y puede traer riesgos para la estabilidad financiera. FinTech también puede competir con proveedores financieros tradicionales en áreas como sistemas de pago, comercio, custodia, administración de activos, e intermediación de préstamos. Los *distributed ledgers* son quizás la innovación más revolucionaria para los bancos centrales, los intercambios centralizados, y los mercados interbancarios, con un impacto potencial en la liquidez del mercado, la competencia, y la transparencia, a pesar de que su desarrollo se encuentra en una etapa temprana. La regulación y la formulación de políticas deben adaptarse para superar los desafíos planteados por las tecnologías modernas, y asegurar que éstas no se transformen en barreras a posibles innovaciones.

FinTech and the Future of Central Banking

Abstract

This document outlines some of the recent evolution in FinTech—technologically enabled innovation in financial services—, particularly how it can impact the provision of financial services in developing economies and the role of central banks. A significant part of the population in lower-income countries still lack access to services that are widespread in high-income ones, such as formal savings in financial institutions, debit and credit cards, and insurance. Therefore, FinTech may have a positive impact on several aspects of financial inclusion including loans and credit scores for the unbanked households and firms. Nonetheless, financial innovation can affect the transmission of monetary policy by changing the role of money aggregates and the banking system, and it may pose risks for financial stability. FinTech may also compete with traditional financial providers in areas such as payment systems, trading, custody, asset management, and loan intermediation. *Distributed ledgers* are perhaps the most game-changing innovation for central banks, centralized exchanges, and interbank markets, with a potential impact on market liquidity, competition, and transparency, although it is still in an early stage of development. Regulations and policy making will need to adapt to overcome the challenges posed by modern technologies, and to ensure that they do not become a bottleneck to possible innovations.

---

[*] This document is based on the keynote speech delivered by the Governor of the Central Bank of Chile Mario Marcel at the *Annual Conference of the Cambridge Centre for Alternative Finance*, Judge School of Business, Cambridge University, UK, on 29 June, 2017. We thank Gabriel Aparici, Solange Berstein, Rodrigo Cifuentes, Carola Moreno, Claudio Raddatz, and seminar participants at Cambridge University for comments and suggestions. We also thank Consuelo Edwards for editing services. The views expressed in this paper do not necessarily represent those of the Central Bank of Chile or its authorities. All errors and omissions are the authors' responsibility.

Contact e-mails: pfurche@bcentral.cl; cmadeira@bcentral.cl; mmarcel@bcentral.cl; cmedel@bcentral.cl.

I. Introduction

Financial services are essential to our lives and our economy. In fact, recorded history shows that economic legislation, loan arbitration, bookkeeping, and accounting are among the oldest roles of government administration (Kramer, 1956; Allen and Yago, 2010). Banks, insurance companies, markets, and transfer savings to productive firms have a role of risk-sharing. This allows asset holders to benefit from overall economic growth and financial inclusion, while it limits individual exposures to risks, such as negative shocks to one's business, employment, wealth, and health. Finally, financial flows are how capital moves from richer countries to the lower income economies in need of higher investment and development.

This policy paper aims to discuss the potential of technologically enabled financial innovations, henceforth referred as FinTech,[1] to change the provision of financial services in the future and, in particular, how it can affect central banking in developing economies.

We first provide an overview of the key features of central banking and its relationship with the financial sector, including the transmission of monetary policy. Then we identify which features of FinTech development can have a greater influence on central banking, financial stability and financial deepening. We then highlight some dilemmas that central banks and regulators face in dealing with FinTech in emerging countries and its incipient role in the Chilean economy.

II. How a Central Bank faces the world

Central banks are key players of the financial system, with major duties in regulation, oversight, liquidity management, and as lenders of last resort (LOLR). However, central banks are still relative newcomers, with over 90% of the world's central banks having been founded in the 20th century (*Bank of International Settlements* [BIS], 2009).

Almost all central banks have price stability and financial stability as their twin core objectives. Most central banks cite price stability as their main mandate, with more than 80 central banks (64 countries plus the 19 members of the euro area) around the world having explicit inflation targets. Although less than one-fifth of the central banks have an explicit financial stability mandate, survey information shows that over 90% of the central banks, including all the members of the euro area, considered that they had full or shared responsibility for financial stability policy and its oversight (BIS, 2009). It is relevant to note that all the *Organization for the Economic Cooperation and Development* (OECD) and euro area central banks report some degree of responsibility for financial stability (Oosterloo and de Haan, 2004), although there is considerable heterogeneity in the way central banks execute this function. Depending on whether there is a shared responsibility with other authorities, the financial stability tasks undertaken by central banks may include "bank regulation and bank supervision, deposit insurance, the provision of safety nets through emergency liquidity assistance, provision of honest broker services, and involvement in the payment system in general" (BIS, 2009).

[1] The *Financial Stability Board* (FSB, 2017) understand "FinTech" as the technologically enabled innovations in financial services that could result in new business models, applications, processes or products with an associated material effect on the provision of financial services.

To achieve their twin goals, central banks apply monetary policy and macro financial regulations, like liquidity, reserves, and capital requirements (Stein, 2012). Monetary policy and macro prudential regulations operate through the financial system, particularly banks. Most money in the economy is made of deposits that result from the maturity transformation—from short-term deposits into medium term loans—that banks perform. In turn, banks meet their liquidity needs for disbursement and reserve requirements partly by borrowing from the central bank. Monetary policy is then operationalized by setting the interest rate (or in some cases the quantity of money) at which commercial banks can store or withdraw money from the central bank.

Today, money and financial operations are overwhelmingly composed of balance sheet records, with banks providing liquidity and money-like instruments to all sorts of activities (Stein, 2012). For this reason, banks need to be strictly regulated and the central bank must manage monetary policy to ensure stability of the purchasing power of money. An adequate transmission of monetary policy to the economy depends on the smooth operation of banks. Consequently, any disruption in the operation of a bank, or in the transmission or provision of funds can have serious detrimental economic consequences.

Hence, a key concern of a central bank is risk, which may come from several sources: external shocks; misperceptions about the macroeconomic scenario leading to incorrect policy decisions; changes in the behavior of banks that may compromise the transmission of monetary policy to market rates; liquidity excess or shortage in the banking sector; bank insolvency; disruptions in the flow of funds at the interbank or retail level; and, ultimately, risk of compromising trust.

Thus, while technologically-supported financial products can potentially improve the quality and speed of financial services to the public or lower their cost, a central bank would focus on how they can influence the risks they face—to either reduce or raise them.

