BANK FOR INTERNATIONAL SETTLEMENTS

Fintech in EMEs: blessing or curse?

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Introduction

Technology-driven innovation in financial services, or fintech, has become more prominent in recent years. Key drivers of this trend are lower costs and scale economies, which can enhance the efficiency and reach of financial services. Emerging market economies (EMEs), many of which have a relatively less developed financial sector and a larger share of the population that is financially excluded than advanced economies (AEs), naturally have more scope to reap significant benefits from these technological transformations. But these innovations could also undermine the franchise value of existing financial institutions and lead to excessive risk-taking or regulatory arbitrage. In addition, changes in the financial landscape brought about by fintech could affect monetary policy transmission and the efficacy of macroprudential policy measures in smoothing financial cycles. Thus, it is important for central banks and the regulatory community to keep track of current developments and to keep regulatory frameworks up to date.

My remarks will examine the benefits and risks of fintech for EMEs. In a nutshell, is fintech is a blessing or a curse for EMEs? First, I will review the fintech developments that are more relevant for EMEs. Specifically, I will focus on two technologies – mobile and internet, and distributed ledger – but only touch upon machine learning and big data. By examining some recent applications to mobile banking and payments, peer-to-peer (P2P) lending, remittances, trade finance and credit extension (Table 1, shaded cells), I will highlight the potential of these innovations as new forms of financial inclusion and financing channels. Finally, after discussing their potential implications for monetary and macroprudential policies, I will conclude by examining the options for a regulatory response.

Fintech landscape with EME interest — Table 1

Service \ Technology	Mobile and internet	Distributed ledger	Machine learning and big data	Potential impact
Payments, transfers, clearing and settlements	Mobile and online payments Cross-border transfers	Remittances	Know-your-customer applications Regtech	"New" forms of financial inclusion
Intermediation and direct finance	Mobile banking Agent-based banking Peer-to-peer lending	Trade finance Initial coin offerings	Credit scoring Risk management	"New" forms of financing
Risk and investment management	Smart contracts, e-contracts		Risk metrics Robo-advisor	"New" forms of insurance

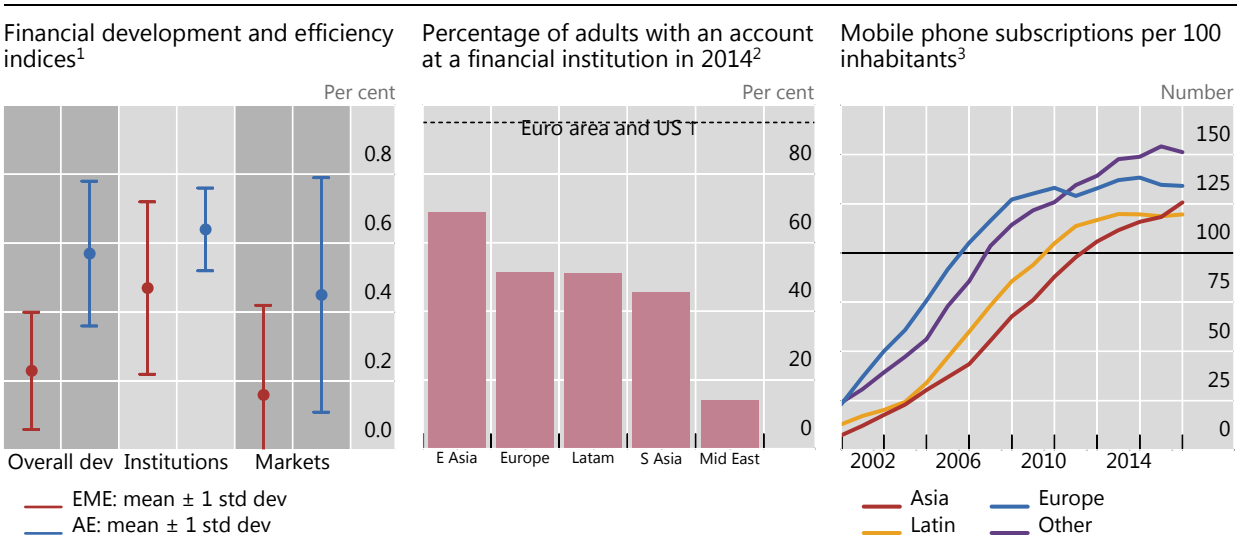
Source: BIS.

[1] Deputy General Manager, Bank for International Settlements; the views expressed here are my own and not necessarily those of the BIS. I would like to thank Michael Chui for an excellent contribution to these remarks and also Christian Upper and Tirupam Goel.

