

THE FUTURE OF MONEY – THE MONEY OF THE FUTURE



Hamburg Institute
of International
Economics



BERENBERG
PARTNERSHIP SINCE 1590

STRATEGY 2030 CAPITAL AND LIFE IN THE NEXT GENERATION. AN INITIATIVE
OF BERENBERG AND THE HAMBURG INSTITUTE OF INTERNATIONAL ECONOMICS.

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Executive Summary

Technological progress is driving a fundamental transformation in many areas of economic life, including the financial sector. The diverse technical options have now made it possible to imagine a cashless economy. The debate surrounding this issue has already begun. Notwithstanding all the technical alternatives, however, we do not believe that cash is on the verge of extinction. Cash remains popular in a number of countries incl. Germany.

Nevertheless, payment behaviour in Germany and other countries will continue to change. Four innovations are particularly important: (1) contactless payment, (2) mobile payment, (3) P2P payments and (4) instant payments. All four rely on the existing infrastructure of commercial and central banks and credit card issuers. They are digital alternatives to paying with coins and bank notes. Additional benefits, security, transparency, and cost structures are especially important for acceptance by consumers.

Digital currencies or cryptocurrencies such as bitcoin are developing as innovative payment systems outside the boundaries of existing monetary and currency structures. This »new money« is attracting a great deal of attention due to its technical properties, including the fact that it is not created centrally by a central bank, but decentrally by a network. However, bitcoin has captured the most attention due to the surge in its price. We consider the appreciation to be speculative and overblown and doubt that bitcoin will become an established currency in the long term. In particular, it is fraught with systemic problems that cannot be easily overcome. From a macroeconomic perspective, the design of cryptocurrencies is not a suitable foundation on which to build a new monetary system.

Regardless of monetary and currency systems, however, blockchain as the technological innovation on which the cryptocurrencies are based offers a wide range of application possibilities and will probably become established as an important element of our current economic system. Cost-intensive payment systems such as bank transfers and credit card payments will come under pressure.

Fintechs are modernising the financial sector. They will turn banks into leaner, platform-based technology enterprises whose capital will increasingly consist of data. Financial services will become hyper-individualised, i.e. increasingly tailored to individuals. This development, in turn, will bring new regulatory questions to the fore.

Trust in the traditional financial sector has eroded in the wake of the financial crisis. This loss of trust has been a major factor contributing to the success of fintechs. The acceptance of fintech services is marked by clear generational differences, as younger users are considerably more open to fintechs.

Fintechs can enhance the efficiency of the financial system by lowering the costs of financial transactions and comprehensively analysing massive quantities of digital information.

The growing importance of fintechs may necessitate a shift in regulatory philosophy, away from the »one business, one rule« principle and towards the principle of »safe spaces« for innovative start-ups.

Introduction

The financial sector is undergoing a fundamental transformation, driven by two main factors:

1. Technological progress allows for completely new business models not only in industry (keyword »Industrie 4.0«), but also in the financial sector, and will almost certainly lead to profound structural changes.
2. The global financial crisis has shaken people's confidence in the financial system to some extent. The wish for new solutions and alternatives to established paper currencies is obvious. Virtual currencies like bitcoin are a direct consequence of this loss of confidence. Regulatory requirements, some of which are likewise a consequence of the banking crisis, also played a key role.

These two issues – the consequences of the financial crisis and technological progress – converge at one point, namely the question of whether the use of cash is even to be considered modern anymore. Technically speaking,



Trust is essential for every currency.

CARL-LUDWIG THIELE, MEMBER OF THE EXECUTIVE
BOARD OF DEUTSCHE BUNDESBANK

it would now be easy to execute payment transactions without cash. In a world without cash, moreover, monetary policy could become even more expansive, making it possible to overcome the consequences of the global financial crisis and the

European debt crisis more quickly. On the other hand, cash is extremely popular in Germany. According to the German Bundesbank, Germans used cash for almost 80 % of their purchases in 2014.¹ A serious attempt to completely abolish cash would certainly lead to social unrest in Germany.

¹ See Deutsche Bundesbank (2015), p. 27.

In other countries, on the other hand, people's relationship to cash is less emotional and at any rate cash is used much less frequently for purchases in many countries. In the United States, Canada, France, and the Netherlands, cash is used for only about half of all purchases.²

However, the upheaval scenarios for the financial sector go far beyond the question of what role cash will play in the future. As a consequence of the global financial crisis, a number of so-called digital currencies (e.g. »bitcoin«) have arisen and some observers already regard them as the money of the future. And so the established currencies now have competition. The underlying »blockchain« technology is thought to have tremendous applications for the financial sector. Above all, the new technological possibilities are being used by young enterprises to create new services. These so-called fintechs are attempting to wrest market shares from the established powers of the financial world with their innovative services and business models.

Cash, digital currencies, and fintechs are the three focal topics of the present publication. In Part A, we take up the latest debates concerning these topics, categorise them, and venture some forecasts. In Part B, we go beyond the rather practical approach to examine these topics more fundamentally and delineate the macroeconomic and regulatory challenges.

² See Schmidt (2016). The data for these countries are from the years 2009 to 2012.

No future for cash?

Technically speaking, the world today could easily do away with cash. Nonetheless, cash still has its *raison d'être* and will continue to play an important role for consumers in the future.

The only reason there is even a debate concerning the restriction or even the abolition of cash is that there are so many alternatives for paying without cash. Debit cards and credit cards are particularly well known and are regularly used by many today. There are also various other payment methods that are not yet as well known, but are to be regarded as secure and reliable. At any rate, the offering of new payment systems is bound to expand further in the course of the digitalisation of the financial sector (see chapter fintechs – drivers of change, p. 32 seq.).



Cash will retain its importance even in a technologically advanced world.

Although forgoing the use of cash would require individuals to change their behaviour, the transition to a cashless society would be easily manageable, in theory, from an overall economic standpoint. The administrative-

logistical cost would be much less than was the case when the national currencies were converted to the euro on 1 January 2002. From a technical standpoint, there are no insurmountable obstacles standing in the way to a cashless society.

Monetary policy motives

Apart from technical questions, the situation is much more complicated. There is a long list of arguments for and against the abolition of cash. From a macroeconomic perspective, the monetary policy implications are particularly interesting.³ Many economists, some of whom highly acclaimed, have advocated the abolition of cash. Their principal argument is that doing away with cash would increase the effectiveness of monetary policy.

Zero-interest rate policy of central banks

During the global financial crisis of 2008/09, major central banks such as the US Federal Reserve and the European Central Bank (ECB) lowered interest rates to zero. With interest rates this low, monetary policy options are virtually exhausted. If the general economic situation requires further monetary policy stimulus, central banks could only resort to unconventional measures such as bond-purchasing programs or they could attempt

³ For more details, see Fell/Quitau (2016). Kireyev (2017) provides an analysis of the macroeconomic consequences of the diminishing use of cash.

to push interest rates below zero. In fact, the ECB has successively lowered the deposit facility rate (the rate at which commercial banks can park their liquidity with the ECB) to -0.4% . Thus, commercial banks are effectively paying a fee of 0.4% p.a. to invest their money with the ECB. European banks paid an estimated EUR 4 billion in negative interest to the ECB in 2016.

By this means, the currency authorities intend to stimulate lending by commercial banks, thereby pumping their liquidity surpluses back into the economy. However, the liquidity of commercial banks would be reduced if their customers deposit less cash in their accounts. If the banks could impose negative interest rates on deposits across the board, many investors would be scared away and they would either consume more or choose alternative investment forms. More consumption would be particularly desirable from an economic standpoint.

ECB interest rates

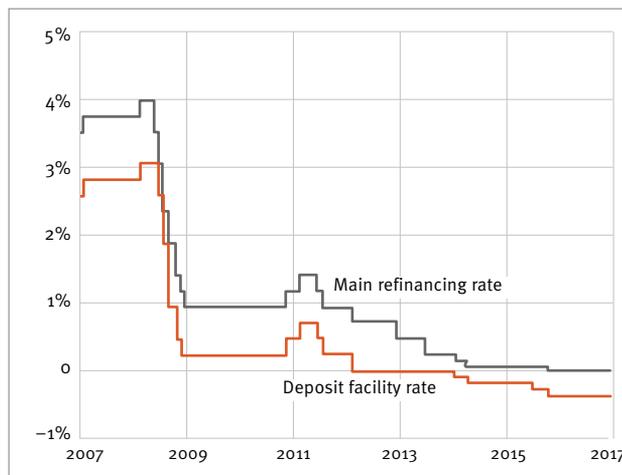


Fig. 1

Source: Bloomberg.