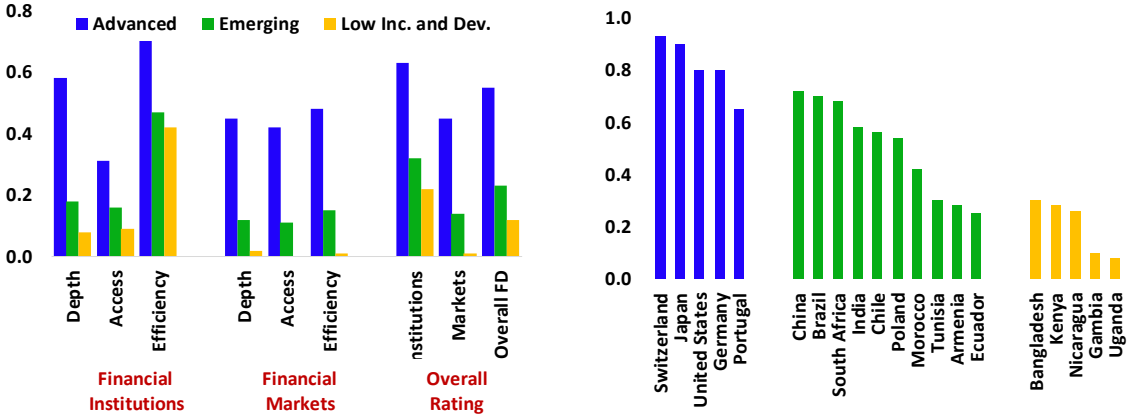
III. The financial sector, central banking, and economic development

Development is closely associated with financial development, both historically and comparatively across countries (Levine, 2005). Financial services channel domestic and external savings to investment, support personal and business projects, cushion risks, and reduce the transaction costs of economic exchanges. While advanced economies are characterized by broad and deep financial markets, finance in developing countries is usually fragmented, unstable and costly (Figure 1).

In middle- and low-income countries, the proportion of the population holding any type of account in a supervised financial institution amounts to 37% and 20%, respectively, which is far below the rates around 90% across the OECD and high-income countries. The usage of bank-intermediated debit and credit cards and formal savings follows a similar pattern (Figure 2).

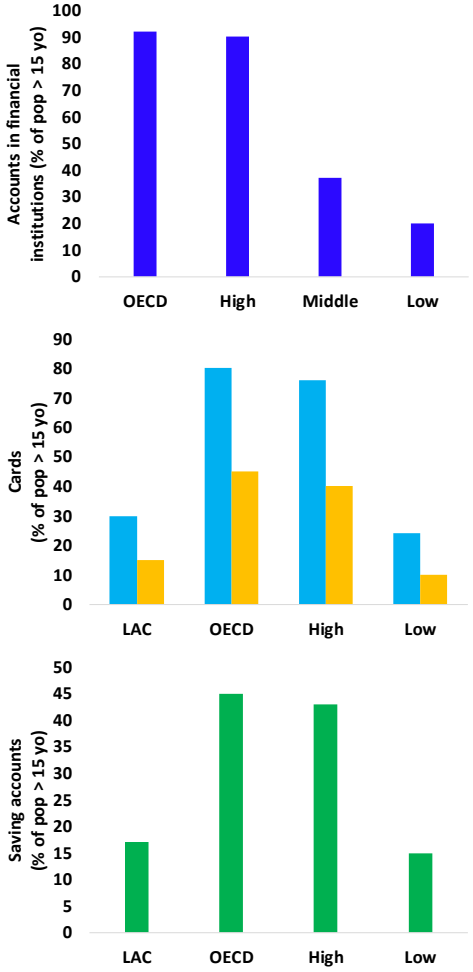
One measure of the importance of financial intermediation in the economy is the ratio of broad money to reserves, which is much larger in financial centers such as Australia and the US relative to developing economies (Figure 3A). Also, life and non-life insurance is far less extended in emerging markets compared to developed countries (Figure 3B).

Figure 1: *Financial Development Index* by country income level and country (*)



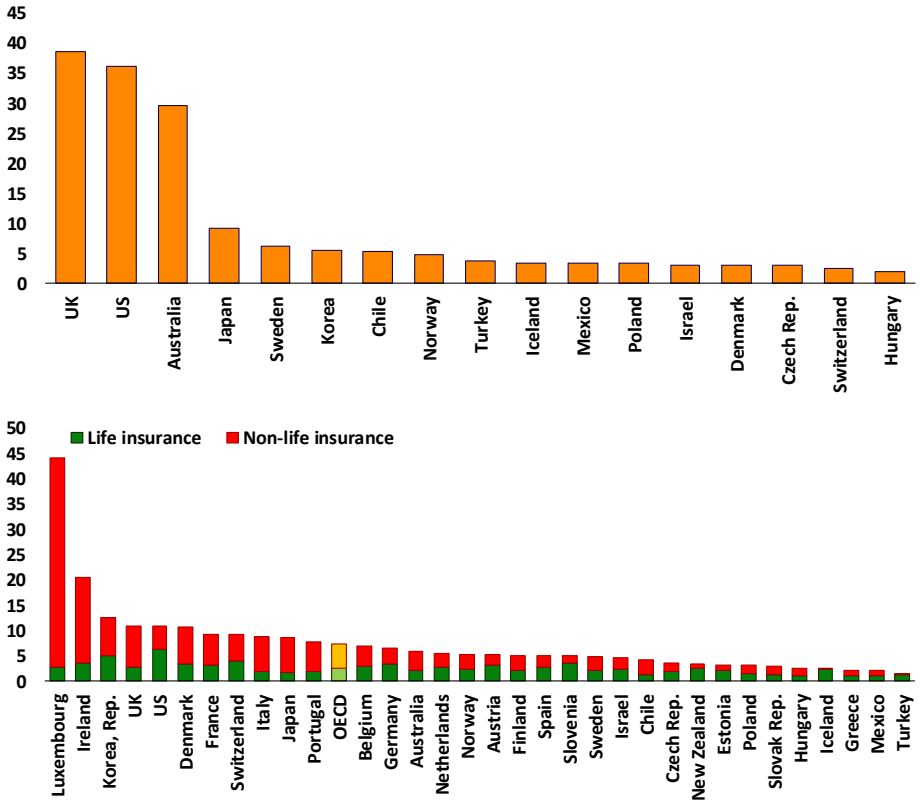
(*) Income level classification according to the World Bank. Source: Sahay *et al*. (2015).

Figure 2: International comparison of coverage of banking services (2014) (*)



(*) "LAC" stands for Latin American and Caribbean countries. "High" and "Low" for high- and low-income countries according to the World Bank.
Source: *Superintendencia de Bancos e Instituciones Financieras* (2016).

Figure 3: A. Ratio of broad money to total reserves (2015), and
B. Penetration of the insurance industry (direct gross premiums as a percent of GDP, 2015)



Sources: The World Bank and OECD.

The financial strength of developed countries has not spared them from financial crises such as the Global Financial Crisis of 2008-9. However, developing countries are prone to even more severe crises, with Latin America listing 15 out of the 25 worst financial crises in history (Reinhart and Rogoff, 2014). The debt crisis that affected several Latin American countries, Chile among them[2], in the early 1980s, the Mexico "Tequila" crisis of 1994, and the Argentinean collapse in 2001, all feature among the all-time worst financial crises. Some common elements of these crises include the devastation of the entire financial system of the affected countries, the evaporation or freezing of deposits, and deep recessions with massive unemployment, and they were only resolved after large bailouts and debt write-offs.