Fintech developments in EMEs

A number of factors have contributed to the rapid growth of fintech in EMEs in recent years. First, financial systems that are less developed and efficient than in AEs create more scope for new services (Graph 1, left-hand panel). Second, a lower degree of financial inclusion offers the potential of broader access. For instance, around half of the adult population in most EMEs is unbanked, compared with less than 10% in the euro area and the United States (Graph 1, centre panel). Third, the increasing penetration of internet and mobile technologies provides a natural vehicle for fintech expansion (Graph 1, right-hand panel).

Financial and fintech developments in EMEs — Graph 1



[1] Financial development index; financial institutions efficiency index and financial markets efficiency index developed by Syirydzenka (2016). [2] Regional averages as defined by the World Bank; dotted line represents levels in the euro area and the United States. [3] Regional aggregates are simple averages. Asia: China, India, Indonesia, Malaysia, the Philippines and Thailand; Europe: the Czech Republic, Hungary, Poland and Russia; Latin America: Argentina, Brazil, Chile, Colombia, Mexico and Peru; Other: Saudi Arabia, South Africa, Turkey and the United Arab Emirates. The number of mobile phone subscriptions can overestimate the actual mobile *penetration* as some individuals may have multiple ones. Nevertheless, this should not affect trend growth significantly.

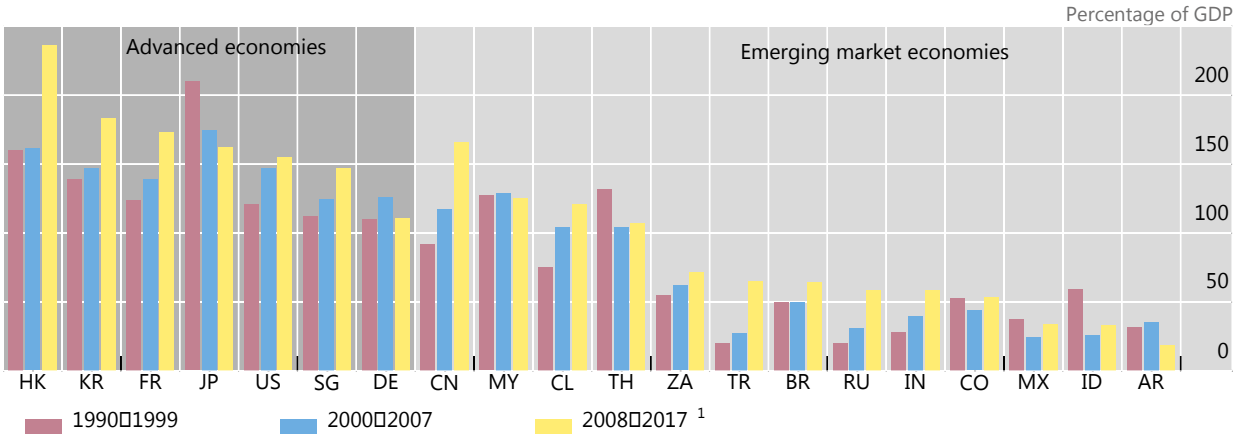
Sources: World Bank, *Global Findex Database*; International Telecommunication Union.

These factors in combination provide a conducive environment for technology companies to address some "traditional" EME problems of insufficient financial services, and credit provision in particular. For decades, the private sector in many EMEs has been "credit-rationed" (Graph 2). In part, the unwillingness of local banks to extend credit to some private sector firms is a consequence of their assessment of risk under asymmetric information between borrowers and lenders (Stiglitz and Weiss (1981)). Borrowers in some EMEs then turned to global banks for funds, but that has exposed them to "sudden stops" of capital flows – an important element of many debt crises. Domestic credit constraint also prompted some EME policymakers, particularly those in Latin America, to embrace excessively expansionary quasi-fiscal credit policies using state-owned banks to fill the funding gap. But on many occasions these policies became hostage to local political cycles, and were often implemented with no concern for the existence of fiscal and foreign exchange constraints in what was termed macroeconomic populism (Dornbusch and Edwards (1991)).

Therefore, after many failed experiments, can fintech contribute to solving some of these traditional problems? Let me walk you through some examples to illustrate the potential of fintech in EMEs.

Credit to the private non-financial sector

Graph 2



1 Data for 2017 up to Q3.

Source: BIS.