Arguments in favour of cash	Evaluation
Cash is a popular payment medium, banning it would restrict freedom of choice.	Cash is still the most popular payment medium in Germany. Ultimately, the citizens themselves should decide how they pay for things. There would need to be good reasons for a government-imposed ban.
Physical cash is the only legal tender.	At least in Germany consumers can be certain that they can pay with cash everywhere. Physical cash moreover means that you hold a claim on the central bank.
Cash protects privacy.	Indeed, close monitoring of citizens and consumers would be made possible in a world without cash. The government and commercial enterprises could use this power to their own advantage.
If cash were abolished, alternative currencies, barter circles, etc., would arise instead.	It is very probable that alternatives to the use of cash would arise. However, alternative currencies, barter circles, etc., would entail higher transaction costs. Therefore, a cash ban could lead to welfare losses.
Electronic money does not work in a power outage, while cash would still be available.	It is true that cash is an option that would make payments possible in the event of power outages or other technical malfunctions. On the other hand, longer-lasting power outages would impair economic activity on the whole, so that after a certain time many goods would presumably no longer be available for sale. Therefore, cash would only be useful in a temporary outage.
Better control of spending	Many consumers are better able to control their spending when they use cash instead of credit cards. In the future, however, technical solutions will very likely play a growing role in spending control. Therefore, this advantage of cash will probably diminish over time.
Easy to use	Paying with cash is considered to be simple and convenient. In the meantime, however, there are cashless payment methods that are even easier than cash, as long as the payment method is completely secure and protected against abuse.
»Interest tax« (not requiring an act of parliament) would be made possible.	If savers would no longer have the option of converting their savings into cash, bank deposits could be devalued by means of negative interest rates. In effect, a kind of »interest tax« that would work like a wealth tax could be imposed without an act of parliament.
The abolition of cash would probably be legally problematic.	Depending on the circumstances, the above-mentioned interest tax could violate property rights, in the opinion of jurists.

Arguments against cash	Evaluation
Cash can reduce the efficacy of monetary policy.	Savers can circumvent negative interest rates by holding cash. In certain situations, therefore, cash can certainly undermine monetary policy strategy. On the other hand, it hardly seems appropriate to combat temporary monetary policy problems with a permanent ban on cash.
Supplying cash is costly.	In fact, supplying cash generates costs. So far, banks have not made these costs transparent to customers. From the customer's perspective, the cost is nil, which typically leads to »overuse«. If the costs were charged to cash users, say in the form of a fee for withdrawing cash, cash usage would be reduced to a cost-efficient level. At any rate, the cost argument does not justify the complete abolition of cash.
Cash is unhygienic.	This is a phony argument. Many institutions of daily life are unhygienic and yet no one would seriously argue they should be abolished.
Electronic payment systems facilitate and speed up the payment process.	Contactless payment (»NFC«) is faster than paying with cash and therefore shortens wait times. It takes time for such advantages to become widely appreciated and put to use, without it being necessary for the government to ban cash.
More effective fight against crime, underground economy, etc.	In theory, cash facilitates criminal activities. However, the experience made in countries in which the ability to use cash has already been restricted shows that crime has not diminished notably.
Lower risk of theft	While the risk of cash being stolen would be eliminated, the risk posed by hackers and online fraud would increase.



Old wine in new bottles: »stamp scrip«

The idea of penalising the holding of money is not new. About 100 years ago, the financial theorist Silvio Gesell proposed a way of revolutionising the monetary system. According to Gesell's ideas, the hoarding of money leads to deleterious demand losses and could set off a deflationary downward spiral in the worst case. Full economic momentum can only be sustained if money circulates constantly. To achieve this goal, bank notes should be regularly devalued; this could be done, for instance, by requiring people to purchase stamps to affix to their bank notes in order to preserve their validity. This would create an incentive to spend money as quickly as possible. Because the value of money diminishes steadily over time, this kind of money is also known in German as Schwundgeld (»shrinking money«). Regional experiments have been conducted with stamp scrip in the past and even in the present. The best-known examples include the »Wörgl stamp scrip« in the early 1930s and the »Chiemgau stamp scrip« that has circulated in the Rosenheim and Traunstein districts since 2003.

Negative interest rates have a similar effect as stamp scrip. Whereas negative interest rates are only employed as a temporary measure to address a temporary macroeconomic disturbance, stamp scrip would be a permanent phenomenon and would therefore constitute a different monetary regime.

Turning from theory to practice, the most probable reaction of savers to widespread negative interest rates would be to withdraw larger amounts of money in cash and store it in safes, for example, in order to circumvent the negative interest rates. If this option were removed by abolishing cash altogether, the consumption-stimulating effect of negative interest rates would be much greater. In recent months, some institutions have in fact passed on the negative deposit rates on to institutional clients and even individual customers in a very few cases. However, this practice can be expected to have little if any effect on the overall economy because negative interest rates are only charged on very large investment volumes. Moreover,

the affected customers have the option of switching to another bank that does not charge negative interest rates as a means of evading the financial »penalty.« Obviously, the desired effects can only be achieved if cash is also abolished in the other hard-currency countries, because otherwise the wish to hold cash could be satisfied by using foreign currencies (e.g. US dollar, Swiss franc).

Monetary policy is slowly normalising

The monetary-policy argument for the abolition of cash outlined above applies only to the special situation in which base interest rates are already at or close to zero and cannot be lowered further. In the United States, the Fed has already initiated a new interest rate cycle and raised interest rates more than once; base interest rates are currently between 0.75% and 1.0% and will rise further this year. Also in Europe, the ECB will normalise its monetary policy once it believes that the threat of deflation has been averted. We expect the ECB to reverse its interest rate policy in 2019, after which interest rates will gradually begin to rise. At this time at the latest, the topic will vanish from the headlines, although the question will certainly still be debated in academic circles. Even in the academic debate, however, consideration should be given to the possibility that it may not be appropriate to react to a temporary economic problem with a lasting monetary revolution.

Also in Europe, the ECB will normalise its monetary policy when it deems the threat of deflation to have been averted.



Fees for cash withdrawals

The debate concerning cash flared up again in late March 2017 when some savings banks and cooperative banks charged fees for withdrawing cash from ATMs, even for the banks' own customers. Although a parallel can certainly be drawn to the general debate regarding the abolition of cash, this policy hardly constitutes a concerted action. On the contrary, charging fees is a reflexive reaction to the transformation of the banking sector. In the past, banks did not need to pass on the costs of cash stocking to their customers because they could earn money on customers' deposits, as a form of mixed costing. Now that the profitability of certain business activities has declined substantially, due in part to the zero-interest rate policy, some banks are beginning to appropriately price certain services for which they always incurred costs internally. It remains to be seen whether this new business policy will gain traction. Although it is entirely appropriate

from a business administration standpoint to make actually incurred costs transparent to the customer, potential adverse image effects need to be considered. In the meantime, some banks have capitulated and reversed these cost charges.

Arguments against cash

The future of cash was the subject of debate even before central banks initiated their zero interest rate policy. There is a long list of arguments for and against the use of cash.⁴ Proponents hope that the abolition of cash will starve the underground economy and combat tax evasion. In fact, this could well be the most important purpose of abolishing cash from the standpoint of politicians. For this reason, limits have already been set on cash payments in twelve EU countries. However, the experience in those countries in which the ability to use cash has already been restricted fuels doubts as to whether the underground economy and tax evasion can truly be repressed by this means.⁵



In Germany, cash has clearly prevailed in the competition of systems.

Moreover, proponents of a cashless society often argue that abolishing cash would appreciably reduce the risk of theft and criminality in general. However,

this argument is regularly countered by the view that online fraud would flourish instead, especially considering that cybercriminality is already a serious problem today.⁶ Finally, personal hygiene is sometimes cited as an argument against cash. However, this seems to be rather far-fetched considering that the same argument could be used to question all kinds of other institutions of daily life, including public transportation, for example.

Germans love cash

At least one pragmatic argument can be made for preserving cash. If at least the Germans still overwhelmingly use cash, it can be argued that cash has clearly prevailed among competing payment systems. Abolishing cash would demonstrate flagrant disregard for the current preferences of the population. Of course, these preferences may change over time, so that no one, not even in Germany, would miss using cash anymore after a few years or decades. At the present time, however, a majority of the population would presumably view the abolition of their favourite payment means as an unwelcome government interference.

⁴ König (2017) provides a detailed summary of the arguments for and against cash.

⁵ In Spain, for example, the upper limit is 2,500 euros for local residents and 15,000 euros for foreigners. In Italy, the general maximum limit is 3,000 euros, in Greece only 1,500 euros, with the exception of auto purchases. For additional details and a list of cash limits by European country, see: <https://www.evz.de/de/verbraucherthemen/geld-und-kredite/im-ausland-bezahlen/hoechstgrenzen-bargeldzahlung/>.

⁶ See Berenberg/HWWI (2016).

Cash protects against complete transparency

A fundamental argument for the preservation of cash is that the (consuming) citizen would be completely transparent to both government and business in a cashless society. Enterprises could use purchasing data to create virtually complete customer profiles and exploit them for their own benefit. In the medium term, this could lead to (higher) personalised prices, which has already happened to some extent with online shopping today. It could also be costly for the citizen if the state attained complete transparency. One potential problem is that future governments that no longer needed to fear evasive action on the part of their citizens would become greedy, leading to sharp increases in taxes and other public levies or charges. Another potential problem with such complete transparency is that the government would be able to monitor consumption habits and even penalise lifestyles deemed to be undesirable. Clearly, such fears are necessarily based on reservations against future governments, but scenarios in which governments would use their knowledge of citizens against them cannot be ruled out. For this reason, liberals sometimes make the argument that cash protects freedom. The Scientific Advisory Board of the German Federal Ministry of Economics and Energy has published a report addressing the questions surrounding the use of cash, including zero-interest rate policies.⁷ The board concluded that there is no reason ...»to significantly restrict the use of cash in the economy through government measures«. This conclusion aligns with our own assessment that the arguments proffered against the use of cash do not stand up to critical scrutiny.

In a cashless world, the individual would be completely transparent.



