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120

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Monetary Policy Implications
of Financial Innovation

Kerstin Bernoth, Stefan Gebauer and Dorothea Schäfer

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DIW Berlin: Politikberatung kompakt 120

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Monetary Policy Implications of Financial Innovation

In-Depth Analysis

IP/A/ECON/2017-01

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Abstract

In this policy brief, we argue that the financial innovations triggered by the FinTech industry have the potential to affect the transmission of monetary policy as well as the informational content of important monetary indicators. The growing FinTech industry could contribute substantially to the emergence of nonbank finance as a substitute for traditional commercial bank finance. While the overall effect of nonbank finance on monetary policy transmission is not yet clear, we argue that regulators and policy makers need to closely monitor the potential effects of FinTech on monetary policy transmission and to adequately adjust financial sector regulation.

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Executive summary

- The FinTech industry is based on specialized start-up financial firms aiming to unbundle the activities of banks by taking advantage of digitalization and big data techniques. As FinTechs bring new risk into the sector, there are implications for stability and monetary policy.
- Despite impressive growth in recent years, the FinTech industry is still tiny in comparison to the traditional banking sector. In the current state, FinTech leaves monetary transmission largely unaffected. However, FinTech innovations have the potential to enforce the shift of credit intermediation away from commercial banks into the nonbank part of the financial system.
- The overall effect of nonbank finance on monetary policy transmission via different channels (balance sheet channel, risk-taking channel, bank lending and bank capital channel) is a priori unclear and empirical findings are inconclusive. However, an increasing provision of bank-like services by nonbank FinTech companies will decrease the informational content of monetary aggregates, thus potentially distorting the information that monetary authorities obtain about the real economy and price stability.
- Distributed ledger technology is likely to change payment, clearing, and settlement operations. However, since trust is key, these operations will remain under the auspice of central banks.
- As the importance of the FinTech sector in providing the real sector with credit and liquid funds continues to grow, policy makers and regulators need to monitor both parts of the financial system with similar rigorously, designing monetary and regulatory policies adequately.

1 Introduction

Financial stability and access to financial services are the most important goals of financial regulation and central banks. A well-functioning financial system is important for economic growth, in particular for the allocation of capital. However, the observed growth of the financial industry during the last decades has not substantially improved capital allocation: financial services remain expensive and the financial sector chronically lacks competition.

As argued by Philippon (2016), financial innovation could play an important role in making progress toward improved access to financial services and increased competition with the banking industry. Before the global financial crisis of 2007/2008, a strong wave of deregulation starting in the 1980s, as well as substantial innovations in financial products and technologies had boosted the role of nonbank finance. Weakened balance sheets and tighter prudential regulation in the aftermath of the Great Recession affected commercial bank lending in recent years and further increased the role of nonbank finance in many economies.

The FinTech industry developed and emerged from specialized start-up financial firms that aim to unbundle the activities of banks by taking advantage of digitalization and big data techniques. The hopes arising from FinTech range from financial inclusion and better access to credit for consumers and for small and medium-sized enterprises (SMEs) to lower transaction costs and a more diverse and resilient financial system. However, as we argue in this policy brief, FinTech also brings new risk into the sector, thus, having stability and monetary policy implications, especially if the sector continues to grow at a high pace (Curran 2016, Carney 2017b).