Mobile technology: applications in banking and payment services

Recent progress in mobile technology has facilitated strong growth in mobile phone-based banking and payment services in EMEs.[2] Both banks and non-banks have contributed. For example, some banks are appointing certified agents to serve unbanked customers in remote areas via mobile devices. Similarly, microfinance institutions are expanding the reach and range of their services. Mobile phone operators are offering banking-type services while e-commerce platforms have introduced mobile payment services. Merchants, for instance, can settle faster and more cheaply through mobile payments (eg by displaying quick response (QR) codes instead of renting point of sale terminals).

A prominent example of mobile banking services is M-Pesa, first introduced in Kenya in 2007. M-Pesa allows users to transfer money via mobile phone messages. Recipients can then withdraw cash from certified local agents. By end-2016, M-Pesa served almost 29.5 million users through more than 287,400 retail agents in 10 countries.

Mobile payment services have grown significantly in recent years. In China, mobile payments are now used by more than half a billion people, their total value growing almost tenfold to CNY 117 trillion ($18 trillion) in the two years to 2017 (CGAP (2017)). The Chinese market is dominated by a small number of big players, with Alibaba (Alipay) and Tencent (WeChat Pay) together accounting for more than 90%. And in India, Paytm, the dominant mobile financial services platform founded in 2010, has over 200 million wallet customers. The rapid growth of mobile payments was supported in part by very competitive pricing. For example, the total mobile payments volume of Alipay and WeChat Pay in China reached almost $7 trillion in the first half of 2017, compared with PayPal's total payments volume of $206 billion over the same period. While the effective mobile payment fee a merchant pays is around 38–60 basis points per commercial transaction in China, PayPal's fee is set at 290 basis points plus a fixed charge of $0.30 in the United States (Goldman Sachs (2017)).

Mobile technology has also enabled easier and cheaper cross-border retail payments. For example, Chinese residents using Alipay and WeChat Pay can shop as tourists at retailers in 28 jurisdictions

2 Mobile payments technology also developed rapidly in AEs. A popular example is "contactless" card payments. Low levels of credit card ownership and a lack of existing infrastructure (such as point of sale terminals) have hampered the growth of this particular technology in most EMEs.

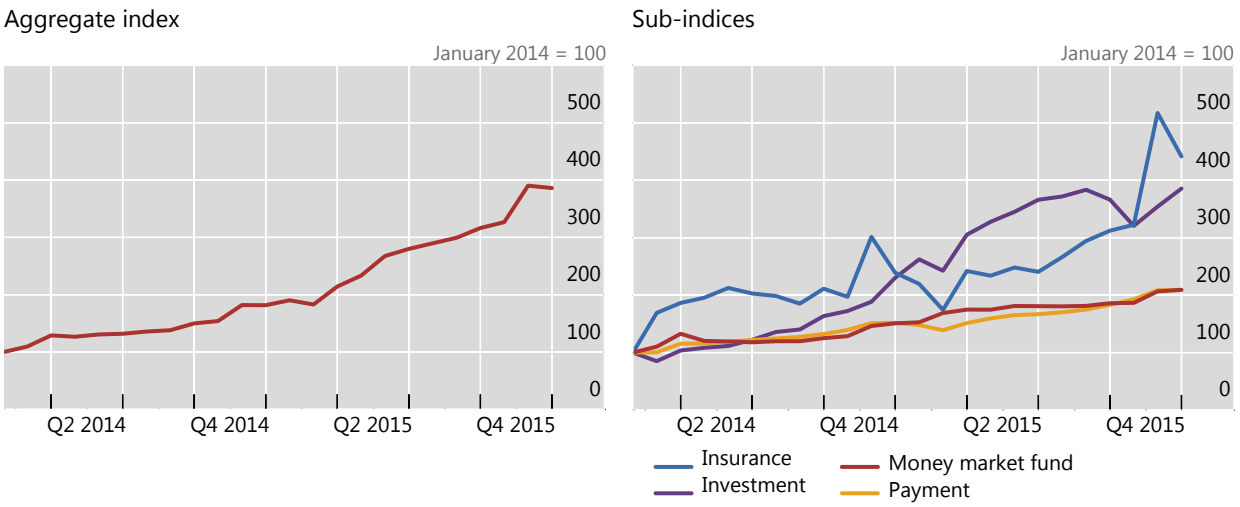
in Asia and pay with their existing Chinese big-tech accounts. Hong Kong residents can also use WeChat Pay (linked with any international credit card) for online payments in China. The Bank of Thailand and the Monetary Authority of Singapore (MAS) have agreed to link their mobile payment systems to allow Thai and Singaporean residents to exchange money via mobile phones at any time.