Evasive reactions

Unless cash is abolished internationally through concerted action, it would be easy to exchange cash in one currency for cash in another. Even in the face of the mere possibility that cash could be abolished, cash could be hoarded and ultimately mutate into an underground currency. At any rate, the complete conversion of cash into electronic money could not be assured. The former Yugoslavia experienced a similar phenomenon when the deutsche mark circulated as a parallel currency for a long time after the introduction of the euro.⁸ Finally, savers could channel their money into riskier asset classes to a greater degree. Greater price fluctuations could result if investors who are actually very risk-averse suddenly invest in riskier

⁷ Scientific Advisory Board of the German Federal Ministry of Economics and Energy (2017).

⁸ See Beck and Prinz (2015).

asset classes. That is because such investors could be expected to liquidate their positions faster than experienced, more risk-tolerant investors would at times of market volatility.

Conclusion

We consider the complete abolition of cash in the coming years to be neither very probable nor desirable. Citizens should be able to freely decide whether they use cash or other payment systems. Therefore, this question



We consider the complete abolition of cash in the coming years to be neither very probable nor desirable.

should be put on hold until such time in the more distant future when a large majority of Germans or citizens of other countries truly want to do away with cash.

Social resistance to such a revolution would still be formidable today, especially in Germany. Nonetheless, we will take up the theoretical question of the essential characteristics of money and possible substitutes in the future.

What is money?

According to the textbook economics definition, money serves three functions:

a) Unit of account

Money serves as a unit of account because monetary prices make it easy to compare the value of goods. Thus, money is a measure of value. In this respect, the currency itself does not play an important role. For the individual, the currency used to compare prices is ultimately a matter of habit. The important thing is that price awareness is not distorted by high inflation rates.

b) Medium of exchange or payment

Money makes it extremely easy to exchange goods and services. If there was no money, it would be necessary to find suitable exchange partners at a great cost in terms of time and effort. Ideally, these exchange partners would need to offer something that one needs and would also need to be looking for precisely that which one has to offer at a given moment. Barter circles are a conceivable alternative, except they would also be cumbersome. The suitability of a currency as a medium of exchange or payment depends in large part on its dissemination or acceptance among consumers and enterprises.

c) Store of value

Money also serves as a store of value. It is needed to save income earned today for future consumption. To fulfil this function effectively, the value of money should be preserved over time and not eroded by general price increases (inflation).

Established currencies such as the US dollar, the euro, or the Swiss franc meet all three of these criteria. Although there were growing fears of major inflation for a while, which would undermine the value store function, in the wake of the global financial crisis, these fears have now proved to be unfounded almost ten years after the outbreak of the crisis. In theory, it does not matter at all whether money exists only as deposit money or also in the form of cash. However, a currency that only exists as deposit money could certainly not claim to be sound money if the central bank systematically debases the savings of depositors by charging negative interest rates.



Virtual currencies on the rise

Virtual currencies like bitcoin have made the headlines for years. The price development of this currency has been impressive, and yet it has also been highly volatile. Virtual currencies are very risky as an investment. It is doubtful whether they could ultimately become established as an alternative to the established currencies.

Even though the fears of major inflation or a collapse of the financial system ultimately proved to be unfounded, established currencies suffered a loss of confidence. Above all, the apparently unlimited creation of money by which central banks stabilised the global financial system contributed to the emergence of virtual currencies, also known as digital currencies or cryptocurrencies. Bitcoin is the most prominent representative of this new kind of money. In the following, we examine the question of whether virtual currencies make a good alternative to traditional money, based on the example of bitcoin.⁹

The greatest advantages of bitcoin and the main differences from traditional currencies are said to be the following:

- a) Unlike established currencies, bitcoin are limited to a quantity of roughly 21 million units and cannot be increased beyond that limit. This characteristic supports the hope that bitcoin could offer effective protection against inflation.
- b) Anonymity: No personal data are exchanged between the senders and recipients of bitcoins.
- c) Bitcoin is not subject to government regulation. The currency is completely independent of banks.

Based on these characteristics, the digital currency theoretically represents another option for executing payments and possibly even investing money. The lasting success of bitcoin and other digital currencies is critically dependent on the absolute reliability and trustworthiness of the underlying technical infrastructure. As economists, we are ultimately unable to judge this technical aspect. However, considering the fact that bitcoin have repeatedly been lost in large quantities in the past, as well as the fact that the European Banking Authority (EBA) has warned of various risks of virtual currencies,¹⁰ heightened attention is advisable.

In the previous section, we stated that money has three functions: it must be usable as a payment medium, a unit of account, and a store of value. However, we do not wish at this point to examine whether an optimally conceived virtual money could theoretically fulfil these three functions and

⁹ We have already examined the fundamentals of virtual currencies in several publications. See Tribisch (2013) and Quitzau/Sonnberg (2014), for example.

¹⁰ See European Banking Authority (2014) and (2016).

Bitcoin Acceptance Points in Large German Cities

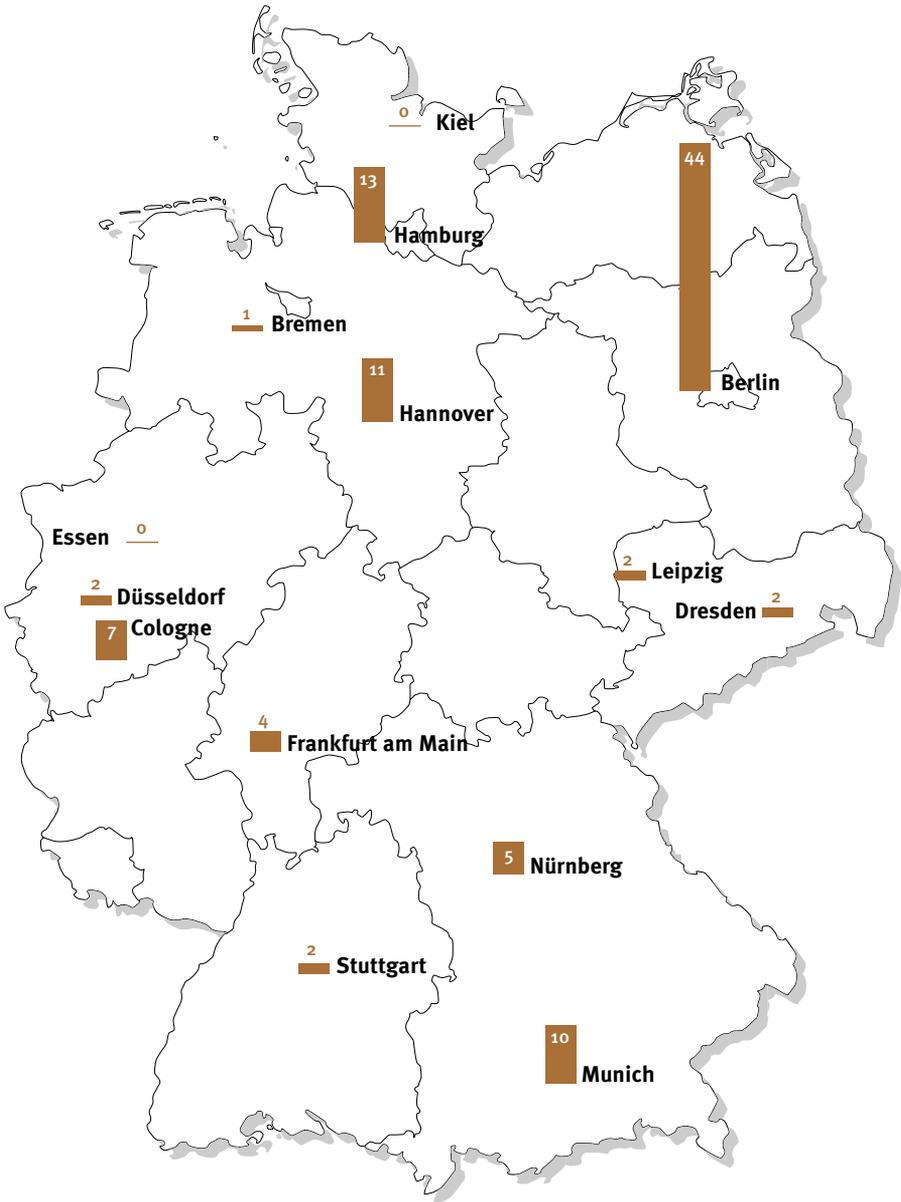


Fig. 2

Source: www.bitcoin-einfach.de; Stand: 24. April 2017.

therefore serve as a good substitute for the existing monetary system. Indeed, we are convinced that the chances for this are good. At the same time, however, the hurdles to be overcome in the transition from the existing monetary system to a virtual one are very high. Instead, we will analyse the status quo and determine whether and to what extent bitcoin today fulfils the three functions of money.

Bitcoin as a payment medium

The virtual currency is practically unsuitable as a payment medium in Germany today. Bitcoin are hardly accepted by merchants anywhere. Although Berlin is regarded as a bitcoin stronghold in Germany, only 44 shops or online vendors in Berlin accept the digital currency as a payment medium (as of 24 April 2017), as compared to thirteen shops or online vendors in Hamburg, ten in Munich and seven in Cologne.¹¹ Making matters worse, these acceptance points often only sell niche products. It would not even be remotely possible to purchase basic living supplies with bitcoin. In Hamburg, for example, the only food one can purchase is through a pizza delivery service; other restaurants and grocery stores do not accept bitcoin yet.