Protracted financial development creates substantial difficulties for the management of price and financial stability, the twin goals of central banks. A low coverage of banking and credit implies that a substantial fraction of the population and companies may not have access to credit and liquidity when they need it. Liquidity and credit constraints prevent relative prices from resolving disequilibria, amplifying the impact of shocks on employment, production, and consumption. Inefficient intermediation of savings reduces the return on real investment and tilt incentives in

[2] See Bosworth, Dornbusch, and Labán (1994) for a complete overview on the Chilean economic experience through the period 1970-80s.

favor of speculation and rent-seeking. Shallow capital markets are unable to hedge market risks, particularly exchange rate and maturity exposures, and foster too much concentration.

Underdeveloped financial services also contribute to economic informality (Támola, 2014). There is ample evidence that economic informality—albeit a rational alternative for people with little choice—is a major obstacle for emerging economies to grow in a more inclusive way. The financial dimension of informality is opaque, unregulated banking (which is prone to insolvency), abuse and fraud. Thus, while central banks would normally focus on price stability, a more efficient and inclusive financial system would make business cycle management easier and provide a boost for development.

IV. What difference can FinTech make?

IV.1 The range of FinTech activities: potential contributions and risks

Central banks and commercial banks have been traditionally close, because maturity transformation and fractional banking is the basis for commercial banks to provide a large set of interrelated services. In contrast, FinTech refers to "technologically enabled financial transactions that could result in new business models, applications, processes or products with an associated material effect on the provision of financial services" (FSB, 2017).

Thus defined, the scope of activities that can be referred to as FinTech is quite broad. Moreover, products or services that are now commonly used could once have been considered FinTech, *e.g*. banknotes, checks, credit cards, ATMs, and electronic transfers. However, the speed at which change is happening can be only imagined, and it relates to technological progress, greater data availability, and developments on programming, encryption and mobile devices. The combination of these elements has the potential to "unbundle" key banking functions such as payments, maturity transformation, and capital allocation (Banque de France, 2016; He *et al*., 2016; Ketterer and Andrade, 2016), and allow for greater competition for financial market infrastructures such as custodians and central counterparties. This certainly may influence those institutions but it also can shatter the architecture upon which central banks rely.

In order to understand the potential impact of FinTech on central banking, it is useful to identify specific dimensions of FinTech innovations whose impact on monetary policy and financial stability can be assessed one by one (Table 1).

FinTech innovations may imply several benefits to financial stability. Crowdfunding and P2P[3] intermediation may reduce systemic risk since they do not involve money creation through the conventional multiplier/maturity transformation mechanism of banks. While this may significantly limit the scale at which operations can develop, they can be an affordable alternative for businesses that are not covered by conventional financial institutions. FinTech market support tools can also contribute to financial stability to the extent that they can mobilize more

[3] A Peer-to-Peer (P2P) service is a decentralized platform in which two individuals interact directly with each other without third-party intermediation. The buyer and the seller transact directly with each other via the P2P service. Some P2P services do not involve an economic transaction such as buying and selling, but bring together individuals to work on joint projects, share information, or communicate without an intermediary.

information to better assess credit risk and to mitigate it through smart contracts, guarantees, and collateral.

Table 1: Dimensions of FinTech and their development

Activity	Product Innovation	Potential Contribution
Payments, transfers, clearing, settlement	Mobile payments, digital wallets, digital currencies, and distributed ledgers.	Management of massive numbers of transactions and sums.
Lending and borrowing; financial intermediation	Crowdfunding, online P2P loan platforms. Use of more big-data and information for credit scoring.	FinTech still represents a small fraction of overall credit, but it is growing rapidly in some countries (see CGFS and FSB, 2017).
Risk management	FinTech insurance firms: InsurTech. Distributed ledgers: registration of guarantees/collateral in transactions.	Improvements in marketing, distribution, underwriting, risk pricing and settlement claims.
Market support	ID verification, cloud computing, digital assets, online notaries.	Faster, more accurate registers. Lower back-office and custody costs. Encrypting sensitive data.
Investment management	E-trading platforms, robo-advisors, smart contracts.	Automated advice can complement human advisers, increasing stock ownership.

Source: Authors' elaboration.

In the same line, FinTech can contribute to the financial development of emerging countries in several aspects: (i) universal access to financial services by consumers and small and medium enterprises; (ii) enhanced security of remittances and transactions among vulnerable sectors (the poor, migrants, rural areas); (iii) higher competition and less concentration of the financial sector, and (iv) reduced costs for participation in the formal economy and easier access to public services based on improved government databases. Recent experiences with M-Pesa in Africa and with Unique ID in India are good examples of such development trends.

In addition, FinTech innovations, such as *distributed ledgers*[4] (DL) can improve the efficiency of financial market infrastructures by increasing the speed for the settlement of transactions, thus reducing needs for collateral and increasing liquidity, and by lowering operational and servicing costs.

However, FinTech developments also pose several risks for financial stability and transmission of monetary policy. In the case of financial infrastructures, new systems may have hidden weaknesses that are not apparent in the trials, leading to financial disruption and critical episodes such as "flash crashes" (see BIS, 2017, for a description of the Sterling pound flash event of 7 October 2016). Users of payments and transfer systems may also be pressed to undertake unwanted credit operations, while automatic "smart contracts" may foster instability if the system fails to check the solvency of each counterparty. Algorithm-based assessments can deepen biases in financial access and engender volatility through herd behavior. Uninsured deposit-taking is an area of particular concern due to its exposure to fraud.

[4] A *distributed ledger* is a database that is consensually shared and synchronized across network spread across multiple sites, institutions, or geographies. It allows transactions to have public "witnesses". The participant at each computer of the network can access the recordings shared across that network, and can own an identical copy of it. Any changes or additions made to the ledger are reflected and copied to all participants in a matter of seconds or minutes.

Perhaps the greatest risk of FinTech is that of cybersecurity (FSB, 2017; Kopp, Kaffenberger, and Jenkinson, 2017). The more financial systems depend on electronic platforms and digital records, the more exposed they are to cyber-attacks, which can disrupt the flow of funds across the economy. Of course, this risk is not an exclusive of the more innovative FinTech developments, but of any electronics-based financial system. For instance, the Real Time Gross Settlement (RTGS) system of the Bank of England suffered a temporary outage in October of 2014, which meant applying alternative settlement forms for a whole day (Shafik, 2016).

Other obstacles also deserve attention. These include the need of larger investments in financial education and literacy. Recent experience shows that even in developed countries people often misuse financial instruments. Consumers often suffer from large debt burdens and complex contracts that they do not fully understand (Haliassos, 2015). Human financial advisors often encourage investors to buy inadequate products with too much risk, low diversification and high fees, as suggested in Haliassos (2015). However, it also appears to be the case that investors reject human financial advisors that provide unbiased and good advice in terms of portfolio diversification (Hackethal, 2015). Therefore, it will be a great challenge for FinTech and robo-advisors to persuade common investors to follow portfolio diversification and other safer investment practices.

Lastly, privately issued cryptocurrencies[5] may curtail the use of official currencies and will make it more difficult to monitor money aggregates, posing a challenge for monetary policy (He *et al*., 2016). Furthermore, the price volatility of virtual currencies and their risk of runs due to losses of confidence could potentially harm regulators as providers of liquidity and LOLR. If financial companies make systemic investments in non-traditional currencies, then an LOLR is less effective having reserves of national currency and traditional foreign currencies.