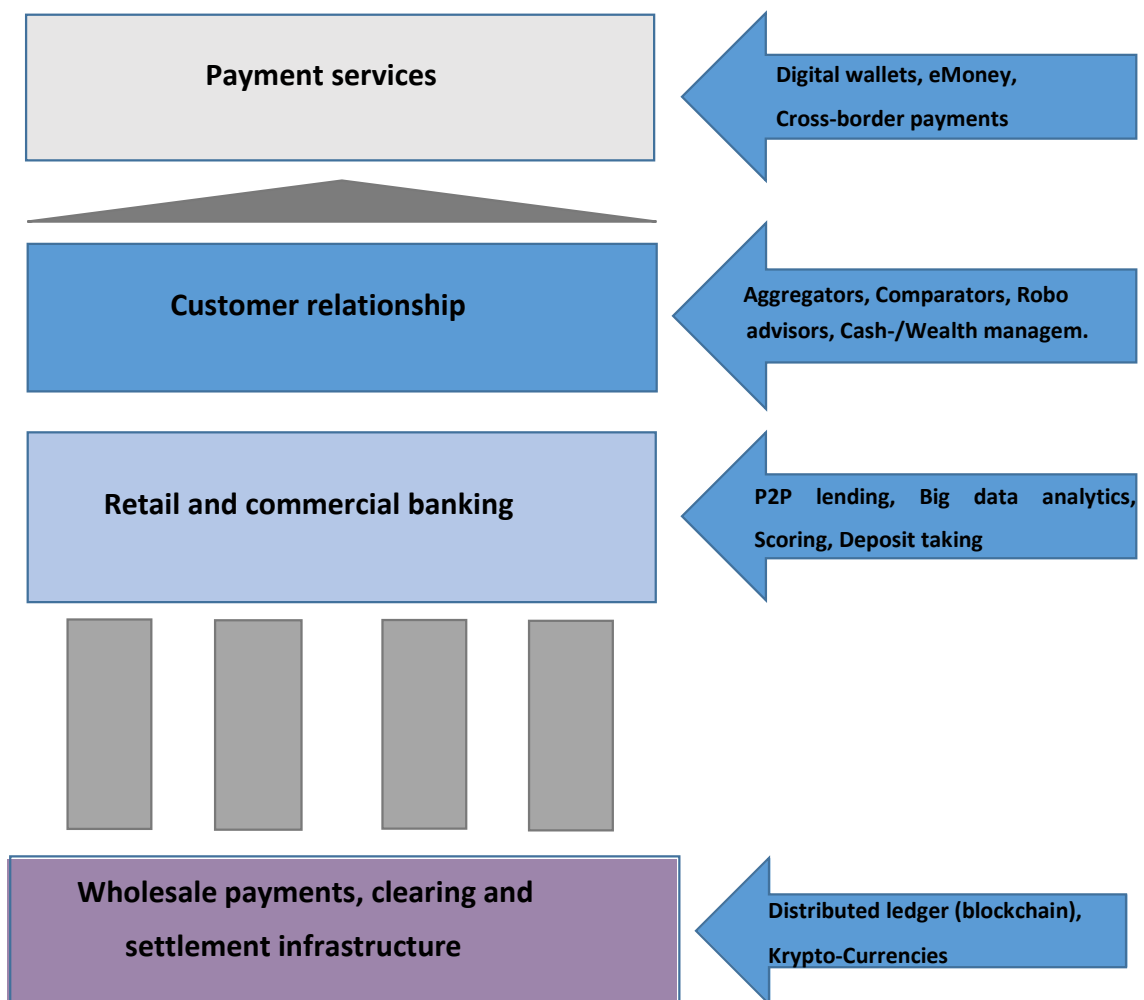
Accordingly, central banks and supervisory agencies should closely monitor developments in the FinTech industry. The key challenge for financial regulators is to create the right balance: The regulatory framework might need adjustment such that it facilitates FinTech innovations that produce benefits for the economy and the financial system, but at the same time also appropriately manages corresponding risks. In a similar vein, central bankers need to closely monitor how the FinTech industry affects the efficient conduct of monetary policy and adjust their monetary policy framework accordingly.

2 Current state of the FinTech sector – Considerable development but still tiny

FinTechs are companies offering innovative financial services by applying new (disruptive) technologies. Based on digitalization and cloud computing, FinTechs offer new, technology-driven business models, applications, processes, and products. Examples of FinTech include electronic money, new digital advisory and trading systems, peer-to-peer lending and other forms of crowdfunding, as well as digital (crypto-)currencies and distributed ledger technology (DLT).

FinTech start-ups aim to compete throughout the financial services value chain (Figure 1), thus reducing the prospects of profit for traditional financial institutions, in particular banks.

Figure 2-1
Fintech in the financial services value chain



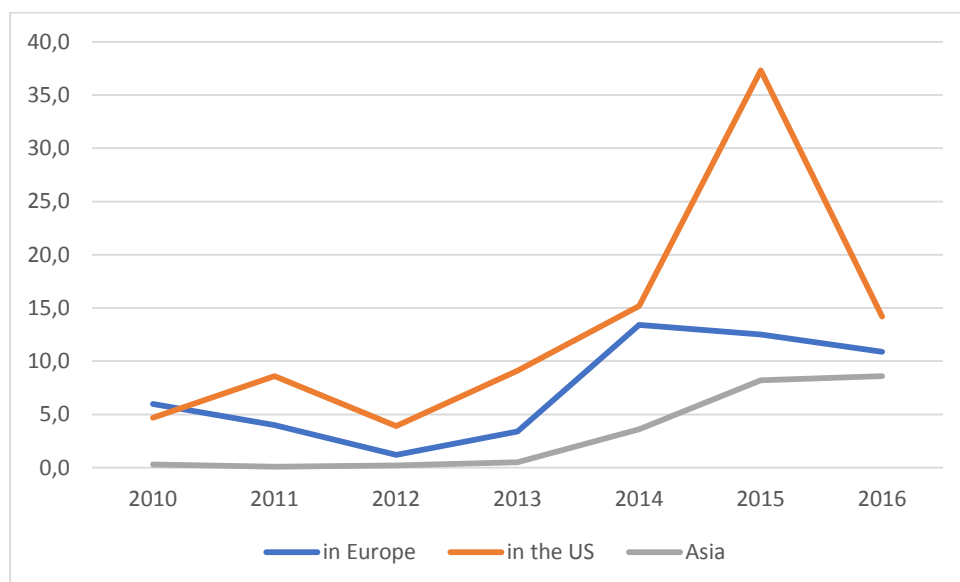
Source: Figure based on Carney (2017).

2.1 Funding

The still young FinTech sector needs large external investments to grow. Aggregate funding in the US, Europe and Asia has increased from 11 billion US-Dollars in 2010 to 58 billion in 2015 (KPMG 2017). Outside the US and Europe, FinTech investments have soared primarily in China (Mittal and Lloyd 2016).