Bitcoin as a store of value

The digital currency is also not suitable as a store of value. Although the price of bitcoin has risen astronomically in the last few years, this appreciation has been accompanied by sometimes sharp and protracted losses. Thus, bitcoin owners that did not have good timing must have suffered substantial losses of value. In theory, temporary declines are not a major problem for long-term savers as long as the long-term upward trend remains

intact. Indeed, the hopes of the bitcoin community rest on the strict limitation of the bitcoin supply to around 21 million units. The limited supply coupled

with practically unlimited demand could at least ostensibly lead to permanently rising prices. However, this advantage could take full effect only if there were no comparable digital currencies other than bitcoin. This cannot be guaranteed; on the contrary, the more the price of bitcoin rises, the more probable that other digital currencies with very similar characteristics would be created or used. Thus, the strict limit on supply applies only to the closed bitcoin system itself, not to the entire population of digital currencies. In theory, unregulated digital money could be created in inflationary magnitudes because these currencies are not backed by anything. Already today, there are numerous, less well-known digital currencies such as Ethereum



The bitcoin supply is limited to 21 million bitcoins.

¹¹ See the website www.bitcoin-einfach.de.

or Monero, for example. According to the website Coinmarketcap.com, there are currently 830 cryptocurrencies with a total market capitalisation of almost USD 80 billion (as of 22 May 2017). This casts doubt on the originally intended advantage of strict supply limitation. Strong competition exposes bitcoin to a tremendous risk of depreciation. In the spring of this year, the bitcoin price declined in reaction to rumours about a possible split of the digital currency. Only specialised technology experts can fully understand the technical circumstances behind this possibility.

Expectations of rising prices can always be supported by the network effect of currencies: the more widespread a currency is and the more it is accepted as a payment medium, the greater its value. Therefore, if bitcoin could become established as the worldwide standard among digital currencies, the demand for bitcoin would naturally rise further. However, the high levels of volatility are a stumbling block. It is not unusual for bitcoin prices to fluctuate by more than 10% on a single day. In fact, intraday fluctuations of more than 20% were observed in early January 2017. And the intraday fluctuations of other cryptocurrencies are considerably higher.

Such rapid price changes pose a serious problem as long as digital currencies are not yet established as a standard, but are used only as a supplementary (parallel) currency. For shops and enterprises that pay their suppliers and employees in euros, accepting bitcoin means exchanging their goods for a volatile foreign currency. The situation is similar on the buyer's side because consumers who receive their pay in euros pay for goods in a foreign currency when they use bitcoin. Therefore, widely fluctuating exchange rates between their own currency and bitcoin would lead to correspondingly wide fluctuations in consumer spending. Only few consumers can afford such volatility in their personal expenditures. And only few enterprises can afford the risk of seeing their sales revenue devalued by double-digit percentage amounts within a single day due to a drop in the bitcoin exchange rate. At the present time, therefore, there is little reason to expect the number of businesses that accept bitcoin or other digital currencies to increase substantially in the near future.

Bitcoin/US dollar exchange rate

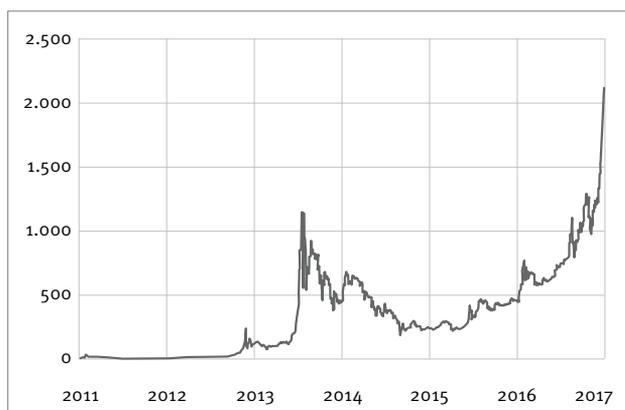


Fig. 3

Source: Bloomberg.

Bitcoin as a unit of account

Although bitcoin is theoretically usable as a unit of account, consumers would need to change the way they think about prices. At the current exchange rate (as of May 2017), one bitcoin is worth a little less than EUR 2,000. Therefore, daily use items priced between one and ten euros would amount to only a few thousandths of one bitcoin. For example, a magazine costing three euros would cost about 0.0015 of one bitcoin. At the moment, there are few if any persons who think in bitcoin when assessing the prices of goods. The mental conversion to bitcoin prices would be comparable with the introduction of the euro, when Eurozone citizens who were no longer able to assess prices in their national currency needed to develop a sense for euro prices.



The massive price fluctuations and the high hurdles that would need to be overcome before digital currencies could become established as payment media can be considered prohibitive factors for now.

Conclusion

Some of the criticism we have expressed might be dispelled if and when digital currencies finally come of age. In the meantime, however, investing in bitcoin should be considered more of a gamble than an investment (nevertheless, there

is no upper limit to its upside potential). The massive price fluctuations and the high hurdles that would need to be overcome before bitcoin and other digital currencies could become established as payment media can be considered prohibitive factors for now. We will explore other details, including the technical fundamentals, in Part B of this publication.

Payment systems

The way we pay for things will change considerably in the future. Technological progress is making the payment process faster and easier in many areas. However, it is becoming evident that German consumers will not be the trendsetters as much as the followers of this trend.

Technological progress continues to change payment behaviour in Germany and other countries. Four innovations are particularly important:

- (1) Contactless payment,
- (2) Mobile payment,
- (3) P2P payments and
- (4) Instant Payments.

End customers may be inclined to view this new access channel (e.g. via mobile phone or tablet) as a new payment instrument. However, all these technologies rely on the existing infrastructure of commercial banks and central banks, as well as credit card issuers, and offer the consumer a digital alternative to paying with coins and bank notes. The acceptance of these trends by consumers will mainly depend on their perception of the added benefits, security and liability, transparency, and cost structures. The role of banks at this crucial point of contact with their customers is subject to fundamental change as additional competitors, particularly fintechs or even banks from other countries, are poised to capture large market shares.

Contactless payment

The practice of »holding up and paying« with the credit card using »near field communication« (NFC) has long become established among our European neighbours. In the United Kingdom, for example, this technology already accounts for a quarter of all card payments.¹² Now even German supermarkets have begun to equip their cash registers with this technology. According to the German Association of Retailers (Handelsverband Deutschland), NFC technology could be installed nationwide by the end of 2017. At the same time, more and more banks are adding NFC transmitters to their debit cards. NFC is an internationally recognised standard that makes the payment process more convenient and provides the basis for further technical innovations. Besides a microchip, the cards also contain a built-in radio antenna, making it possible to pay for goods from a distance of up to four centimetres from the POS terminal. Therefore, it is no longer necessary to insert the card into the card scanner. Also, the shopper also does not need to enter a PIN or sign for purchases up to and including

¹² See The UK Cards Association (2016).

EUR 25 (UK: GBP 30). This convenience afforded by this further streamlining of the payment process is perceived as a major advantage. According to a recent TSYS study, 87% of respondents in Germany agreed with this statement after the payment method was explained to them.¹³ After being similarly instructed, relatively high numbers of respondents also agreed that contactless payment is a quick and easy payment method. These results are considerably different from those of a survey conducted by the German Bundesbank, however, in which the respondents were not informed of the exact processes of alternative cashless payment options.



Security concerns in particular stand in the way of widespread acceptance by consumers.

is equipped with this technology. All together, fewer than 10% of all respondents have actually used contactless payment in the last six months. In the United Kingdom, this same survey produced much different results: 97% of respondents there are familiar with this technology and one out of two has used it in the last half year.

For merchants, the principal motivation for equipping their payment systems with this technology is to accommodate the desire of customers for digital innovations and to strengthen their bond with these consumers. But there are financial advantages as well: after the initial investment, the increased use of debit cards or credit cards leads to lower costs for transporting and insuring cash. Furthermore, the faster payment process means that more customers can be served in the same space of time.

Security concerns

To date, however, security concerns in particular have stood in the way of widespread acceptance by consumers. Specifically, people are worried that personal data could be stolen and abused. 58% of German respondents in the TSYS study share this concern. In addition, many respondents see a risk that money could be stolen from them »in passing« without any physical contact and without their noticing it, through the use of radio technology. However, there are upper limits of EUR 25 per transaction and EUR 50 per day. These concerns about data misuse are similarly high in the United Kingdom. And although one out of two respondents there indicated that they use contactless payment to buy things on a regular basis, only 40% believe that this technology is secure. Special envelopes that shield bank cards offer protection against unwanted data capture.

¹³ TSYS is a company that offers innovative solutions for payment transactions. To better understand these results, it should be noted that the study was only aimed at persons who meet the minimum technical requirement (debit card, smartphone). Furthermore, it was an online survey. Therefore, the respondents were younger on average than the overall population and have a higher affinity for technology.

Furthermore, the data are encrypted before being transmitted and can only be decrypted by the merchant's specific terminal devices. Personal data such as the name and address are not transmitted. In assessing the risk of NFC technology, however, the alternative should also be weighed: if someone steals your wallet, the losses of card misuse could be limited by quickly blocking the cards. On the other hand, there is no way to limit the loss of cash contained in a stolen wallet.

What is the potential of contactless payment in Germany?