A significant risk is that, while digital currencies are safe in direct transactions between users, security and operational failures exist with third-party intermediaries such as exchanges (Moore and Christin, 2013). Digital currencies may also facilitate tax evasion, fraud, illegal transactions (He *et al*., 2016), which requires strengthening *Anti Money Laundering* and *Know Your Customer* laws.

Smart contracts may allow for "automatic" Ponzi schemes that are anonymously protected by the use of cryptocurrencies and will keep executing automatically even after the fraudulent scheme is uncovered (Bartoletti *et al*., 2017), which requires surveillance from platforms and authorities. Finally, the use of digital services may need better internet and telecommunication infrastructure.

IV.2. The potential impact of Distributed Ledger Technologies and Blockchain

Blockchains[6] and, in broader terms, *Distributed Ledger Technology* (DLT) may represent the most revolutionary development in FinTech and the one with greatest potential to redefine the financial

[5] A cryptocurrency is a digital or virtual currency that uses cryptography for security. A cryptocurrency is difficult to forge because of this security feature. A defining feature, and arguably its most attractive one, is its organic nature, rendering it theoretically immune to authorities' interference or manipulation. Private cryptocurrencies are, by definition, not issued by authorities. When they are issued by a central bank, they constitute the so-called "Central Bank Digital Currency" (CBDC; see subsection IV.3).

[6] A blockchain is a public ledger of all Bitcoin transactions that have ever been executed. It is constantly growing as "completed" blocks are added to it with a new set of recordings. The blocks are added to the

system and central banking (Smets, 2016). Essentially, DL represents a database that is shared and updated by a network of members (KPMG, 2016). Unlike *the cloud*, which is a database with many users but with a single copy managed by a central authority or main user, the DL can be updated and managed by several of its members. The nature of the DL may make it more robust against cyber-attacks, information technology outages, and other operational failures, since—even if one of its administrators fails—there is the possibility that the database will remain fully active if 51% or more of its members agree about the updated register. A blockchain is a specific type of DL, because it includes the encrypted history of all past transactions (blocks) in every updated register.

DL and blockchains can be either private (or permissioned)—where only a few users are administrators and with permission to update the database—or public (all users are administrators and any user can update the register), or hybrid (users have distinct levels of permission, with some users being allowed to update and read some files, but not others). Current simulation studies show that a permissioned DLT infrastructure with real users' identities may be more efficient in terms of market competition, lower network management costs, improved information, and compatibility with *Anti Money Laundering* / *Know Your Customer* laws (Berndsen, 2016; Malinova and Park, 2016).

Why do DLT and blockchain have such a significant disruptive potential? A well-known result of economic theory is that money is merely a register (or balance sheet) with limited memory (Kocherlakota, 1998): central banks (and, historically, government treasuries before central banks entered the scene) are the official currency issuer, therefore currency holdings represent that its owner either provided goods and services to the state or made a transaction with another user who traded with the state. In general, creating a financial asset requires a trusted central counterparty (either a central bank or a market custodian) that will act as an intermediary for all transactions. DLT and blockchain keep all the transactions and ownership titles of the network's assets in a single register, which is reliably observed by all the agents; therefore, it is not possible to deceive its members with a "double-spending" or counterfeiting problem in which the same asset, currency or collateral is pledged to different parties. This implies that DLT can be used to create any sort of financial contract, digital asset and currency, because its digital assets will be trusted by all the network members. Due to the strong resilience and trust among the DLT network, this infrastructure could even allow for new kinds of financial contracts, including real-time multi-party transactions (Berndsen, 2016).

DLT can have a wide-range of applications across several industries (Goldman Sachs, 2016): (i) creation of digital currencies by private companies (*e.g.* Ethereum) or public networks (*e.g.* Bitcoin), (ii) emission of government-backed or central bank digital currencies (Fung and Halaburda, 2016), (iii) more efficient transaction systems in digital custody of assets (*e.g*. blockchain project promoted by the *American Depository Trust and Clearing Corporation*, blockchain for gold transactions is being studied by the *UK Royal Mint*), over-the-counter markets (*e.g*. the *Utility Settlement Coin* system supported by the *UBS Investment Bank*, *R3 Corda* platform) and public exchanges (*e.g*. the Eurex Clearing project by Deustche Borse), (iv) money remittances and international payments (*e.g*. VISA, Ripple, and Stellar), (v) real estate and land registries (with

---

blockchain in chronological order. Therefore, each computer connected to the Bitcoin network gets a copy of the blockchain, which gets downloaded automatically upon joining the network. The blockchain has complete information about the addresses and their balances right from the genesis block to the most recently completed block.

experiments being studied in both developing and developed countries, such as Ghana, Honduras, Kenya, Ukraine, Georgia, the Netherlands, Sweden, UK, and US), (vi) smart contracts (*e.g*. Ethereum), (vii) proxy shareholder voting (*e.g*. NASDAQ's Linq), and (viii) public access to government administration, electricity grids, education titles, health records and insurance payments.

DLT can enhance the efficiency of payment systems as all the processes of order-settlement-payment are implemented in real time, while at present most settlement processes take two to three days, creating operational and counterparty risk. The benefits of FinTech applications in this field in terms of financial stability may include: (i) increased market efficiency, in particular for RTGS among large financial institutions, (ii) enhanced risk measurement of each bank and a more transparent financial system, (iii) lower trade costs, robustness against cyber-attacks, and less need for collateral, and (iv) a stronger wealth-channel for monetary policy if more agents access financial assets and loans.

Basically, in the case of securities exchange, DLT could replace a complicated system with many institutional layers, separate databases, plus transaction costs and settlement risks at each step: custodians who keep the securities and perform basic services such as collecting dividends; brokers through whom orders are placed; exchanges and clearing houses where trade and settlement occur (Broadbent, 2016). In this case, DLT would create a single transaction and update a single database which would be instantly recognized by all the network members, thereby reducing the transaction costs and communication delays with brokers, clearing houses and custodians.

Furthermore, a DLT powered market could substantially reduce information asymmetries and improve market outcomes (Malinova and Park, 2016). In essence, current financial markets are often segregated among centralized exchanges which have high liquidity for certain securities and over-the-counter (OTC) markets that have multiple dealers that provide lower-cost and custom-tailored contracts. One disadvantage of OTC markets is that prices are more difficult to figure out and the financial strength of its members is more opaque, which can lead to a sudden liquidity drain as in the collapse of the repo markets during the Global Financial Crisis (Bernanke, 2015). A DLT market infrastructure with real users could join the roles of centralized exchanges and OTC markets, enhancing transparency, competition, and liquidity (Goldman Sachs, 2016; Malinova and Park, 2016).

IV.3. Central Bank Digital Currencies[7]

The Central Bank Digital Currencies (CBDC) represent perhaps the most ambitious project for a DLT system. A CBDC could imply several advantages for its users (Raskin and Yermack, 2016): (i) lower costs and higher speed for the interbank market; (ii) the implementation of central bank open market operations in a calendar of 24 hours/7 days and reducing overnight transaction risk; (iii) an easier framework to pay interests on central bank currency and avoid restrictions from a zero-lower-bound policy, and (iv) replacing the current joint roles of credit and money creation by

[7] We refer to Central Bank Digital Currencies merely as a more efficient way to conduct inter-banking transactions. This is not related to a "cashless" economy since the role of cash for transactions by the public and as store of value is virtually impossible to substitute.

commercial banks with a narrower banking system in which financial institutions have full equity and little or no leverage.