Internet technology: peer-to-peer (P2P) lending

The internet has also been transformational for the finance industry. One of the earliest applications of internet finance is third-party payments, under which a third-party agent (eg PayPal) processes the transactions between a buyer and a seller in a more secure way online. Second, technology firms compete or collaborate with traditional financial institutions to provide banking and insurance services online. Third, these companies also offer wealth management products such as money market funds and trusts to customers online. Fourth, many financing activities such as crowdfunding, P2P lending and consumer financing have also grown rapidly on internet platforms.

A country that has witnessed a remarkable growth in internet finance in recent years is China. According to Peking University's Internet Financial Development Index (IFDI), internet finance grew almost threefold nationwide in China between 2014 and 2015 (Graph 3, left-hand panel) (Huang et al (2016)). Among the main business categories that constitute the IFDI, insurance and investment (including P2P lending) have the fastest growth, much higher than that of the money market fund and payment sub-indices during that period (Graph 3, right-hand panel).

Internet Financial Development Index — Graph 3

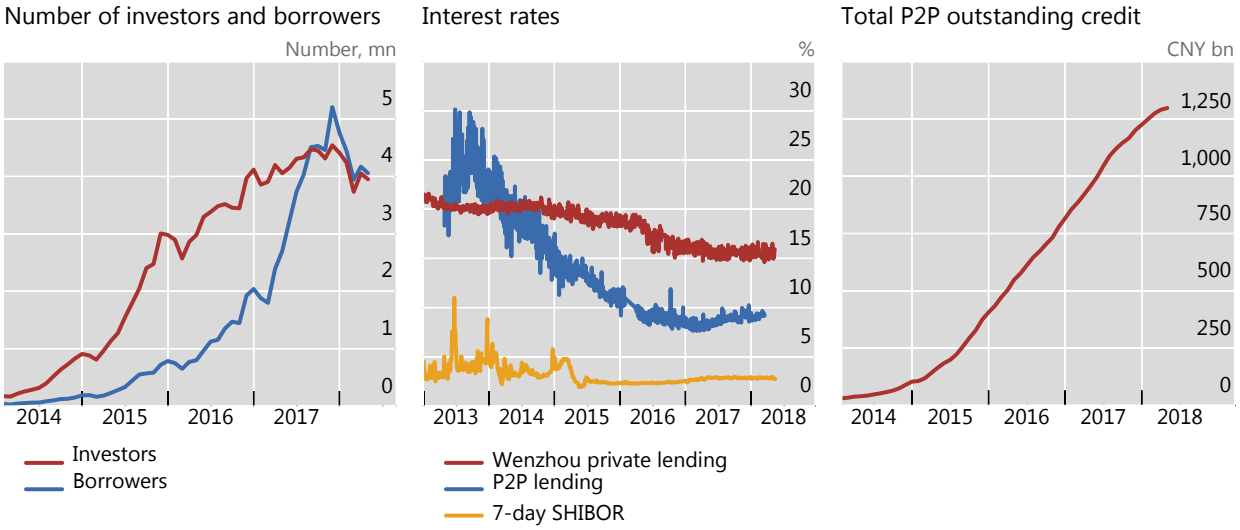


Source: Institute of Internet Finance, Peking University.

In response to the exceptional increase in P2P lending, the Chinese authorities started by the middle of 2017 to tighten the regulations on some fund-raising activities via these platforms to allay fears that these loans could lead to investment bubbles and to protect the public from falling for Ponzi schemes. The number of investors and borrowers began moderating slightly in late 2017 (Graph 4, left-hand panel). From the borrower's perspective, these P2P platforms offer loans at a lower interest rate than other informal lenders (eg Wenzhou private lending). And for investors, P2P loans offer more favourable returns than some prevailing market rates (Graph 4, centre panel). By the end of March 2018, total outstanding P2P credit reached CNY 1.3 trillion (Graph 4, right-hand panel). Although P2P loans now amount to just 1% of total bank loans in China, this form of internet lending could complement traditional financial

services in funding underserviced segments such as small and medium-sized enterprises and low-income households.

P2P lending in China — Graph 4



Source: WIND.

Distributed ledger technology: two applications

The benefits of several other promising technologies are more prospective. Distributed ledger technology (DLT) forms the basis of cryptocurrencies such as bitcoin, but could have much broader applications (see eg Deshpande et al (2017) and World Bank (2017)). The decentralised data storage inherent in DLT reduces the need for intermediaries or validators, such as the central server of a credit card company. The availability of data records to all network participants, and the ability to verify transactions jointly, provide safeguards against fraud as there is no single point of vulnerability. Furthermore, record reliability is higher since any change requires validation collectively or by a subset of users responsible for the task.