It should be noted first of all that the use of cashless payment forms for smaller purchase amounts has been rising steadily for many years now. Admittedly, more than 90% of consumers still use cash for purchases up to EUR 20, but NFC technology as a convenient alternative to cash can be expected to benefit from and accelerate this trend. The necessary technical prerequisites will be fulfilled across the nation in the near future. With a distribution of 97% in Germany, the debit card (known as »girocard« in Germany) is the most-used cashless payment instrument for both consumers and merchants. Therefore, the German Bundesbank concluded in 2015 that these properties form »a good basis for payment card-based innovations«. It should also be noted, however, that there is a clear age difference when it comes to familiarity with this payment method: two thirds of 25 to 34 year-olds, but only one third of those »65 and older« are familiar with it.¹⁴ Therefore, the speed at which this trend will spread is heavily influenced by the change of generations.

With a distribution rate of 97 % in Germany, the debit card is the most-used cashless payment instrument.



Mobile payment

The smartphone is being used for a growing number of mundane tasks, including shopping and purchasing. The term »mobile payment«, which has been taken over from English, encompasses a broad range of application possibilities. In the narrower sense, it refers to the use of a mobile terminal device (usually a smartphone) to purchase goods at the point of sale (POS); thus, it is an alternative to paying with cash or debit card or credit card.

In the broader sense, mobile payment refers to the initiation or even the execution of payment transfers with the aid of a mobile device. Besides paying for goods at the POS terminal, it also refers to digital purchases of applications (»apps«) from smartphones or tablets. The results of studies of this trend vary accordingly: according to a recent survey conducted by the

¹⁴ See Deutsche Bundesbank (2015).

auditing and consulting firm PricewaterhouseCoopers (PwC), 30% of Germans already use mobile payment systems. The definition used in this study also includes the use of apps to purchase clothing or train tickets. In a concurrent survey conducted by TSYS, which was limited to payment at the POS, only about half as many (16%) of respondents in Germany stated that they are already using their smartphone to pay at the POS terminal. A representative survey conducted by the auditing and consulting firm Deloitte showed an even lower result: Only 4% of online respondents said they use their mobile phone to pay for goods in a shop.



Germany lags behind other countries when it comes to paying with the mobile phone.

Mobile payment in the narrower sense

The mobile telephone is not yet widely used as a payment instrument in Germany.

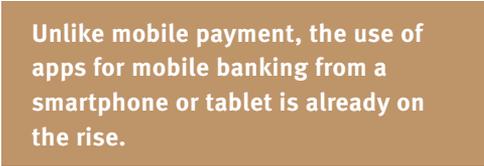
In this respect, Germany lags behind other countries. In the Netherlands, Italy, and the United Kingdom, 10% of consumers already use mobile payment methods. Japan leads the statistics by a wide margin, as one out of two consumers pays with the smartphone at the POS.¹⁵

There are many reasons for the low use of mobile payment in Germany. On the side of merchants, a uniform system has not (yet) been established. Instead, there are numerous individual products offered by mobile telecom providers, retail chains, banks, and technology enterprises. There is no nationwide, universally accepted product (yet) for consumers who wish to only pay with their mobile phones. Instead, they must register with a large number of different providers and use different apps depending on the merchant. The different systems range from Bluetooth technology to scannable QR codes structured like bar codes, which can be used in lieu of a traditional wallet. However, applications based on NFC technology are already available for the latest smartphones. They work in a similar way as contactless payment with a debit card or credit card.

In all forms of mobile payment, a traditional payment medium such as a credit card or direct debit authorisation (for example) is kept on file in the user's account. At the POS terminal, the customer opens the corresponding app on his mobile phone and, if necessary, selects one of several credit cards on file. The smartphone establishes a wireless link over a very short distance to the POS terminal (NFC) and the customer authorises the transactions, usually with his fingerprint. Only 10% of the persons surveyed by TSYS are not aware of the fact that this payment option is available in isolated cases. In the United Kingdom, only 3% of respondents indicated

¹⁵ See Deloitte (2017).

that they had never heard of mobile payment. These high familiarity levels can be explained by the fact that three companies known for their marketing prowess – namely PayPal, Google, and Apple – discovered this market before the banks did and now compete with the banks in this area. These three US companies also lead the list of the best-known providers of mobile payment methods, according to a survey by PwC.¹⁶ However, Apple Pay is not yet available in Germany. Deutsche Bank has offered its customers the option of paying with their smartphones since early April of this year. This function, which was added to the bank's existing mobile banking app, operates on the basis of NFC technology. However, this service can only be utilised with Google's Android phones because Apple refuses to grant access to the NFC hardware on its devices to any and all third-party providers, in the style of a monopolist. The launch of Apple Pay in Germany is linked with high expectations. Having revolutionised the market for mobile surfing ten years ago, the tech giant today enjoys a massive customer base.¹⁷ But even the savings banks and cooperative banks are working on a digital money exchange that will enable their customers to pay for goods at the point of sale. They are seeking to integrate not only credit cards, the use of which is not widespread, but also debit cards into their app. German banks are seeking to introduce mobile payment instruments on the basis of their existing banking platforms. Unlike mobile payment, the use of apps for mobile banking from a smartphone or tablet for certain kinds of transactions is already on the rise. One third of all consumers already uses such an application and another quarter is willing to try it out in the future.¹⁸



Unlike mobile payment, the use of apps for mobile banking from a smartphone or tablet is already on the rise.

The programmes offered by established service providers in Germany are still in their infancy. Moreover, other obstacles explain the restrained use of these services. The main reason is the lack of a recognisable additional benefit for consumers. Particularly compared with contactless payment, there is no objective advantage; it is simply a matter of personal preference. This could change, however, if digital money exchanges are combined with customer retention or loyalty programmes. A known pioneer in this field is the Payback bonus programme. In addition to granting loyalty points in various retail chains, online shops, and even petrol stations, Payback now also offers its customers a way to pay for goods and services with its partners by using the same app in all cases.¹⁹ This use could be further optimised in the future. For example, the customer's smartphone could log in

¹⁶ See PwC (2016b).

¹⁷ Apple iPhones currently account for approx. 16.5 % of all smartphones sold in Germany (see kantarworldpanel.com).

¹⁸ See PwC (2016a).

¹⁹ Because the technology is based on a scannable QR code, Payback pay is also available to Apple users.

to the merchant's customer WLAN upon entering the shop. The provider's app would automatically check past purchases against current bonus and discount programmes and inform the customer of special offers based on his own purchasing behaviour.



The risks associated with a completely »transparent« customer cannot yet be fully fathomed.

However, such functions represent another reason for the slow rate of acceptance, considering that 85% of survey respondents have indicated they have

security concerns regarding the use of mobile payment methods.²⁰ The possible risks associated with a completely »transparent« customer cannot yet be fully fathomed. Such risks highlight an essential advantage of cash: anonymity. However, there are also practical risks: For example, mobile payment would not be possible without sufficient battery capacity.

Mobile payment in the broader sense

The broader definition of mobile payment methods also encompasses Internet-based purchases on mobile terminal devices, which can be done from anywhere. Here too, PayPal leads the list of the best known payment services providers in this segment. According to the latest PwC study on mobile payment, paydirekt ranked second in 2016.²¹

What is the potential of mobile payment in Germany? Following the nationwide expansion of NFC technology, Germany will have a uniform infrastructure for the first time. Furthermore, smartphone use has reached a new high: According to the trade association bitkom, 78% of people over 14 in Germany used a smartphone in 2016. However, the providers have not yet succeeded in offering an appreciable benefit to most of their potential customers.

P2P payments.

P2P (peer-to-peer) payments refer to private transactions between private individuals with no commercial basis. According to the latest German Bundesbank study on payment behaviour in Germany, 87% of such transactions are conducted in cash. P2P payments are conducted on the basis of electronic data transfers over the Internet, usually initiated from special apps for smartphones or tablets. Following the introduction of the Single Euro Payment Area (SEPA) in 2014, the number of digits of a single bank account rose considerably (IBAN). P2P apps represent a user-friendly alternative because they execute transfers on the basis of mobile phone numbers

²⁰ See PwC (2016b).

²¹ See PwC (2016b).

or e-mail addresses. These apps fall into one of two categories: stand-alone apps focused on payments (e.g. the German providers Cringle and Lendstar and the Swedish enterprise Swish),²² and the extended function of existing messenger services (market leaders are Facebook from the United States and the Chinese Internet giant WeChat).

In both cases, the user needs a recognised payment medium (as in the case of mobile payment), which he deposits in his customer account in the given app. The user must also allow the application to access his contact list. This way, the actual transfer can be performed in just a few steps. First, the user selects the recipient from his contact list and enters the desired transfer amount. Similarly to known online banking methods, the transaction is authorised by means of iTAN, smsTAN, or similar TAN generators. This system is much more user-friendly and faster than other known transfer formats. In some cases, data entry can be done by voice commands such as »send cash to ...« However, there is

an important limitation in that both the sender and the recipient of transfers must be users of the same app. And yet, there are a few exceptions to this rule: PayPal (for example) allows its customers to transfer money also to non-customers. In this case, the recipients are informed of the incoming transfer by an e-mail. To receive the amount, they only need to enter their account data into the PayPal system once. These data are not stored and there is no need to register for the service. After that, the recipient's bank account is credited.

P2P payments are conducted on the basis of electronic data transfers over the Internet.



Payment apps are hardly widespread in Germany to date

In terms of usage, however, these mobile payment apps are still in their infancy in Germany. Only 9% use such applications regularly. By contrast, 43% said that they had absolutely no knowledge of this payment method, according to the results of the TSYS survey. Even in the United Kingdom, the survey results were similar: The 21% of respondents who said they use this service regularly is only slightly higher than the corresponding percentage in Germany. And even among the Britons, 30% have no knowledge of this payment method.