Allowing massive access to the balance sheet of the central bank, however, can pose significant challenges. The main challenge is moving from a few dozens of wholesale partners to thousands or even millions of retail account holders, which would directly compete with deposit accounts in commercial banks. CBDC could lead to the replacement of the classical role of central banks at the top of a tiered liquidity system to that of a massive retailer. Since commercial banks are quite dependent on deposits and creating loans from a fractional reserves system, then the CBDC could have the negative effect of draining banks and financial institutions from their main source of funds, especially if these are unable to tap other funding sources (Broadbent, 2016; Smets, 2016). Essentially, households and firms in need of credit could end up in more difficulties due to the end of fractional banking. Speculators may also observe relevant information about the weaknesses of one particular financial institution or the system at large, exploiting such information in market runs or speculative attacks.

For these reasons, the DLT experiments at the Bank of England, Monetary Authority of Singapore, European Central Bank, Bank of Japan, Bank of Sweden, and Bank of Canada take a cautious approach, aiming to achieve a *Proof of Concept* and address technical issues. It is also the case that several central banks may see the use of CBDC as an instrument for updating their RTGS systems and interbank markets, rather than a digital currency for universal use among the general public (FSB, 2017). However, the centralized nature of RTGS systems is already quite efficient and with few intermediate steps, therefore there may be little room for DLT/blockchain to bring substantial improvements (Broadbent, 2016).

The Canadian experience concludes that a DLT/blockchain system is still far from being an adequate replacement for the RTGS framework (Chapman *et al*., 2017). Many central banks, including the European Central Bank, Bank of England, and Bank of Canada, have highlighted that the next generation of RTGS will not be based on DLT (FSB, 2017), due to robustness needs and technical requirements for settlement. Also, today central banks do not have the adequate human teams to develop such advanced infrastructures on their own without incurring large costs (Fung and Halaburda, 2016). These experiments suggest that a CBDC or a universal digital currency is still above the current technological state and could be years or even decades away (see Kenneth Rogoff as interviewed by Wild, 2016).

It is also worth noting that while some countries (such as Norway, Sweden, and Denmark) are currently reducing their physical cash transactions, none of them is yet going “cashless”. Sweden has ended the obligation for certain retailers to accept physical cash, but cash remains a compulsory means of payment for retailers in Denmark and Norway (Danish Payments Council, 2016). However, national currencies (or currencies backed up by a multinational central bank such as the *European Central Bank*) are not going to disappear from use anytime soon, since central bank backed currencies are the most stable store of value and unit of account against inflation and other shocks.

For these reasons, central bank issued currencies should remain in use as the most popular medium of exchange, whether in a physical or a digital format. While Sweden’s *Riksbank* is undertaking an experimental project with a digital e-krona to decide whether to issue it or not, it is

intended to act as a complement to cash, not to replace it (Skingsley, 2016; Sveriges Riksbank, 2017).

V. Challenges and dilemmas for central bankers and regulators

As previously mentioned, FinTech innovations may influence how central banks fulfil their goals on inflation and financial stability. While FinTech start-ups and their developers may be the exact opposite of naturally conservative central banks, the challenges that they pose to financial regulators are not entirely new. How to articulate regulations in a way that allows innovations to emerge and develop without compromising stability and trust is a question that was raised many times through the history of central banking. For instance, back in 1979, the first regulation of the Central Bank of Chile for credit cards was three pages long and it included rules on: who was eligible to have these cards ("persons with moral solvency and adequate economic capacity"), how merchants should conduct transactions paid by cards, and a number of scenarios in which the card could be void or the supervisor could withdraw the authorization to issue credit cards.

However, the dilemmas for economic authorities do not stop at this philosophical level. There are many concrete dilemmas between valid policy goals:

- *Inclusiveness versus risk of uninformed decisions.* One of the main potential benefits of FinTech innovations, particularly for emerging economies, is financial inclusion, as many more people can have access to financial services. However, while this may be unambiguously positive for the most basic financial products, such as payment systems, it may be not so for products which pose greater financial risks to uniformed clients. To address this issue, the policy response should comprise financial education (which is a long-term solution) and a proper financial consumer protection framework.

- *Decentralization, choice, and competition versus operational efficiency, economies of scale, and client knowledge.* Should FinTech innovations result in an unbundling of the core functions of financial institutions, many relatively small firms may have a large share of the financial industry (decentralization). Having more firms would allow clients to have more choices of financial services and an overall increased competition. However, scale is important in the financial sector, and having too many firms providing the same service may not be efficient. In this sense, incumbents may have an edge over FinTech innovations, due to prior knowledge of their clients. Striking the right balance between competition and efficiency is up to the market to decide, but from a regulator's perspective ensuring a levelled playing field is important and how decentralization unfolds, if at all, should be followed closely.

- *Personal credit assessment and privacy.* Financial information is very sensitive by its nature, and ownership or access to it may be controversial. It is true that having access to that information could allow for a better and more targeted supply of financial products, and having a record of sound financial behavior can improve credit scoring, which can bring benefits to consumers. However, spreading that information raises concerns. Unrestricted access for FinTech companies to financial information is not an appealing option, whereas a full ban in practical terms may choke them. A middle ground can be to allow for some sort of access and use of financial information by FinTech companies, with strict sanctions for misuse or leakages.

- *Inclusiveness versus formalization*. These concepts seem to be very similar but there are subtle, yet important, differences. As mentioned, FinTech innovations may be a catalyst that allows persons to have access to financial services, such as payment, saving and investment instruments that they otherwise would not, being valuable to undertake such activities. However, formalization cannot be taken for granted. When the public trust their resources to informal or unregulated FinTech entities, they may be taking greater risks than they are willing to take, particularly counterparty risk. On the same token, risks of money laundering and tax circumvention increase because enforcement of those rules is more difficult for entities that are outside the regulatory perimeter. In Latin America, however, most FinTech start-ups are promoting digital solutions that work with the formal financial sector. For instance, in Colombia the FinTech start-up *ComparaMejor*, which promotes credit and insurance as a "digital broker" for established banks and insurance companies, has a business revenue that is over 30 times the revenue of *Aflore*, a FinTech start-up promoting informal credit relationships, insurance and financial advice.

Central banks have dealt with these sorts of dilemmas in the past, and they are currently dealing with them as innovators come knocking on their doors. Certainly, the answers that they can provide depend both on their mandates and on the legal powers that they have, but the ability to align FinTech developments with the objectives of inflation control and financial stability ultimately depends on the regulations issued by central banks and financial authorities themselves.

Other challenges that may be more FinTech-specific are those related to cybersecurity and the potential cross-border dimension of these innovations. While cyber risks are not a brand-new issue, they may be more prevalent in FinTech companies, by their very nature. In addition, depending on whether they fall within the regulatory perimeter, they may or may not have a more intrusive supervision.