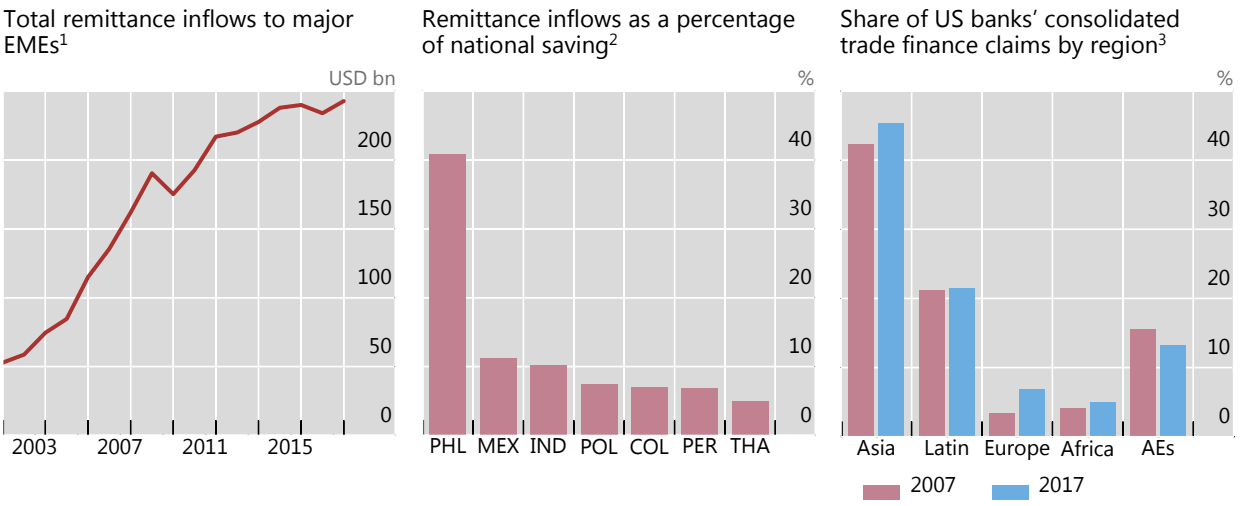
Remittances and cross-border payments

Cross-border transfers, especially remittances, are an important source of income for some EMEs. Total remittance inflows to major EMEs rose from $50 billion in 2002 to around $250 billion in 2017 (Graph 5, left-hand panel). Six of these economies recorded average inflows of over 5% of national saving over the past five years (Graph 5, centre panel). However, these cross-border transfers are generally very costly, especially when the banks involved do not have a direct relationship and must work through correspondents (CPMI (2016)). By streamlining domestic and cross-border systems, DLT might reduce the transaction costs involved.

Consider international bank transfers more generally. Currently, most cross-border bank transfers go through SWIFT. A correspondent banking relationship adds an extra layer that has to collate and net out payment messages before transmitting confirmations or denials to the ultimate banks. This increases the required time and fees. By switching to a DLT-based system, banks could potentially bypass the additional intermediaries and transact directly. The Philippine government is exploring the possibility of using DLT-based services to cut remittance costs that are currently, on average, over 7% of the amount transferred to as low as 2% (Espenilla (2018)).

Remittances could help reduce poverty through improved financial inclusion by helping to expand the range of financial services for the recipients. This in turn could bring other benefits such as consumption smoothing and greater investment.

Remittance and trade finance in EMEs — Graph 5



[1] Argentina, Brazil, Chile, China, Colombia, Hong Kong SAR, India, Indonesia, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Russia, Saudi Arabia, South Africa, Thailand and Turkey. [2] Average between 2013 and 2017. [3] Total extensions of credit with maturities of one year and under that are directly related to imports or exports and will be liquidated through the proceeds of international trade.

Sources: IMF, *World Economic Outlook* database; World Bank: US Federal Financial Institutions Examination Council (FFIEC).