These results can be explained by the relatively small number of usage options. The analogy of friends dividing up a restaurant bill among themselves is often cited as an example of quick and uncomplicated payment in the marketing of P2P payment apps. Instead of paying the individual amounts

²² See Figure 5, p.31.

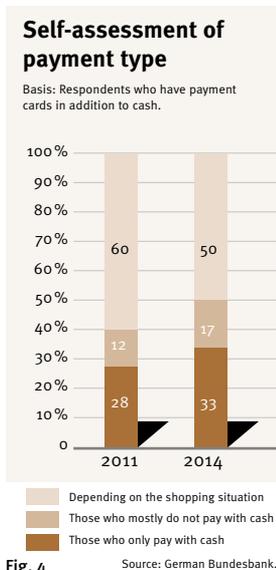


Fig. 4

with cash, the owed amounts are paid via smartphone apps. However, only 40% of a representative sample surveyed by PwC finds this function to be useful.

By contrast, the market-dominating messenger services of Facebook and Wechat are striving for another goal: They want to offer their users a comprehensive digital platform. Already today, individually optimised web contents are displayed to users in the social networks. In the future, it should be possible to order and even pay for the products advertised on these platforms.

There is a price, however, for all these practical advantages. The customer pays this price not in money, but by releasing his personal data. User profiles will become even more extensive and detailed because they can directly incorporate parts of the customer's spending behaviour.

Instant Payments.

The next step in harmonizing payments within the EU is the execution of transfers within a few seconds. Following the introduction of SEPA transfers in 2014, a further step is now being taken in the direction of a digitalised Europe, namely real-time transfers. Once again, European Payments Council, an association of European banks, is leading the way on this initiative. The mission of this association is to bolster the competitiveness of the EU as a means of promoting growth.

The new Instant Payments system will make it possible to execute transfers for a maximum amount of EUR 15,000 at all times of the day or night. The transferred amount will be credited to the recipient's account within 10 seconds after the originator of the transfer has confirmed execution. Besides transfers, the system can also be used for direct debits and debit card purchases. The system will be available for use in all the EU 28 countries, as well as Iceland, Norway, Liechtenstein, Switzerland, Monaco, and San Marino. However, individual banks in the participating countries will be free to choose whether or not they participate in the system. The launch of this new system is planned for November 2017.

Besides the goal of establishing a uniform network for instant payments in Europe as means of closing the gap with existing systems in countries like the United Kingdom, Sweden, and China, this new system will also create

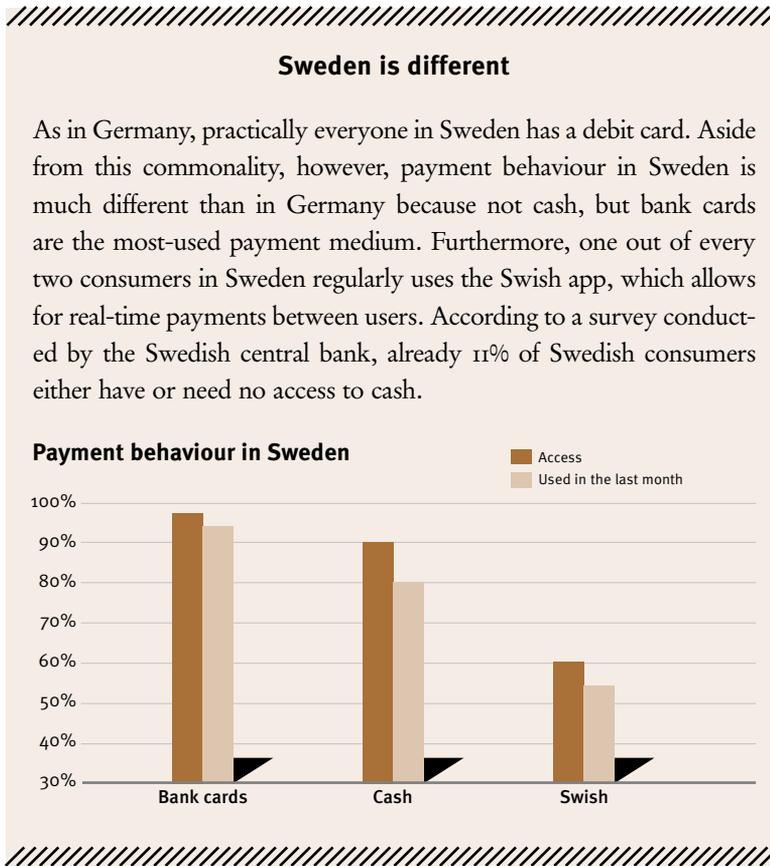


Fig. 5

Source: Swedish central bank (2015).

advantages for consumers and merchants. Merchants will benefit from immediate payment security and liquidity inflows (as in the case of buying a car or making e-commerce purchases, for example). Combined with the new possibilities for P2P payments, instant transfers bring cashless payments one step closer to being a perfect substitute for cash.

Fintechs – Drivers of change

Fintechs are the »up-and-comers« of the financial industry. Fintechs are the »up-and-comers« of the financial industry. By employing new technologies they bring a breath of fresh air to the industry. Data as a form of capital is gaining in significance.

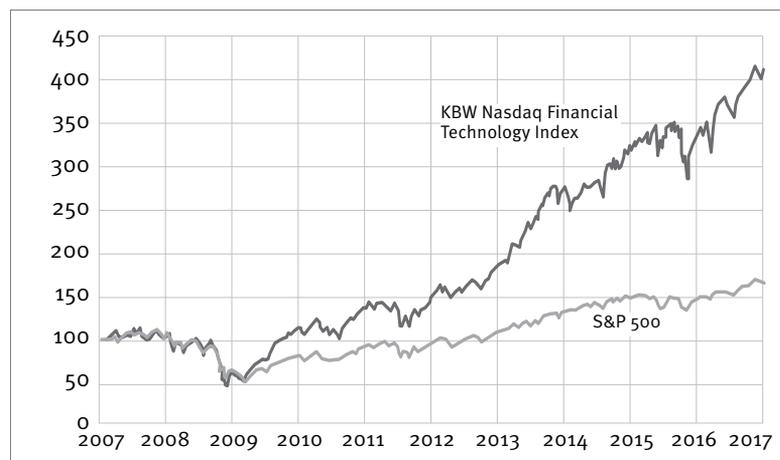
Everybody is talking about fintechs these days. This term is derived from the words »financial technology«; fintechs are companies that employ modern data processing techniques to offer specialised financial services. They are the »up-and-comers« of the banking industry and the most important transporters of technological progress to the banking and financial system.

According to one study commissioned by the German Finance Ministry, there are more than 400 fintechs in Germany.²³ The total market volume of fintechs operating in Germany in the segments of financing and asset management was EUR 2.2 billion in 2015. In addition, a transaction volume of EUR 17 billion was reported in the segment of payment services.

At the latest since the great financial crisis of 2008, a very substantial, though partially still invisible, but at any rate fundamental transformation has been occurring in the financial system. Figure 6 shows the development of the KBW Nasdaq Financial Technology Index, an index fund that makes it possible to invest in US fintech companies. The comparison with the S&P500 Index shows that fintechs offer attractive investment opportunities when the individual companies are well chosen.

²³ See Dorfleitner et al. (2016).

The first fintech index fund



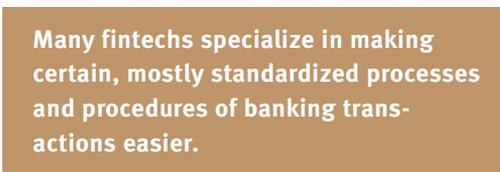
The KBW Nasdaq Financial Technology Index tracks the performance of fintech companies whose shares are traded in the United States. The index was created in July 2016; prior data points were back-calculated.

Fig. 6

Source: Bloomberg.

With their innovations, fintechs are challenging traditional banks and gnawing on their business models, but for precisely this reason banks are also working with them.²⁴ The cooperation is primarily amicable with fintechs that established themselves from the beginning as service providers to – and not competitors with – banks. There is said to be around 70 cooperation arrangements between major German banks and fintech companies at the present time.²⁵

Therefore, the boundary between banks and fintechs is rather fluid. There are two fundamentally different ways that fintechs transport technological innovations into the financial sector. In some areas, business models are being radically supplanted; in other areas, innovations are being implemented rather incrementally. Furthermore, blockchain technology (see Part B, HWWI, p. 49 seq.) will presumably bring about the greatest upheavals for banks and fintechs alike. This gives rise to the following questions: How are fintechs bringing technological innovations to the financial system? What kinds of innovations can be expected? And finally, how will they change the business models of banks?



Many fintechs specialize in making certain, mostly standardized processes and procedures of banking transactions easier.

What is a fintech?

A fintech can be many things; and sometimes you might not even know that you are dealing with a fintech because they must cooperate with banks to a certain degree in many areas. Many fintechs specialize in making certain, mostly standardised processes and procedures of banking transactions easier and faster.

In order to do this, fintechs require standardised interfaces between individual providers of financial services. For this reason, laws increasingly require banks to offer so-called APIs (Application Programming Interfaces). These are standardised transfer points for all kinds of information. These legally required interfaces are at the heart of the transformation of the financial and banking sector described here. This is how fintechs interlink with traditional banks. Furthermore, the EU Payment Services Directive (PSD2) requires banks throughout Europe to share important transaction and customer data with non-banks, thus including fintechs, in order to promote competition and consumer protection.