Figure 2-2

Total investment (VC, PE, and M&A) in FinTech companies (in billion US Dollars)



Source: KPMG (2017), Own Calculations

However, in 2016 funding in the huge markets in Europe and the USA declined (see Figure 2). Funding decreased by about 13 percent in Europe and around 60 percent in the United States. While global total investment in the FinTech industry decreased further from \$4.15 billion in Q4'16 to \$3.2 billion in the first quarter of 2017, the decline in FinTech funding in Europe reversed, growing to \$880 million. European venture-backed FinTech companies received \$610 million, the largest venture investment in FinTech companies in Europe since 2010.

2.2 Current outreach compared to the banking sector

The lending business is at the heart of the retail and commercial banks' business model. Thus, in particular, peer-to-peer (P2P) consumer lending, P2P business lending, and crowdfunding challenge traditional banking. Table 1 shows the development of these segments in Europe, excluding the United Kingdom (UK), between 2013 and 2015. The UK market is the largest in

Europe. In 2015, the market volume of alternative finance in the UK was more than four times as large as in the rest of Europe.

Between 2013 and 2015, the business of FinTechs in selected areas grew substantially. However, despite impressive growth, especially in P2P business lending, financing volumes are still tiny compared to those of the traditional banking sector. For example, imagine that the total volume of 1.02 billion US Dollar would grow with the average annual rate of 81% until 2025. Then, the total financing volume would reach about 9 percent of net corporate lending and about 64 percent of net consumer lending in the Eurozone in the year 2016.

Table 2-1

Selected models of European online alternative finance market - Volumes without UK (in million euro) and bank lending in the EU

	2013	2014	2015	2016	Average growth rate (2013-2015)	Prognosis 2025 ^a
Peer-to-peer (P2P) Consumer lending	157	275	366		53%	25,199
Peer-to-peer (P2P) Business lending	40	93	212		130%	886,574
Invoice Trading ^b	1	7	81		800%	
Crowdfunding (equity-based and reward-based)	99	177	298		73%	73,641
Other	13	20	64		122%	185,082
Total	310	572	1,021		81%	395,682

In comparison to financing from the banking sector

Net corporate lending - Eurozone	4,345,203	4,302,017	4,266,529	4,288,613
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Net consumer lending - Eurozone	575,762	565,315	597,838	618,555
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^{a,b} The Prognosis is based on the assumption that the segment grows at the average rate per year through 2025. The average growth rate neglects the outlier Invoice Trading.

Source: Cambridge Center for Alternative Finance (2016), ECB, Own Calculations.

Although the FinTech sector has expanded considerably in recent years, it is still tiny in comparison to the traditional banking sector. Thus, the comparison indicates that, currently, FinTechs leave monetary transmission largely unaffected. However, if growth in the FinTech sector accelerates in the future and banks fail to cooperate with (and incorporate) FinTechs (e.g. take-over, merger, joint venture), traditional banking and subsequently monetary policy could be affected.

3 Fintech, nonbank finance and monetary policy

An important reason why central banks must closely follow developments in financial innovation is that some developments may change how the economy reacts to monetary policy (monetary policy transmission) or may affect the information content of the indicators that central banks regularly monitor and that serve as a basis for taking policy decisions such as monetary aggregates. In this sense, FinTech innovations may reinforce recent developments in the finance industry that are shifting of credit intermediation away from commercial banks in the nonbank part of the financial system, a diverse and growing sector with heterogeneous finance institutions involved, whose overall importance for financial stability and monetary policy transmission has recently been acknowledged by policy makers and scholars alike.

3.1 The role of nonbank intermediation for monetary policy transmission

Nonbank finance can be defined either in terms of institutions involved or by the (market-based) products traded, with the empirical findings on the role of nonbank finance for monetary policy crucially depending on the specific definition applied. On the institutional side, definitions of nonbank intermediaries include FinTech companies, but usually also cover a wide range of heterogeneous finance corporations, including investment banks, insurance companies, pension funds, hedge funds, money market mutual funds, as well as more specialized institutions involved in securitization processes, such as broker-dealers, special purpose vehicles (SPVs), asset managers, and so forth.

In theory, the overall effect of nonbank finance on monetary policy transmission is unclear a priori. Whereas different main channels of monetary policy are discussed in the literature (Boivin et al. 2010), only a few studies investigate the way these channels are affected and altered once nonbank finance is explicitly taken into account (IMF 2016).

One traditional channel of monetary transmission works through the balance sheet position of borrowers, or the balance sheet channel of monetary policy (Bernanke and Gertler, 1995; Bernanke, Gertler, Gilchrist, 1996). Financial intermediaries' lending decisions crucially depend on the financial position of households and firms, with monetary policy affecting these financial positions in several ways. Although the working of the balance sheet channel of monetary policy does not directly depend on the concrete structure of financial intermediaries, but on the borrower side of the market, Bolton et al (2016) argue that its effects are potentially larger when the share of nonbank intermediaries is high, as traditional banks try to dampen

the effect of interest rate changes on lending given their stronger incentive to form long-term relationships with borrowers, whereas nonbanks have a lower incentive to insulate their clients from monetary policy shocks.