Regarding the cross-border dimension of FinTech, almost all of the regulated financial activities require their providers to have, at least, partial establishment or commercial presence in the country where they offer their services. However, for internet-based financial services, geographical boundaries tend to be blurry and local regulations are easier to circumvent. Therefore, cooperation at the international level between supervisors may be required both to enforce local regulations and to prevent regulatory arbitrage.

VI. FinTech and features in Latin America and the Chilean economy

Currently, the FinTech industry does not operate in a vacuum. Although it has the ability to operate without necessarily being established in a particular country, the offer of FinTech services should have some relationship with the level of development and the needs of each country. For instance, the use of virtual currencies such as Bitcoin seems to be higher in countries with high inflation or where capital controls are in place. In this sense, the FSB identifies drivers for the development of financial innovation that relate to both demand and supply factors.

On the demand side, there is a combination between the need to increase the number of persons with access to financial products, and the fact that customers, particularly the younger ones,

expect better, cheaper, faster and ubiquitous products. On the supply side, in addition to technological progress, greater connectivity is very important for these companies to thrive.

The way in which these factors interact varies among countries. For instance, the need for financial inclusion is certainly bigger in emerging economies and therefore FinTech payments, remittances and lending may have greater development than those related to DL.

VI.1. The Latin American experience

In a recent report, the Inter-American Development Bank (IADB) and Finnovista (2017) highlight the rapid penetration of FinTech in Latin American economies, with 60.1% of all the firms founded in the short period of 2014-6. By 2016, 230 FinTech firms were established in Brazil and 180 in Mexico, followed by 84, 72, and 65 in Colombia, Argentina, and Chile, respectively (totalizing 90% of total FinTech firms in Latin America).

IADB and Finnovista (2017) identify consumer segments disregarded by the financial system as the main reason why FinTech shows such an explosive growth in these countries. Within the poorest 40% of the population, 59% do not have formal access to the financial market. Hence, FinTech stimulates the credit demand providing lower costs in products not offered by major providers because of low profitability. Inherently behind the FinTech development is the financial inclusion goal with the subsequent ongoing challenges for authorities, a common element shared by major economies of the region. One particular application being developed in Chile and Mexico is the use of payment history in utilities and the transaction history of small enterprises to create an alternative credit scoring, which may promote credit among currently financially excluded households and firms.

The Brazilian financial system is characterized by high interest rates and banks' concentration. Currently, consumers in Brazil pay an average of 190 percent per year for unsecured overdraft, credit card, and consumer loans with banks, whereas four banks held 72.7% of the assets of the country's commercial financial institutions by 2016. For these reasons, FinTech is perceived as an opportunity to provide lower fees and efficient financial inclusion through lower operational costs (Goldman Sachs, 2017). However, cost-efficient opportunities are not necessarily used without a suitable regulation. For this reason, the *Banco Central do Brasil* is looking to implement regulation to supervise FinTech companies. New regulation would incorporate FinTech firms to banks for loan offering, and facilitate P2P service with individual investors.

Mexico is currently discussing the so-called "FinTech Law" in which all actors, including *Banco de México*, are actively involved. Special caution is deserved for customer protection and financing anti-laundering operations. User identification and biometrics are key elements for the success in surveillance under the new regulation. The Law also focus in crowdfunding, payment methods, and cryptocurrencies. The main objectives pursued by both authorities and FinTech entrepreneurs are to promote competence, financial inclusion, and stability.

Colombia is involved in a National Strategy for Financial Inclusion aiming at 86% of the population using financial services in the near future, with FinTech firms playing a role in regulation set up. Currently, a main concern is credit provision for small- and medium-sized enterprises, which is taking the form of crowdfunding (by 2015 sizing USD 34 bn). This activity and robo-advisoring are subject to regulation, as well as avoiding Ponzi schemes with Bitcoins. FinTech providers in

Colombia are associated under the "Colombia FinTech" initiative, actively participating in regulation issues alongside Colombian authorities.

In Argentina, the *Banco Central de la República Argentina* established in April 2017 a formal dialogue with FinTech firms. This involves three issues regarding technology, payment methods, and any other remaining topic on financial technology. This is in line with a new Entrepreneurs Law (March 2017) aiming to reduce bottlenecks in the creation of new firms. Fast-growing financial innovation firms are perceived as an opportunity for cost-effective provision of funds as well as a financial inclusion tool, which encompasses 34% of the decline in the number of small banks within the period 2000-2015.

Uruguay recently announced its intention to conduct a six-month pilot program to issue and transfer digital notes through mobile devices. Instead of DLT technology, this program will rely on a private company's technology called *Global Standard for Money Technology* (Bergara, 2017).

VI.2. The Chilean landscape

For Chile, some reports suggest that it is among the Latin American countries where the FinTech industry has developed the most (Figure 4). This is mainly due to the fast development of crowdfunding, which appears to have flourished from its connection to factoring services (Ziegler *et al*., 2017)[8].

This coexists with a rather large, diversified and deep market for conventional financial services (see Figure 5). Under this framework, firms can get financing from several sources, including banks and bond markets, among others. In recent years, an increase in external financing is consistent with lower cost and the scale of the operations of those sources.

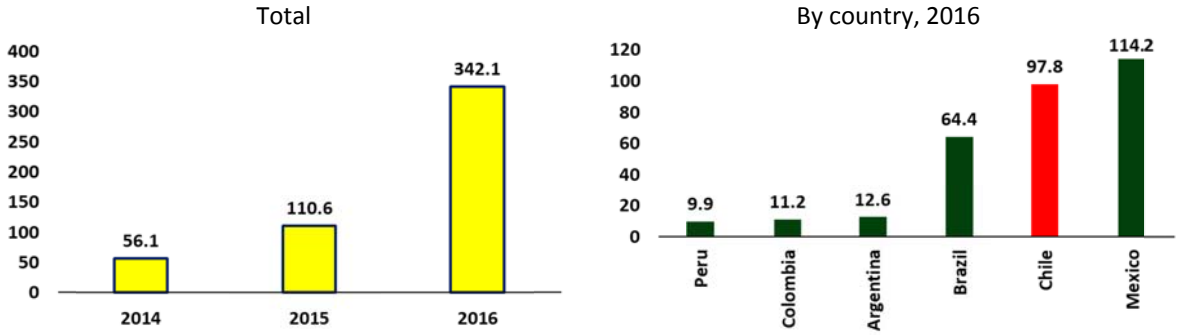
In addition to the above, it should be noted that Chile has reached almost universal coverage of basic services through the so-called "Cuenta RUT" (ID-associated bank account), managed by the state-owned bank *BancoEstado*. This is a sight account that can be opened by anyone holding a legally issued ID. At present, there are some 9 million of these accounts under operation (for a total population of 17.9 million), allowing its bearers access to electronic transfers, debit cards, and ATM cash withdrawals.