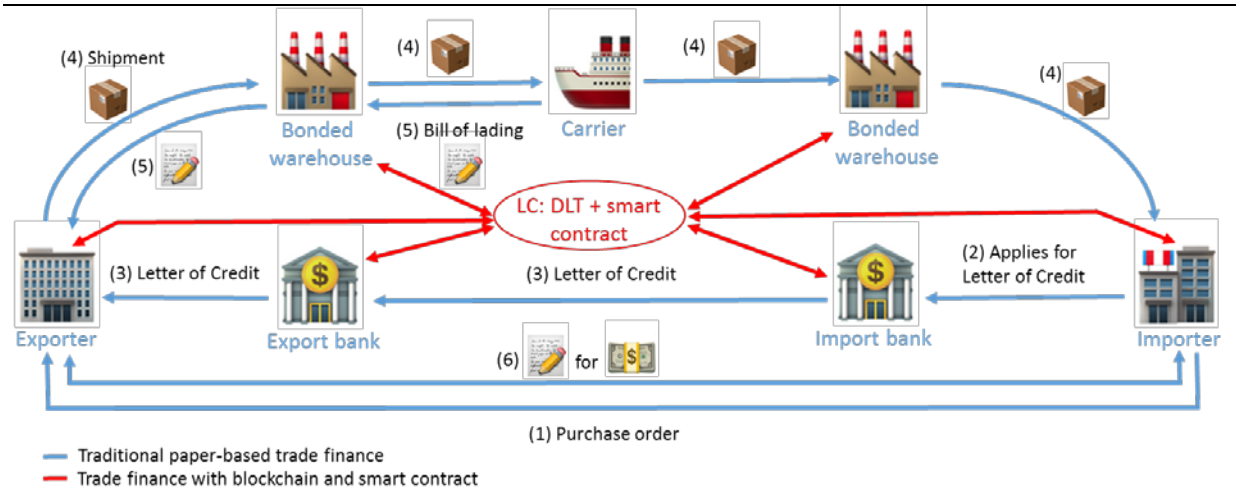
Trade finance

Trade finance is the oil that lubricates global trade. CGFS (2014) finds that disruptions in trade finance could account for up to one fifth of the decline in trade volume in the immediate aftermath of the Great Financial Crisis. Asia, which accounts for around 45% of total US consolidated bank trade finance claims, is more vulnerable to such disruptions (Graph 5, right-hand panel).

Existing trade finance arrangements leave room for efficiency gains. Bank-intermediated instruments such as letters of credit (LCs) often require manual processing and verification (Graph 6, blue lines). This labour-intensive and time-consuming work accounts for about half of LC costs (Flint (2016)). DLT-based LCs, supported by "smart contracts" (digital agreements that are automatically executed once all parties have fulfilled agreed preconditions), could reduce execution time and labour cost, and even fraud (Graph 6, red lines). Since changes by any participant with the necessary permission to modify a DLT-based LC or other logistics documents (eg a bill of lading) are immediately known to everyone, illegitimate use may be very difficult.

Commercial banks and some central banks (eg Hong Kong Monetary Authority, Reserve Bank of India and MAS) have collaborated with startup companies to explore an application of DLT to trade finance. One transaction conducted in late 2016 showed that DLT could cut processing time from 20 days to only a few hours relative to a paper-based system (Barclays (2016)). Other banks are reported to have tested similar DLT-based trade finance systems successfully. However, commercial viability hinges on widespread adoption and cross-border interoperability.

Traditional and digitalised trade finance flows[1] Graph 6



[1] A **bonded warehouse** is a secured facility supervised by customs authorities where imports are stored pending their release on assessment of import duties and other charges. A **bill of lading** is a document issued by a carrier as a receipt for cargo accepted for transportation, and must be presented in order to take delivery at the destination. A closely related document is a warehouse receipt, which is an agreement for storage rather than carriage.

Source: BIS.

Machine learning and big data analytics: applications in lending

Machine learning (ML) and big data (BD) analytics can boost financial firms' competitiveness. Large technology companies naturally have a comparative advantage vis-à-vis traditional financial intermediaries in exploiting advances in computing power and data storage. Importantly, their customer-centred business models require them to make greater use of large and diverse data sets (eg compiled from online payment and social media behaviour) to gain a competitive edge. For example, some Chinese lenders are reportedly experimenting with ML and BD to screen online borrowers and improve credit scoring and risk management.

Risks related to fintech

Fintech can have many positives for the financial industry. The above examples show that fintech could improve the efficiency of some core bank functions such as payments and settlements and retail banking services, thereby boosting banks' returns individually and the resilience of the banking system in aggregate. In addition, better credit screening using fintech could improve risk assessment, credit allocation and capital efficiency (Carney (2016)). But the rapid growth of fintech could also pose risks to consumer and investor protection, as well as to financial stability more broadly.