Likewise, monetary policy affects aggregate lending via the balance sheet of financial intermediaries (bank lending channel). Maturity mismatch between intermediary assets (mainly long-term loans) and liabilities (short-term funding) plays a crucial role, as increases in short-term rates, via monetary policy, raise funding costs but leave long-term returns relatively unchanged in the short run (Bernanke 2007). In the original version of the bank lending channel, leverage is crucial as bank net worth is more strongly affected by monetary policy the higher the institution's leverage ratio, which is defined as total debt compared to equity or net worth. While bank leverage is limited by prudential regulation, the increasing role of (potentially) highly levered nonbank intermediaries for overall credit supply might strengthen the transmission of monetary policy via the (non)bank lending channel. Furthermore, differences in valuation standards between financial institutions matter. Nonbanks generally tend to rely more extensively on mark-to-market valuations than commercial banks and, thus, are more likely to respond to changes in asset prices due to monetary policy shocks than commercial banks. Additionally, the sensitivity of intermediary net worth toward monetary policy shocks appears to decrease with firm size, access to (international) capital markets, and diversified funding portfolios (IMF 2016), dimensions on which nonbank intermediaries vary substantially across countries, leaving the overall effect of nonbanks on the bank lending channel hard to assess a priori. In addition, capital adjustment costs, in combination with regulatory requirements, affect the degree of monetary policy transmission via financial intermediaries. For instance, commercial banks operating at the required level of capital might not increase lending to a substantial degree in response to looser monetary policy, given the need to raise further capital and the associated costs of doing so. Thus, in the short run, the credit response of commercial banks to monetary policy changes can be especially sluggish (Van den Heuvel, 2002). Nonbank intermediaries not constrained by capital requirements, however, potentially increase their share in overall credit and thus likely mitigate the dampening effect of capital constraints on monetary policy transmission if bank credit can easily be substituted by nonbank lending. Furthermore, by shifting part of the loan portfolio off the balance sheet, commercial banks can circumvent capital requirements by using of nonbank intermediaries (regulatory arbitrage). Thus, a rising gap between regulation of banks and nonbanks can mitigate the overall dampening effect of the bank capital channel for monetary policy transmission.

Finally, monetary policy affects the risk taking behaviour of financial intermediaries, with monetary policy expansions generally associated with increased risk-bearing capacities of financial intermediaries and, ultimately, increased lending activity. Differences in the business structure of banks and nonbank intermediaries affect risk taking in response to monetary policy changes and, thus, the effectiveness of the risk-taking channel (Adrian and Shin, 2011). IMF (2016) list four factors that affect the risk-taking behaviour of financial intermediaries, thereby affecting the transmission of monetary policy via the risk-taking channel. First, leverage plays a crucial role for the risk-taking behaviour of intermediaries. Lower interest rates increase profits, especially when maturity mismatch between assets and liabilities is large. In particular, profits of nonbank intermediaries - relying to a larger extent on short-term wholesale funding compared to commercial banks - increase when short-term interest rates decrease, which, in turn, increases their risk-bearing capacity. Consequently, a larger share of highly levered nonbank intermediaries might amplify monetary policy transmission via risk-taking behaviour. Second, monetary policy expansions can encourage search-for-yield behaviour, especially when the share of fixed nominal yield liabilities in the funding mix is large. Lower interest rates imply lower returns on riskless assets, thus increasing demand for risky assets that deliver higher returns, particularly for commercial banks that are characterized by a significant share of fixed-yield liabilities. Furthermore, capital requirements might incentivize banks to boost reported earnings by replacing low-yielding assets with high-risk-high-return assets (Hanson and Stein, 2015). Finally, relative compensation schemes (Chevalier and Ellison, 1997) and a pervasive use of internal risk-management models, issues that potentially affect nonbank intermediaries more than commercial banks, can encourage risk taking behaviour and, thus, the transmission of monetary policy.

Due to the presence of different channels through which nonbank finance can affect monetary policy transmission, empirical findings are inconclusive and depend strongly on the definition of nonbank finance, the country group, and period covered, as well as on the concrete channel of transmission studied. Due to data availability and the relatively strong role of nonbanks in financial intermediation in the US financial system, most of the empirical literature on the role of nonbanks in monetary policy transmission focuses on the United States. In doing so, several studies find a dampening effect of the presence of nonbank intermediaries on monetary policy transmission. Often, these studies differentiate among several nonbank institutions and find differences in the reaction of institution types to changes in monetary policy.