Cuenta RUT is a hybrid financial product that provides a good example of the factors that facilitate technologically enabled financial products in Chile. These include universal and secure identity registration; universal online invoicing; internet penetration, and regulations that foster cash-flow services, like factoring and leasing.[9]

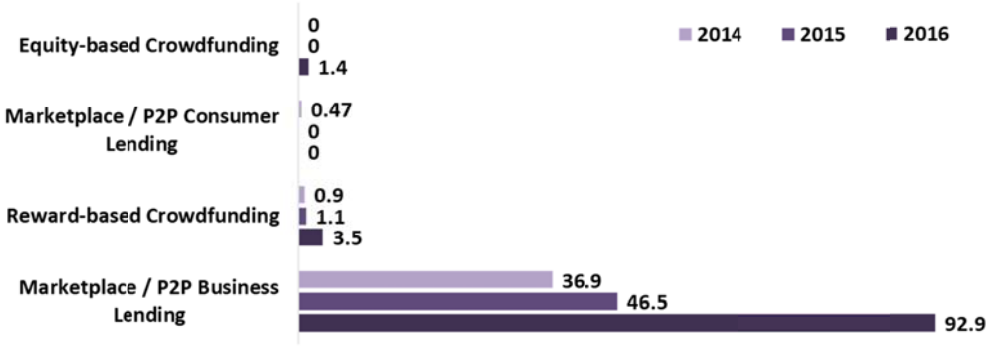
[8] Crowdfunding in Chile is an interest example of the dilemmas faced by financial regulators. The Chilean crowdfunding industry has bloomed even though the banking supervisor accused its biggest company of infringing the banking law in 2012.

[9] *Cuenta RUT* started in 2006. As of 2016, it has opened 900,000 new accounts with respect to the previous year, totalizing 9.2 million of active cards (Chile's population: 17.9 million). It provides remarkable inclusion facts: 52% are female, 32% live in rural or remote areas, 75% perceived CLP 400,000 per month (less than twice the minimum wage) or no income, 300.000 are immigrants (69% of total immigrant population), and 60% do not have past-due loans.

Figure 4: Latin America: Volumes by alternative finance model, in millions of dollars

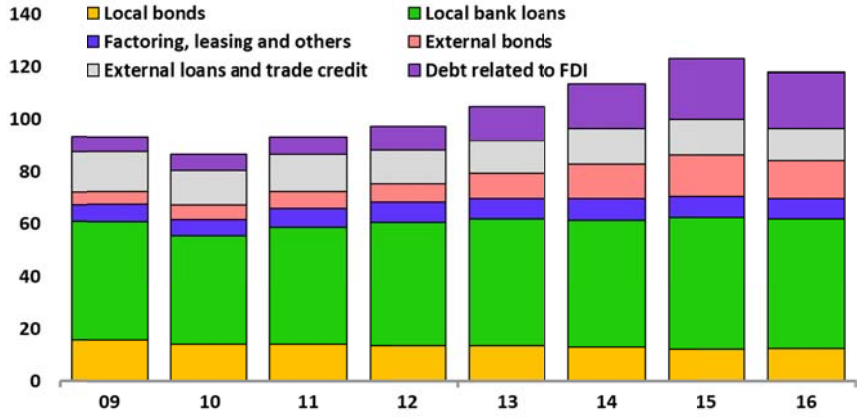


Chile: Volumes by alternative finance model, in million of dollars, 2014-2016



Source: Ziegler *et al*. (2017).

Figure 5: Total debt of non-bank loans, as a percent of GDP



Source: *Superintendencia de Bancos e Instituciones Financieras*.

These same factors provide the basis for the development of electronic retail payment services. Last year, a bill was passed allowing for the issuance of prepaid cards by non-bank institutions to foster financial inclusion and competition. Given the sensitive nature of deposit-taking, the law establishes integrity requirements for these issuers, restrictions on how the funds can be used, and requires the Central Bank to issue regulations with the prudential requirements for this industry.

The Central Bank of Chile used this opportunity to undertake a full revision of its retail payments regulation aiming to contribute to the development and updating of our retail payments market. The new regulations not only set the prudential requirements for non-bank prepaid card issuers; it also narrows down the scope of regulated entities dealing with the processing of transactions, and changes their capital requirements, aiming to facilitate the entrance of new participants to the acquiring and processing business.

By removing requirements that may be burdensome for small entities, and by considering explicitly the possibility of non-physical payment cards, as well as remote purchase of cards and acquiring of merchants, we expect to see the retail payments market in Chile taking a new shape in the near future. That almost certainly would involve—and perhaps require—active participation of FinTech entities.

These features give some ground for optimism on the potential contribution of FinTech not only to the accessibility of financial services but also to price and financial stability and development in Chile.

VII. Conclusions

Central banks need to keep pace with changes and be vigilant of FinTech developments in order to capture their most valuable characteristics. This may imply improving payment infrastructures, enhancing cybersecurity, adapting regulations, using and managing new data to assess micro and macro financial risks.

In the past, debit cards allowing cash withdrawals from ATMs led to believe in a complete refurbishing in banking activity. Revolutionary as they were for the public, those changes did not transform the banking business substantially. Banks kept taking short-term deposits to on-lend at longer maturities. They kept clearing funds and settling balances with one another and with the central bank to meet liquidity and reserve requirements. The main change for monetary policy in most countries was to switch from the control of monetary aggregates to the fixing of the policy rate for overnight liquidity operations as the vehicle to implement monetary policy.

Technology is now creating opportunities for changes in financial services that are more far-reaching for the public, financial institutions and central banks. Information technologies are doing this because finance is, to a large extent, an information and record-keeping business. By challenging the conventional centralized, multi-layered settlement and clearing system, DLT, and many other technological developments, it creates the possibility of an unbundling of financial services that question the very notion of banks and other intermediaries.

These are exciting opportunities not only for financial start-ups and the public, but also for leaders of developing countries, that see in these technological developments the opportunity to leapfrog financial development and remove one major roadblock to inclusive economic growth. To materialize this, however, policy makers—including central banks—need to make sure that they are not exposing people to greater risk, especially when they are using financial services for the

first time. Moreover, they may want enhanced access to financial services to facilitate formalization of economic activity rather than grow the shadow economy further.

To this end, FinTech innovations should be in principle governed by the same regulatory framework as traditional entities, adapting such regulations whenever necessary.

Chile has a solid ground to build from. Safe identity registration, massive access to the internet, a broad supply of complementary net-based services and, above all, near-universal bank accounts mean that, rather than leapfrogging, Chile and other emerging economies can move fast in the FinTech highway. This means that financial services providers may play a key role in this trip rather than remain in the side-lines, but they will need to adapt their business models and be prepared to share the road with other non-traditional travellers.

The main asset of a central bank today is not gold stored in their vaults, but trust from the public. Being able to understand the FinTech revolution and to ensure that this contributes to economic stability and people's welfare is one crucial way to remain trustworthy.

References

Allen, F. and G. Yago (2010), *Financing the Future: Market-based Innovations for Growth*, Prentice Hall Professional, US.

Bank for International Settlements (2009), "*Issues in the Governance of Central Banks*", report from the Central Bank Governance Group, Bank of International Settlements.

Bank of International Settlements (2017), "*The Sterling 'flash event' of 7 October 2016*," report prepared by an ad-hoc Markets Committee working group led by Rebecca Jackson, Liam Crowley-Reidy (Bank of England) and Andreas Schrimpf (Bank for International Settlements, Secretary).