²⁴ An overview of these cooperation arrangements can be found here: <http://paymentandbanking.com/cooperations-between-banks-and-fintechs-in-ger/>.
²⁵ See Dorfleitner et al. (2016)

The one thing that all fintech companies have in common is that they make their money by providing financial services based on the latest technology and data-processing techniques. Admittedly, the same can be said of many banks, but the difference is that the banks' »traditional« business models were in place long before the rise of digitalization, which is sometimes also called the next industrial revolution.

It is no accident that fintechs and not traditional banks are bringing technological progress to the economy and society. First of all, fintechs are usually smaller companies and are therefore more agile and willing to experiment. But more importantly, fintechs are often subject to less regulation because they are not (initially) banks in the legal sense. By contrast, banks

must adhere to strict regulations governing how they conduct and protect their business. Especially in the United States, it can be observed already now that fintechs behave in a manner similar to banks (so-called shadow

banks). Not impeded by the tangled undergrowth of bank regulations, they capitalize on their less regulated status by generating growth primarily in segments that are either not profitable enough or legally uncertain for many traditional banks.²⁶

➤➤ **Already today, Fintechs offer a wide range of mobile payment solutions, such as transferring money from one smartphone to another.**

Fintechs are changing the way payments are done

Fintechs today offer user-friendly interfaces that facilitate formerly cumbersome processes such as transfers and credit card payments. For example, the customer can photograph an invoice with the smartphone and the text recognition software will transmit the data to the online transfer form. Fintechs also offer a wide range of mobile payment solutions that bank customers can use, such as transferring money from one smartphone to another. And yet, fintechs are not only changing payment systems. Another typical area of business is digitalised and automated asset management. So-called robo-advisers base their investment strategy on rule-based models to determine the best portfolio structure. And completely new types of products such as crowdfunding and peer-to-peer lending are being created.

Table 1 on page 35 provides an overview of the field of activity of fintechs. These fields are roughly presented in the order of their current relevance. The table shows the many ways that fintechs are encroaching on the business of banks. As mentioned above, fintechs are most present in the operational area. This is because technological progress is usually applied first to recurring processes that are not as data-intensive as others.

²⁶ See Buchak et al. (2017).



Selected activities of fintechs

- 1. Operational improvements** – Examples: Online banking, bookkeeping, analysis of account movements, mobile POS terminal systems (shops, restaurants), identification of customers
- 2. Payments** – Examples: Elimination of friction in foreign payments, e-commerce, P2P, better managing insurance against payment default, using and linking existing bank accounts), photographic transfers, integrated donation options, online bill payment
- 3. Saving** – Example: Easier access to multiple call money/term deposit offers of different banks, combining social networks with commercial platforms, online asset management, and crowd investing, meaning individual loans to enterprises or investments in other properties
- 4. Lending** – Examples: Assessing creditworthiness on the basis of online data, trading of receivables, and crowd-funding, meaning the faster issuance and brokerage of consumer loans
- 5. Insurance** – Examples: Specialised insurance policies priced on the basis of online data, better comparison by digital brokers
- 6. Cryptocurrencies** – Example: Bitcoin

Tab. 1

Source: Bloomberg.

How fintechs are already changing the business model of banks

The change that fintechs will bring to the business model of banks is potentially huge. That is because costs are still high in many areas of the banking business, which presents great potential for the innovations driven by fintechs²⁷ Furthermore, the convenience afforded to customers is driving the introduction of fintech offerings based on new technologies to the financial sector. Finally, banks naturally want to constantly improve their core mission of assessing, evaluating, and managing risks, and for that reason they pursue better information technology. This is why we expect that this potential will be exploited slowly but surely. This potential can be divided into three main categories: a) efficiency enhancement, b) modular design principle, and c) tailored offerings. These categories are elaborated further in table 2, p. 36.

²⁷ Philippon (2016).



The transformative potential of fintechs	
Efficiency enhancements	The operational efficiency of all processes will be enhanced tremendously through the use of technology.
Modular design principle	Standardised interfaces will enable consumers to combine the individual activities of banks and other providers of financial services according to their wishes.
Tailored offerings	The enlargement of the data basis caused by the digitalisation of daily life will enable financial services providers to assess customers' wishes and the associated risks more precisely.

Tab. 2

Source: Berenberg based on Brühl (2017).²⁸

Blockchain will bring about the greatest changes in the long term

Of the areas depicted in table 2, blockchain technology probably harbours the greatest disruptive potential, especially in matters of efficiency enhancement and security. In simplified terms, a »blockchain« is a decentralised encryption and identification technology that creates a ledger – for units of money, land ownership rights, or securities – in which all transactions are recorded and which is administered by a large number of computers. According to experts, this makes transactions more secure in many respects. This technology is currently being used mainly for bitcoins (see also chapter virtual currencies on the rise, p.18 seq.). However, some fintechs are working on making blockchain technology usable for other financial transactions. In the meantime, 42 banks are working in a consortium to develop a technical standard for blockchains.²⁹

²⁸ Derived from Brühl (2016).

²⁹ The following paragraphs are based on Schulz (2016).



Blockchain – Application Example:

Transaction: Person A buys a security from Person B.

Verification: Through the blockchain, the buyer can identify the security without a doubt and determine that the seller is in fact the lawful owner of the security, and that the security is not counterfeit.

▣ **Unmistakable identification.**

Transaction: The information about the new owner of the security is converted into an encrypted data block. Non-participants are unable to see who is involved in the transaction.

▣ **Anonymity is assured.**

Validation: Copies of the blockchain exist on many computers that are connected with each other over the Internet. They all check the data block and therefore the transaction. If someone falsifies the information about a security on one computer, the others will notice immediately and ignore the transaction.

▣ **The decentralised design makes it harder to manipulate transactions.**

Execution: Once the transaction is verified, the transaction data are added to the blockchain. Because the blockchain can no longer be modified, but only supplemented, the transaction is reproducible in the future as well, just like all other previous transactions.

▣ **The transaction history is fully reproducible.**

Result: The blockchain now shows Person A as the owner of the security. Thus, Person B could not sell it a second time even if the security were still in his possession.

▣ **Fraud is more difficult.**

Source: Berenberg, based on Schulz (2016).

Blockchain technology can do a lot more than manage digital units of money. As shown on page 37, the technology can also be used to advantage in transactions of all kinds by helping to overcome theft, money laundering, fraud, mistrust, and often even the impotence of regulatory authorities. It allows for the unequivocal identification and evaluation of the object of any transaction. Blockchain can restore trust precisely in those areas where trust is lacking.



Information and performance flows will be executed decentrally in the future.

Blockchain has the potential to lower costs substantially. The financial system is based on the work of people at centralised points who record, monitor, and post all payments, using forms and digital input masks. By contrast, blockchain is based on the decentralised verification of the authenticity and correctness of a payment by all the data centres involved, which then report it as correct and post the payment. The work that was formerly done by humans will be processed by computers in seconds, free of errors and with complete reproducibility. There will no longer be a need to channel payments through central control points. Theoretically, banks would also no longer need to maintain a risk cushion. Because the system only posts a transaction when the equation is correct on both sides, but then does so immediately, a large portion of the risk cushion will no longer be necessary.



It will become faster and cheaper to move and transfer ownership of money, securities, and other assets. Banks will need fewer employees to process payments.

However, there are certain key prerequisites that blockchain technology does not yet fulfil. It is not yet possible to net transactions within a blockchain, which is customary in the financial system today, nor is it possible to correct them afterwards. Furthermore, the legal basis for transferring property rights has not yet been established. With respect to the digital currency bitcoin, it has already been shown that the capacities needed for the financial industry are simply lacking. From the standpoint of banks, it is also problematic to make their business dependent on a system in which outside computers, including those of competitors, process the bank's own data. Moreover, it is not always desirable for it to be known exactly when a bank transfers money, foreign currencies, or securities, and to whom. Therefore, it is very possible that blockchain will become established beyond

bitcoin within small, private blockchain systems that can only be used by a limited number of authorised persons; this represents a potential business for banks in which fintechs will offer specialised, supporting services.

Finally, blockchains will make it possible for banks and regulatory authorities to provide an unfalsifiable, irrevocable, always verifiable chain of evidence of all transactions at the press of a button. It will become easier to detect offenses such as tax evasion and the circumvention of sanctions.

Banks will offer private blockchains to process transactions.



One trend that is common to all forms of digitalization is the aggregation of many different functions within a single access mask. The smartphone itself is the biggest step in this direction: With all its apps, it is like a Swiss army knife containing all

Regulatory authorities will demand that banks be able to completely document the transactions of their customers on the basis of blockchain technology.



possible functions that the smartphone owner (mostly) put together himself, based on his own preferences and needs. Financial services will change in a similar way. Already now, fintechs has successfully introduced solutions that are primarily based on the simplification of financial processes. The main driver of this trend is the remarkable convenience afforded to customers. Thus, the importance of convenience banking will grow.

As a result of these developments, banks will purchase services from fintechs and offer them under their own name, on the one hand, and on the other hand non-banks including social media and retail shops in particular will increasingly order banking services in order to offer them from their own platforms. Consequently, banks will become increasingly specialised and provide non-core services, when necessary, by outsourcing them to other providers. Thus, the individualised service component will become more important; so-called life phase offerings will be assembled and offered to customers. As a result, banks will differentiate themselves more, with greater segmentation by customer groups. Many new opportunities for arise particularly for banks offering upscale customer service. On the other hand, banks with overly broad offerings will increasingly come under competition and cost pressure.