Igan et al. (2013) find that some institutions (money market mutual funds, security broker-dealers) increase their asset holdings after monetary policy easing, whereas issuers of asset-

backed securities (ABS) decrease their balance sheets after monetary policy tightening, with respective implications for intermediation activity by different institutions. Pescatori and Sole (2016) use a VAR framework including data on commercial banks, ABS issuers, and other finance companies, such as insurance companies and mortgage pools, as well as government-sponsored entities (GSEs). They find, *inter alia*, that monetary policy tightening decreases aggregate lending activity, even though the size of the nonbank intermediary sector increases, which indicates a relative dampening of the transmission channel as nonbanks step in as lenders whenever commercial banks reduce credit provisions. Similarly, Den Haan and Sterk (2011), using US flow-of-funds data, find that nonbank asset holdings increase in response to monetary tightening, even though overall credit declines or stays relatively flat. Mazelis (2016) distinguishes between commercial banks depending on deposit liabilities, shadow banks that are highly levered and depend on funding from other intermediaries, and investment funds that draw funding from real economic agents directly. He finds that, whereas commercial bank credit remains relatively flat after monetary tightening and is reduced only in the medium term, shadow banks and investment funds increase lending in response to monetary policy tightening in the short term. Nelson et al. (2015) find similar results, even though their definition of shadow banks differs from the one of Mazelis (2016). For European banks, Altunbas et al. (2009) show that institutions engaged to a large extent in nonbank activities, such as securitization, are less affected by monetary policy shocks, a finding in line with the above studies on US intermediaries: a larger share of nonbank activity insulates credit intermediation from monetary policy shocks, thus dampening the transmission of policy shocks, *ceteris paribus*.

In contrast to the findings above, by analysing both aggregate and micro-level data for several advanced and emerging economies in a comprehensive study, IMF (2016) find an overall strengthening effect of nonbank finance on monetary policy transmission. The effect appears to be more pronounced in countries with larger nonbank sectors, mainly due to their finding that nonbank intermediaries' balance sheets contract (expand) stronger in response to monetary tightening (easing) than do bank balance sheets. Furthermore, they identify the risk-taking channel as playing a crucial role for monetary policy amplification by nonbanks, mainly via asset managing firms.

3.2 FinTech and the informational content of monetary aggregates

A non-negligible part of FinTech products focus on payment services or fund intermediation services, such as P2P lending, payments via smart phones, and virtual currencies. Many of them are offered by nonbanks and do not rely on the involvement of bank accounts or firms'

balance sheets in the transaction but act as prepaid bearer instruments. This might impact the informational content of monetary aggregates (M_1 , M_2 and M_3). The reason is that traditional banks mainly fund themselves via deposit issuance; nonbank financial institutions rely to a larger extent on market-based liabilities. While bank deposits are considered to be money-like assets, thus constituting a significant part of traditional monetary aggregates, nonbank liabilities do not necessarily represent money-like assets. Moreover, in response to financial innovation, the demand for official banknotes and coins in circulation might decrease, and gets substituted with alternative means of payment. As such, the provision of bank-like services by nonbank FinTech companies may imply a distorted or incomplete representation of money and credit supply in the economy. Moreover, money demand could be destabilized, which may also hamper the assessment of inflationary risks in the economy.

3.3 Distributed ledger and virtual currencies

Distributed ledger technology (DLT) also has the potential to significantly impact the financial market architecture. Advocates stress the multiple benefits of DLT, such as simplifying the clearing and settlement processes, higher speed in interbank clearing and settlement, lower transaction cost and counterparty risk, higher transparency, ease of software development, as well as faster technological integration. However, there are also huge inherent risks, including unproven technology, unresolved issue of cyber security, crypto-currency price volatility (no fixed exchange relation to central bank money), and uncertain regulatory status (Kirilenko 2016).

In particular, central bankers should be interested in monitoring the development of the DLT market in the coming years (e.g Smets 2016, Nakaso 2016 and Camera 2017). On the one extreme, central banks could use DLT to sidestep the banking sector by allowing firms and households to access its balance sheet directly without approaching a bank. On the other extreme, private banks could jointly use it to side step the central bank and establish their own clearing and settlement infrastructure. In either scenario, monetary transmission would change completely.

Moreover, DLT enables issuing virtual currencies, such as Bitcoin. These shadow currencies compete, in principle, with central bank money. Thus, DLT has the potential to question the monopoly power of central banks over currency. However, there is no reason to expect that policymakers, monetary authorities, and regulators would risk losing power. One likely scenario is that central banks may adopt DLT themselves to improve their own payment, clearing, and settlement operations within the existing system (Raskin and Yermack 2016). Large com-

mercial banks may cooperate with central banks to exploit the benefits of DLT, but the banking sector will not be allowed to set up an independent payment, clearing, and settlement system. Central banks will also not allow direct access to its balance sheets because doing so would make the banking system obsolete.

The impact of the shadow currencies on monetary transmission ultimately depends on whether firms and households broadly accept them. Limited usability and a lack of fixed exchange to the official currency speak against wide-spread acceptance in the near future.

To summarize, the FinTech evolution is likely to change payment, clearing, and settlement operations. However, since trust is key, these operations will remain under the auspices of central banks. Subsequently, FinTech-shadow banks and shadow currencies may be the ones that have the largest effect on the monetary transmission channel.