Financial risks: Like all financial intermediaries, fintech companies engaged in intermediation may expose their investors and creditors to liquidity and credit risks. First, compared with incumbent financial firms, fintech startups may not have the necessary risk management expertise and underestimate the level of risk they are taking on. Second, if fintech-based lending platforms evolve to start using their own balance sheet to intermediate funds, maturity mismatches could arise and open up the possibility of runs. Third, payments firms offering mobile wallets could hold client monies and invest them in less liquid assets. This would expose clients to liquidity mismatch risk. The FSB (2017), however, finds that very few fintech

companies have performed maturity and liquidity transformation at the current juncture, but warns that such risks may arise when their business models evolve.

Cyber-risks: In an era of internet-based financial services, cyber-attacks on personal devices (eg via virus-infected QR codes) or central servers (eg via hacking of a data server) can lead to theft of consumer information and unauthorised financial transactions. Such threats to consumer protection can be larger when cyber-security standards are less well developed. The threat of disruption (eg of a payment network), and thus potential losses to consumers are larger also when underlying systems have a single point of failure or dependency (eg all data stored in one location).

Data privacy risks: Another source of concern for consumer protection is the misuse of consumer data by fintech companies themselves. For instance, subsidiaries of a banking group could share consumer data with each other or even sell it to other entities without consumer awareness or consent. An entity may also use non-financial and/or social behaviour data to develop so-called social credit ratings for use in borrower screening, which may be unacceptable to individuals or even society at large. The dispute between Facebook and Cambridge Analytica over the alleged harvesting and use of personal data was a case in point.

Implications for financial stability

The currently limited size of the fintech sector probably limits financial stability risks at this stage. But its rapid growth rate could change things rather quickly. For example, systemic risks could also arise if fintech threatens the business models of established players. Fintech payments providers, P2P lenders, robo-advisors and foreign exchange agents are now competing directly with incumbent banks in many of their core functions. Given time, these new entrants could unbundle traditional banking models and deny the incumbents their traditional economies of scale and scope. In the extreme, the large technology firms could become "too big to fail".

Furthermore, proponents of fintech sometimes argue the new entrants are bringing new forms of finance, currency and methods of payment to new customers or just "democratising finance". But somehow this statement sounds similar to promises of risk-spreading and reduced capital needs made when the subprime story was unfolding in the run-up to the Great Financial Crisis.

Fintech may also raise financial stability concerns by creating dependencies on certain critical services, or single points of failure. Prolonged disruptions in such services (say, due to failure of telecommunication systems or cyber-attacks) can generate significant financial system stress. For example, payment delays due to a technical fault in a DLT-based cross-border payment system could lead to a funding shortfall for all banks in the DLT network and disrupt their ability to function.

Fintech could also increase contagion risk. Some fintech applications such as ML trading strategies and ultra-complex investment algorithms could encourage herding on common information, resulting in trading positions becoming more correlated.

Investors' fascination with crypto-assets as a form of electronic payment and store of value in the future (or any other function they are meant to serve) seems to have contributed to demand for these assets. And it may well be that the investors who are not deterred by these assets' extreme price volatility are engaging in illegal activities such as tax evasion and money laundering. In this context of crypto-assets being primarily used as a vehicle to legitimise profits from illegal activities, the emergence of financial bubbles could at the same time become a big financial stability risk if the strong growth is left unchecked (Carstens (2018)).

Implications for monetary (and other) policies

Fintech has the potential to transform the financial industry, and in doing so it will affect the effectiveness of macroprudential measures and monetary policy transmission.

In recent years, many EME central banks have introduced new or improved existing macroprudential tools to enhance the resilience of the banking system. Yet their effectiveness may be compromised if banks and borrowers are able to avoid them via regulatory arbitrage or if activity shifts to other, unregulated institutions. In this context, the emergence of fintech firms in competition with banks in many core bank functions could weaken the effectiveness of central banks' macroprudential toolkits.

Fintech could also affect the conduct of monetary policy. As mentioned earlier, fintech has the potential to unbundle banking. If that materialises, it will affect the roles of bank capital and the way banks acquire liabilities – the key determinants of the credit channel of monetary policy. Furthermore, in improving financial inclusion and participation in financial markets, fintech could also affect consumer spending by boosting household assets – the so-called wealth channel of monetary policy transmission. As for the central banks, if some new econometric application of ML and BD analytics could help in estimating the present and future state of the economy more accurately, that could benefit monetary policy decisions.