Banque de France (2016), "*Financial Stability in the Digital Era*", panel discussion on the Banque de France's Financial Stability Review, Annual Paris Europlace International Financial Forum, New York, US. 18 April, 2016.

Bartoletti, M., S. Carta, T. Cimoli, and R. Saia (2017), "*Dissecting Ponzi Schemes on Ethereum: Identification, Analysis, and Impact*", mimeo, University of Cagliari, Italy.

Bergara, M. (2017), *Navegar en la incertidumbre requiere entender este mundo*, available at http://www.bcu.gub.uy/Comunicaciones/Paginas/Bergara_ADM_2017.aspx.

Bernanke, B. (2015), *The Courage to Act: A Memoir of a Crisis and Its Aftermath*, WW Norton and Co., US.

Berndsen, R. (2016), "*If Blockchain is the Answer, What is the Question?*", speech delivered at the Dutch Blockchain Conference, De Nederlandsche Bank. 20 June, 2016.

Bosworth, B.P., R. Dornbusch, and R. Labán (1994), *The Chilean Economy. Policy Lessons and Challenges*, The Brookings Institutions.

Broadbent, B. (2016), "*Central Banks and Digital Currencies*", speech delivered at the London School of Economics and Political Science. 2 March, 2016.

Chapman, J., R. Garratt, S. Hendry, A. McCormack, and W. McMahon (2017), "*Project Jasper: Are Distributed Wholesale Payment Systems Feasible Yet?*", Financial System Review, June 2017, Bank of Canada.

Committee on the Global Financial System (CGFS) and Financial Stability Board (2017), "*FinTech Credit*", Bank of International Settlement and Financial Stability Board Report. 22 May, 2017.

Danish Payment Council (2016), *Report on the Role of Cash in Society*, available at https://www.nationalbanken.dk/en/bankingandpayments/danish_payments_council/Pages/default.aspx.

Financial Stability Board (2017), "*FinTech Credit*", Financial Stability Board Report. 27 June, 2017.

Fung, B. and H. Halaburda (2016), "*Central Bank Digital Currencies: A Framework for Assessing Why and How*", Staff Discussion Paper 2016-22, Bank of Canada.

Goldman Sachs (2016), "*Blockchain: Putting Theory into Practice*", Equity Research. 24 May, 2016.

Goldman Sachs (2017), "*FinTech Brazil's Moment*," cited in the *New York Times*, *Goldman Sachs Sees Big Potential for Fintech in Brazil*, 15 May, 2017.

Hackethal, A. (2015), *Financial Advice*, in E. Faia, A. Hackethal, M. Haliassos, and K. Langenbucher (Eds.), *Financial Regulation: A Transatlantic Perspective*, Cambridge University Press.

Haliassos, M. (2015), *Keeping Households out of Financial Trouble*, in E. Faia, A. Hackethal, M. Haliassos, and K. Langenbucher (Eds.), *Financial Regulation: A Transatlantic Perspective*, Cambridge University Press.

He, D., K. Habermeier, R. Leckhow, V. Haksar, Y. Almeida, M. Kashima, N. Kyriakos-Saad, H. Oura, T. Sedik, N. Stetsenko, and C. Verdugo-Yepes (2016), "*Virtual Currencies and Beyond: Initial Considerations*", IMF Staff Discussion Note 2016/3.

Inter-American Development Bank and Finnovista (2017), "*FinTech: Innovaciones que no sabías que eran de América Latina y el Caribe*," available at https://publications.iadb.org.

Ketterer, J.A. and G. Andrade (2016), "*Digital Central Bank Money and the Unbundling of the Banking Function*," Discussion Paper IDB-DP-449, Inter-American Development Bank.

Kocherlakota, N. (1998), "Money Is Memory", *Journal of Economic Theory* **81**(2): 232-251.

Kopp, E., L. Kaffenberger, and N. Jenkinson (2017), "*Cyber Risk, Market Failures, and Financial Stability*", IMF Working Paper No. 17/185.

Kramer, S.N. (1956), *History Begin at Summer: Thirty-Nine First in Recorded History*, Third Edition, University of Pennsylvania Press, US.

KPMG (2016), "*Consensus – Immutable Agreement for the Internet of Value*", KPMG Report.

Levine, R.K. (2005), *Finance and Growth: Theory and Evidence*, in P. Aghion and S.N. Durlauf (Eds.), *Handbook of Economic Growth, Volume 1A*, Elsevier, North-Holland.

Malinova, K. and A. Park (2016), "*Market Design with Blockchain Technology*", mimeo, University of Toronto, Canada.

Moore, T. and N. Christin (2013), "Beware the Middleman: Empirical Analysis of Bitcoin-Exchange Risk", *Financial Cryptography and Data Security*, 2013: 25-33.

Oosterloo, S. and J. de Haan (2004), "Central Banks and Financial Stability: A Survey", *Journal of Financial Stability* **1**(2): 257-273.

Raskin, M. and D. Yermack (2016), "*Digital Currencies, Decentralized Ledgers, and the Future of Central Banking*," Working Paper 22238, National Bureau of Economic Research.

Reinhart, C. and K. Rogoff (2014), "Recovery from Financial Crises: Evidence from 100 Episodes," Working Paper 19823, National Bureau of Economic Research.

Sahay, R., M. Čihák, P. N'Diaye, A. Barajas, R. Bi, D. Ayala, Y. Gao, A. Kyobe, L. Nguyen, C. Saborowski, K. Svirydzenka, and S.R. Yousefi (2012), "Rethinking Financial Deepening: Stability and Growth in Emerging Markets," IMF Staff Discussion Note 2015/8.

Shafik, M. (2016), "A New Heart for a Changing Payments System", speech, Bank of England. 27 January, 2016.

Skingsley, C. (2016), "*Should the Riksbank Issue e-krona?*" speech at FinTech Stockholm 2016, Sveriges Riksbank.

Smets, J. (2016), "*FinTech and Central Banks*," speech delivered at the Colloquium of the Belgian Financial Forum in cooperation with SUERF, the European Money and Finance Forum and Eggsplore. 9 December, 2016.

Stein, J. (2012), "Monetary Policy as Financial-Stability Regulation," *Quarterly Journal of Economics*, **127**: 57-95.

Superintendencia de Bancos e Instituciones Financieras (2016), *Informe de Inclusión Financiera en Chile 2016*, available online at www.sbif.cl.

Sveriges Riksbank (2017), *Riksbankens e-krona, 14 March 17, Project Plan*, available at http://www.riksbank.se/en/Financial-stability/Payments/Does-Sweden-need-the-e-krona/.

Támola, A. (2014), "*Credit, Labor Formality and Firm Size: Analytical Framework and Regional Evidence in the Context of the IDB's Country Strategy Dialogue*", Technical Note 627, Inter-American Development Bank.

Wild, J. (2016), "*Central Banks Explore Blockchain to Create Digital Currencies*", *Financial Times*. 2 November, 2016.

Ziegler, T., E. Reedy, A. Le, B. Zhang, R. Kroszner, and K. Garvey (2017), "*2017 Americas Alternative Finance Industry Report*", Cambridge Centre for Alternative Finance, Cambridge University, UK.

BANCO CENTRAL
DE CHILE