4 Conclusions and policy recommendations

The importance of the FinTech industry will very likely continue to grow in the future. Financial innovations triggered by digitalization and progress in the communication technology will have important implications for both financial stability and monetary policy. On the one hand, they have the chance to improve the efficiency of the financial system and the banking sector, which will promote economic growth. On the other hand, however, the emergence of FinTech could pose a risk to financial stability due to a lack of transparency and regulation. Thus, the key challenge for financial regulators is to create the right balance: The regulatory framework might need adjustment such that it facilitates Fintech innovations that produce benefits for the economy and the financial system, but also appropriately manages the corresponding risks. Further, we argue in this policy brief that the financial innovations triggered by the FinTech industry also have the potential to impact the transmission of monetary policy as well the informational content of important monetary indicators. In this respect, FinTech and financial innovations contribute substantially to a wider trend in financial markets, namely the emergence of nonbank finance as a substitute for traditional commercial bank finance. Although the overall effect of nonbank finance on monetary policy transmission is not yet clear, we argue that regulators and policy makers need to be aware of the potential effects of nonbank finance on monetary policy transmission, on the one hand, as well as prudential regulation on the other hand. Central banks need to broaden the set of indicators used in policy analyses from traditional measures of financial markets with specific data on the nonbank financial sector. For instance, information on credit origination and balance sheet conditions of the

nonbank financial system need to be incorporated in the assessments on which policy decisions are based. Traditional measures of monetary aggregates, which do not necessarily cover money holdings of nonbank financial intermediaries, could be complemented by balance sheet data of nonbank financial institutions (IMF, 2016) in the assessment of money and credit supply. As the importance of the FinTech sector in providing the real sector with credit and liquid funds continues to grow over the next couple of years, policy makers need to consider information about both parts of the financial system with similar rigorousness, designing monetary and regulatory policies adequately.

Thus, there is a need for financial regulators, policymakers, and central banks to closely follow the developments in the FinTech segment, analyze the implications of technology developments, then adapt financial regulation and policies accordingly.

References

- Adrian, Tobias and Hyun Song Shin (2011). "Financial Intermediaries and Monetary Economics." In: Handbook of Monetary Economics, Vol. 3, edited by Benjamin M. Friedman and Michael Woodford. Amsterdam: Elsevier. Available online at <http://www.sciencedirect.com/science/article/pii/B9780444532381000120>
- Altunbas, Yener, Leonardo Gambacorta and David Marques-Ibanez (2009). "Securitisation and the bank lending channel" European Economic Review, Volume 53, Issue 8. Available online at <http://www.sciencedirect.com/science/article/pii/S0014292109000361>
- Badertscher, Brad, Jeffery Burks and Peter Easton (2011). "A Convenient Scapegoat: Fair Value Accounting by Commercial Banks during the Financial Crisis" Accounting Review, Volume 87, Issue 1. Available online at <http://aaajournals.org/doi/10.2308/accr-10166?code=aaan-site>
- Barasinska, Nataliya and Schäfer, Dorothea (2014). "Is Crowdfunding Different? Evidence on the Relation between Gender and Funding Success from a German Peer-to-Peer Lending Platform" German Economic Review, Volume 15, Issue 4, 436–452. doi:10.1111/geer.12052.
- Bazot, G. (2013). Financial consumption and the cost of finance: Measuring financial efficiency in Europe (1950-2007). Working Paper Paris School of Economics. Available at: <https://www.parisschoolofeconomics.eu/IMG/pdf/jobmarket-1paper-bazot-pse.pdf>
- Berger, Allen, Rebecca S. Demsetz, and Philipp E. Strahan (1999). "The consolidation of the financial services industry: Causes, consequences, and implications for the future" Journal of Banking and Finance, Volume 23, 135–194.
- Bernanke, Ben S. (2007). "The Financial Accelerator and the Credit Channel" Remarks at The Credit Channel of Monetary Policy in the Twenty-first Century Conference, Federal Reserve Bank of Atlanta, June 15. Available online at <https://www.federalreserve.gov/newsevents/speech/bernanke20070615a.htm>
- Bernanke, Ben S. and Mark Gertler (1995). „Inside the Black Box: The Credit Channel of Monetary Policy Transmission" Journal of Economic Perspectives, Volume 9, Issue 4. Available online at <https://www.aeaweb.org/articles?id=10.1257/jep.9.4.27>
- Bernanke, Ben S., Mark Gertler and Simon Gilchrist (1996). "The Financial Accelerator and the Flight to Quality" Review of Economics and Statistics 78 (1): 1–15. Available at http://www.istor.org/stable/2109844?seq=1#page_scan_tab_contents
- Bernanke, Ben S., Mark Gertler and Simon Gilchrist (1999). "The financial accelerator in a quantitative business cycle framework" In: Handbook of Macroeconomics, Vol. 1, edited by John Taylor and Michael Woodford. Amsterdam: Elsevier. Available online at <http://www.sciencedirect.com/science/article/pii/S157400489910034X>
- Boivin, Jean, Michael T. Kiley and Frederic S. Mishkin (2010). "How Has the Monetary Transmission Mechanism Evolved Over Time?" In: Handbook of Monetary Economics, edited by Benjamin M. Friedman and Michael Woodford. Amsterdam: Elsevier. Available online at <http://www.sciencedirect.com/science/article/pii/B9780444532381000089>