A related ongoing debate is whether a central bank should issue its own digital currency to facilitate payments and serve as a stable unit of account and a secure store of value. There are some important considerations involving the design characteristics of a central bank digital currency (CBDC) (see eg Bordo and Levin (2017)). For example, should CBDC payments involve transfers between accounts held at the central bank only? Should the CBDC be accessible by all residents and interest-bearing? How will a CBDC affect the interactions between the central bank and fiscal authorities? If CBDCs are issued, these characteristics will have important implications for the conduct of monetary policy and may require adjustments in the monetary anchor and policy operations. Note that these CBDC concerns may not all be fintech-related and that they apply to both EMEs and AEs.

Regulatory response

The rapid growth of fintech poses several challenges for central banks in the design and implementation of regulations. In general, there are two approaches to regulating fintech firms: *risk-based* and *size-based*. First, risk-based regulation is based on the motto of "same risk, same regulation", under which fintech companies should be regulated on the basis of the risks they pose. However, identifying and classifying these risks is often challenging. Second, sized-based regulation is founded on the assumption that smaller fintech firms are less likely to present systemic risks. Regulation and supervision could focus on the larger fintech firms, giving the smaller ones more latitude to test their services. However, for other risks such as cyber- and data privacy risks, all firms may be regulated and supervised alike. For instance, Brazil is planning a cyber-risk regulation framework to be in place by July 2018 for all firms that use cyber-technologies.

Regulators may need to adjust supervisory oversight. For example, new rules regarding dissemination of detailed information about fintech products and services to increase investor and consumer protection may be warranted. Similarly, restrictions regarding institutional investments in fintech activities could also limit such risks.

The multifaceted nature of fintech developments will necessitate tight coordination between central banks, financial regulators and other government agencies. For example, regulating mobile companies and internet companies offering financial services may require close coordination between cyber-regulators, payment systems authorities, telecoms regulators and the central bank.

Given that fintech developments, and thus the risks associated with them, can transcend borders relatively easily, international cooperation is another important aspect. International cooperation in the form of data sharing and privacy laws, rules on cross-border investments and payments, or legal authority could be useful for effective supervision. It could also help harness the benefits of fintech, for example via interoperable trade finance or remittance systems, as in the case of Hong Kong SAR and Singapore.

Another difficult challenge is how to preserve the incentives for technological innovation. This could help hinder innovations and financial services from migrating to the shadows. In this context, it may be important to limit regulatory uncertainty. Moreover, authorities could catalyse fintech innovation by investing in financial infrastructure (examples being the Mobile Payments Platform established by the Central Bank of Argentina and a new nationwide clearing house for online payment services set up by the People's Bank of China).

Going forward: pragmatic strategies

Many EME central banks have adopted some pragmatic strategies in responding to these fintech developments. First, many central banks are equipping themselves to cope with the challenges. They have set up dedicated fintech units or working groups, often with specialised staff members, to keep up with technology developments.

Second, central banks are taking a proactive approach to foster technological developments. For example, some central banks are offering research and development (R&D) support, or plan to engage in such activities themselves.[3] R&D support could encourage innovators to converge under a formal roof, which could foster competition. Some central banks are also facilitating knowledge-sharing and the exchange of ideas between innovators, industry participants and/or academics via forums.[4] Another important measure is to establish controlled regulatory environments, or "regulatory sandboxes", to allow innovators to test their products and services, sometimes with real customers. These initiatives are useful not just for market players, but also for regulators. By helping with the identification of active fintech players and evolving risks, these initiatives could serve as an effective guide for regulators as they strive to adjust their regulatory standards in response to fintech.

The third approach is to pick the low-hanging fruit. To that end, some central banks are collaborating with technology companies to develop applications that aim to improve some long-standing "paper-heavy" inefficient practices in areas such as trade finance and domestic letters of guarantee.

Fourth, central banks are striving to maintain a level playing field by promoting interoperability in fintech. For example, central banks may invite technology companies to develop common QR codes that can be accepted across different mobile wallets, or internet platform operators and banks to become stakeholders in an online clearing house.

A fifth approach consists in acting tough on those innovations where central banks find it difficult to draw a line. The recent bans on initial coin offering activities imposed by the Chinese and Korean authorities are an example of the readiness of central banks to intervene if needed.

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[3] For example, TechLab is a project proposed by the Central Bank of Chile (CBC) aimed at exploring the use of technologies such as DLT and big data within the CBC.

[4] For example, Finopolis 2018 is an international platform organised by the Bank of Russia for the discussion of key trends in fintech, as well as the presentation of new products.

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