- Bolton, Patrick, Xavier Friexas, Leonardo Gambacorta, and Paolo Emilio Mistrulli (2016). "Relationship and Transaction Lending in a Crisis" Review of Financial Studies, Volume 29, Issue 10. Available online at <https://academic.oup.com/rfs/article/29/10/2643/2223384/Relationship-and-Transaction-Lending-in-a-Crisis>
- Brainard, Lael (2016), "The Use of Distributed Ledger Technologies in Payment, Clearing and Settlement" Remarks at Institute of International Finance Blockchain Roundtable, April 14, 2016. Available online at <https://www.federalreserve.gov/newsevents/speech/brainard20160414a.htm>
- Burton, Lucy (2017). "Mark Carney warns of fintech threat to traditional banks" Daily Telegraph 12 April 2017. Available online at <http://www.telegraph.co.uk/business/2017/04/12/mark-carney-warns-fintech-threat-traditional-banks/>
- Cambridge Center for Alternative Finance (2016). "Sustaining Momentum" 2nd Annual European Alternative Finance Industry Study. Available online at <https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/sustaining-momentum/>
- Camera, Gabriele, A Perspective on Electronic Alternatives to Traditional Currencies (January 20, 2017). Sveriges Riksbank Economic Review 2017:1, 126-148. Available at SSRN: <https://ssrn.com/abstract=2902721>
- Carney, Mark (2017a). "The Promise of FinTech – Something New Under the Sun" Speech given at the Deutsche Bundesbank G20 conference on "Digitising finance, financial inclusion and financial literacy", Wiesbaden 25 Januar 2017.
- Carney, Mark (2017b). "Building the Infrastructure to Realise FinTech's Promise" Speech given at the International FinTech Conference 2017, Old Billingsgate, 12 April 2017. Available online at <http://www.bankofengland.co.uk/publications/Documents/speeches/2017/speech974.pdf>
- Chen, Anton Badev, Timothy Brezinski, Linda Fahy, Kimberley Liao, Vanessa Kargenian, Max Ellithorpe, Wendy Ng, and Maria Baird (2016). "Distributed ledger technology in payments, clearing, and settlement," Finance and Economics Discussion Series 2016-095. Washington: Board of Governors of the Federal Reserve System. Available online at <https://doi.org/10.17016/FEDS.2016.095>.
- Chevalier, Judith, and Glenn Ellison (1997). "Risk Taking by Mutual Funds as a Response to Incentives." Journal of Political Economy, Volume 105, Issue 6. Available online at <http://www.journals.uchicago.edu/doi/10.1086/516389>
- Curran, Theresa (2016). "Fintech: Balancing the Promise and Risks of Innovation" Consumer Compliance Outlook: Third Issue 2016. Available online at <https://consumercomplianceoutlook.org/2016/third-issue/fintech-balancing-the-promise-and-risks-of-innovation/>

- Den Haan, Wouter J. and Vincent Sterk (2011). "The Myth of Financial Innovation and the Great Moderation" *Economic Journal*, Volume 121, Issue 553. Available online at <http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0297.2010.02400.x/abstract>
- Dorfleitner, Gregor, Hornuf, Lars, Schmitt, Matthias and Weber, Martina (2016). „FinTech-Markt in Deutschland“ Report. Available online at http://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Internationales_Finanzmarkt/2016-11-21-Gutachten-Langfassung.pdf
- Geiling, Luisa (2016). "Distributed Ledger: The technology behind virtual currencies: the example of blockchain" Available online at https://www.bafin.de/SharedDocs/Veroeffentlichungen/EN/Fachartikel/2016/fa_bj_16_02_blockchain_en.html
- Hanson, Samuel G. and Jeremy C. Stein (2015). "Monetary Policy and Long-Term Real Rates" *Journal of Financial Economics*, Volume 115, Issue 3. Available online at <http://www.sciencedirect.com/science/article/pii/S0304405X14002360>
- Harris, Milton, Christian C. Opp and Marcus M. Opp (2014). "Higher Capital Requirements, Safer Banks? Macroprudential Regulation in a Competitive Financial System" (March 11, 2014). Available at SSRN: <https://ssrn.com/abstract=2181436> or <http://dx.doi.org/10.2139/ssrn.2181436>
- Igan, Deniz, Alain Kabundi, Francisco Nadal De Simone and Natalia Tamirisa (2013). "Monetary Policy and Balance Sheets" IMF Working Paper 13/158, International Monetary Fund, Washington, DC. Available online at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2304102
- IMF (2016). "Monetary Policy and the Rise of Nonbank Finance" In: *Global Financial Stability Report—Fostering Stability in a Low-Growth, Low-Rate Era* (Washington, October 2016). Available at <https://www.imf.org/external/pubs/ft/gfsr/2016/02/pdf/text.pdf>
- Kirilenko, Andrei (2016) "Fintech and Central Banks" Presentation. Available online at <http://bank.gov.ua/doccatalog/document?id=31627281>
- Knell, Markus, and Helmut Stix. "The income elasticity of money demand: A meta-analysis of empirical results" *Journal of Economic Surveys* 19.3 (2005): 513-533. Available online at <http://onlinelibrary.wiley.com/doi/10.1111/j.0950-0804.2005.00257.x/full>
- KPMG (2017), "The Pulse of Fintech Q1 2017" Report. Available online at <https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2017/04/pulse-of-fintech-q1.pdf>
- Malatesta, Fabrizio, Sergio Masciantonio and Andrea Zaghini (2016). "The Shadow Banking System in the Euro Area: Definitions, Key Features and the Funding of Firms" *Italian Economic Journal*, Volume 2, Issue 2. Available online at <http://link.springer.com/article/10.1007/s40797-016-0032-0>
- Mazelis, Falk (2016). "Implications of Shadow Bank Regulation for Monetary Policy at the Zero Lower Bound" Working paper. Available online at <https://ideas.repec.org/p/hum/wpaper/sfb649dp2016-043.html>

- McKinsey (2016). "Cutting Through the FinTech Noise: Markers of Success, Imperatives for Banks" February 2016. Available at <http://www.mckinsey.com/industries/financial-services/our-insights/cutting-through-the-noise-around-financial-technology>
- Mittal, Sachin and Lloyd, James (2016). "The Rise of FinTech in China" Report. Available online at [https://webforms.ey.com/Publication/vwLUAssets/ey-the-rise-of-fintech-in-china/\\$FILE/ey-the-rise-of-fintech-in-china.pdf](https://webforms.ey.com/Publication/vwLUAssets/ey-the-rise-of-fintech-in-china/$FILE/ey-the-rise-of-fintech-in-china.pdf)
- Nakaso, Hiroshi (2016). "FinTech – Its Impacts on Finance, Economies and Central Banking" Remarks at the University of Tokyo - Bank of Japan Joint Conference in Tokyo on "FinTech and the Future of Money". Available online at https://www.boj.or.jp/en/announcements/press/koen_2016/data/ko161118a.pdf
- Nelson, Benjamin, Gabor Pinter and Konstantinos Theodoridis (2015). "Do Contractionary Monetary Policy Shocks Expand Shadow Banking?" Bank of England Working Paper 521, Bank of England, London. Available online at <http://www.bankofengland.co.uk/research/Pages/workingpapers/2015/wp521.aspx>
- Pescatori, Andrea and Juan Sole (2016). "Credit, Securitization and Monetary Policy: Watch Out for Unintended Consequences" IMF Working Papers 16/76, International Monetary Fund. Available online at <http://www.imf.org/external/pubs/cat/longres.aspx?sk=43827>
- Philippon, Thomas (2015). "Has the US finance industry become less efficient? On the theory and measurement of financial intermediation" The American Economic Review Volume 105, Issue 4, 1408–38. Available online at <https://www.aeaweb.org/articles?id=10.1257/aer.20120578>
- Philippon, Thomas (2016). "The FinTech Opportunity" NBER Working Paper No. 22476. Available online at <http://pages.stern.nyu.edu/~tphilipp/papers/FinTech.pdf>
- Plantin, Guillaume (2015). "Shadow Banking and Bank Capital Regulation" Review of Financial Studies, Volume 28, Issue 1, 146-175. Available online at: <https://academic.oup.com/rfs/article/28/1/146/1681521/Shadow-Banking-and-Bank-Capital-Regulation>
- Pope, Devin G. and Sydnor, Justin R. (2008). "What's in a Picture? Evidence of Discrimination from Prosper.com" (August 12, 2008). Available online at <https://ssrn.com/abstract=1220902>
- Raskin, Max and Yermack, David (2016). "Digital Currencies, Decentralized Ledgers, and the Future of Central Banking", National Bureau of Economic Research, NBER WP 22238, 16p. Available online at <https://www.nber.org/papers/w22238>
- Rysman, Mark and Schuh, Scott (2016). "New Innovations in Payments" NBER Chapters, in: Innovation Policy and the Economy, Volume 17, pages 27-48. National Bureau of Economic Research, Inc. Available online at <https://ideas.repec.org/h/nbr/nberch/13759.html>

- Smets, Jan (2016). "Fintech and Central Banks" Speech at the Colloquium of the Belgian Financial Forum in cooperation with SUERF, Fintech and the Future of Retail Banking, Brussels, December 9, 2016. Available online at <https://www.financialforum.be/sites/financialforum.be/files/media/1695-1-jan-smets.pdf>
- Van den Heuvel, Skander J. (2002). "Does Bank Capital Matter for Monetary Transmission?" Economic Policy Review, Volume 8, Issue 1. Available online at <https://www.newyorkfed.org/medialibrary/media/research/epr/02v08n1/0205vand.pdf>
- Woolsey, Barbara (2017) "Germany's Central Bank Advises Against Bitcoin" Handelsblatt Global 09. May 2017. Available online at <https://global.handelsblatt.com/finance/germanys-central-bank-advises-against-bitcoin-762108>
- Bach, Stefan, Christhart Bork, Michael Kohlhaas, Bernd Meyer, Barbara Praetorius, Heinz Welsch u.a. (2001): Die ökologische Steuerreform in Deutschland. Eine modellgestützte Analyse ihrer Wirkungen auf Wirtschaft und Umwelt. Heidelberg.