Banks will specialize in providing advice and combining individual services into packages; this way, they will increasingly become financial services platforms.

Larger and larger quantities of data are being generated as a result of new technologies. This trend is known as big data. With the aid of algorithms, artificial intelligence, and machine learning (meaning the »artificial« generation of

knowledge from experience), millions of data points can be analysed and connections and forecasts that are also relevant for banks can be produced. Probabilities can be calculated with increasing precision. Profiles of customers (and even non-customers) will become more exact; based on discovered or presumed behavioural patterns, the behaviour and financial situation of customers can be predicted with greater accuracy. Therefore, such profiles will become increasingly valuable.

Slowly but surely, therefore, the basis for deciding how much credit should be extended to people – and thus the amount of their budget – will change. Traditionally, loan amounts and interest and principal repayment terms have been determined in an interview between customers and bank advisors on the basis of income proofs. And so this process is already individualised. However, some fintechs are offering upgraded versions of or alternatives to this approach. Personal information is compiled from many other sources, in order to produce a more exact profile of the borrower.



In the future, the budget restriction of every individual will be hyper-individualised. Standardised credit lines will be phased out

Technological progress will also affect the way people use financial services in the future. For example, glasses that provide additional information to the wearer as they look through them have

been available for years already. One example is *augmented reality*. Technology implanted in the human body in the form of computer chips (for example) will also change the financial sector. First of all, they will collect data that are valuable in themselves. Above all, however, they will likely also serve to make certain transactions more efficient: for example, a chip implanted in the finger could be used for making payments. The possibilities are practically boundless; in the distant future, it will be possible to measure even brain activity much more precisely and put this information to use in everyday applications, such as signalling a legally valid willingness to pay.

Data collection as the basis for financial transactions is a politically sensitive topic. Due to the wish for data privacy, which is particularly strong in Germany, customers will presumably demand additional consent obligations for extended data collection. Therefore, the operational security of traditional banks, which is itself the result of strict regulation, is not just a disadvantage compared with the often less regulated fintechs. Theoretically, traditional banks will have an advantage in this respect, particularly when it comes to their ability to obtain the consent of customers for critical transactions, because a personal relationship (and ideally trust) has already been established.³⁰

Technologies worn on the body or implanted in the body will change and increasingly dominant everyday payment behaviour.



Naturally, the changes that fintechs are bringing to the financial system also harbour risks.³¹ Even though larger and larger quantities of data will be collected in the future, that does not necessarily mean that the quality of the data will also be good. Already now, for example, many people are very careful about what can be learned about them from online sources, suggesting that the potential for manipulation is growing. There is also the question of how much of the collected data can even be interpreted for financial purposes. And even if this question could be answered, the interpreting algorithms could be manipulated and attacked. Therefore, if decisions are increasingly made on the basis of complex calculations and even artificial intelligence, such decisions could be very difficult to comprehend.

Banks will need to derive even more benefits from the trust of their customers.



At the same time, however, politicians and consumer protection advocates will continue to demand a certain degree of accountability.³² On top of that, the degree to which society will accept the complete illumination of the individual is unclear. While the »transparent individual« may be desirable from the standpoint of risk assessment and preference determination, it is at least doubtful whether it is desirable from other perspectives. Due to this conflict of interest, data privacy questions will be increasingly addressed in the regulatory environment.

New questions surrounding the protection of personal data will complicate the regulation of the financial sector.



³⁰ Also see the PWC study »Privatkundengeschäft der Zukunft«.

³¹ <https://www.project-syndicate.org/commentary/managing-big-data-risks-by-ernest-davis-2017-02>.

³² <https://www.golem.de/news/internetdienste-vzbv-fordert-kontrolle-von-algorithmen-1704-127450.html>.

Conclusion

Slowly but surely, fintechs will change the financial sector by becoming an important part of it. The »bank« of the future will be a lean, platform-based technology enterprise whose capital will increasingly consist of data that enables the bank of the future to offer highly individualised services. The pace of change will be determined not only by technological innovations, but also by regulation to a large degree.

A brief history of money

The role of money has changed dramatically over the course of time. Money did not play a role in the very early phases of human history. Today's »paper currencies« developed gradually after bartering was found to be impracticable.

In human history, money did not always play the dominant role it does today. Early cultures often cultivated a gift economy. Goods and services were given without an agreement for immediate or future rewards. This worked as long as the group of gift givers and recipients was not too large and was limited to family members or clan members. The less two persons knew each other, the more the need arose to expect something in exchange for the good.³³ Such barter transactions were documented for the first time between the clans of our ancestors. The barter economy was born. Goods were exchanged in certain ratios. If someone owned chickens, but needed animal skins, he would need to find someone who was willing to offer him animal skins in exchange for chickens. This was not only time-intensive, but also cumbersome in many cases because the bartered goods always needed to be transported.

The decisive innovation arose from the realization that a particular item could be designated to serve as a substitute for one side of a barter transaction. Depending on the people and the civilization, different goods such as seashells, stone disks,

animal skins, gemstones, or pearls were used for this purpose. This invention of early money is one of the most powerful mechanisms for promoting social cooperation. Payment media have evolved and been refined considerably over the course of the centuries that followed. The first coins were minted under King Croesus in ancient Asia Minor in the 6th century B.C. The practical purpose of coinage was to serve as a quality seal for the underlying metal, which established trust between buyers and sellers. In addition, coinage harmonised the value of the metal so that it no longer needed to be weighed to measure its value.

Although mintage had the effect of harmonising specific coins, private minting rights were in effect and therefore regionally different currencies in the form of coins were in circulation for a long time. Only under Charlemagne were private minting rights abolished and the first super-regional currency,

Bartering proved to be complicated. The introduction of a universally recognised payment medium was a trailblazing innovation.



³³ See Ametrano (2014).

the denar, was introduced. Because transporting larger quantities of coins very quickly proved to be impracticable, paper money emerged for the first time in China in the 11th century. The coins were kept on deposit and deposit receipts stating the quantity of coins deposited were issued. Paper money gained trust because banks were required to hold the equivalent value in coins and issue coins in exchange for deposit receipts at any time. The deposit receipts, which did not themselves have any intrinsic value, were accepted in lieu of the corresponding commodity money, i.e. coins. From this point it did not take long to realise that only a smaller portion of the claim to (gold) coins (documented on the deposit receipts) needed to be covered by the corresponding amount of gold because all deposit receipts would never be redeemed at the same time. This was the birth of partial coverage of representative money, in this case deposit receipts, which allowed for more freedom in the creation of money. This practice also allowed for large seigniorage profits, meaning the profit earned on the creation of money as the difference between the value of the deposit receipts and the corresponding production costs.



Cash and deposit money were further milestones on the way to the modern monetary system.

Another decisive step towards the kind of money we know today was the creation of deposit money or book money, which is just as much part of our current understanding of money as coins and bank notes. When someone deposits money in the form of coins and bank notes with a bank, the bank posts this amount to the customer's account and retains the coins and bank notes (passive creation of deposit money). In addition, banks create additional deposit money by lending on the basis of excess reserves (active creation of deposit money). Deposit money exists only in electronic form and is created with the aid of central bank money, coins and bank notes. Because deposit money is not backed by central bank money (coins and bank notes), it is also called fiat money. »Fiat« is derived from the Latin passive verb »feri«, which means »emerge«. Thus, fiat money means »money emerges«. Fiat money is the opposite of commodity money, which is based on or completely backed by gold, silver, or the like (e.g. gold and silver coins). In effect, the creation of deposit money makes it possible to multiply the amount of money in circulation. This multiplication of the money supply is the subject of constant public and scholarly debate because it is very difficult to control or predict (see also page 45).

Sovereign Money Initiative in Switzerland – Do people want to return to the backing of money by francs?



In Switzerland, about 90% of Swiss francs exist in the form of book money or deposit money created by the banking system by means of active or passive deposit money creation (see the main text). Only 10 % exists in the form of central bank money, including cash in the form of bank notes and coins.

The Swiss Sovereign Money Initiative wants to change this by forbidding the creation of money by the banking system. Consequently, banks would only be able to lend money that was previously loaned to them by customers or the central bank. This demand can be briefly summarised as follows. Since only the Swiss National Bank would be able to »create« francs, money in bank accounts would be completely backed by real francs. This would also enhance the central bank's control over money in circulation, which would not be complicated by the multipliers of deposit money creation.

The mainly political and business proponents of this initiative offer the following justification for such a system: deposit money is used by banks for speculation, leading to bubbles; the banks pocket the profits, but any losses must be borne by taxpayers. The introduction of full coverage would protect the bank accounts of individuals from crises and make the financial and banking system more secure.

The Swiss government and officials of the Swiss National Bank (led by its Chairman Thomas Jordan) reject these proposals, claiming that such a major systemic change is fraught with risks and uncertainties and would endanger the international status of Switzerland as a financial centre unless other countries would take the same step.

The next step in the »history of money« could be influenced by the following two trends, which are very much the subject of public debate:

▨▨▨ The abolition of cash

▨▨▨ The triumph of cryptocurrencies

Payment systems are not impervious to the increasing digitalisation of society. In this context, cash would seem to be on the verge of extinction. Furthermore, the so-called digital or cryptocurrencies are attracting more

and more attention. The most prominent and oldest example is bitcoin, which accounts for roughly 79% of the total market for cryptocurrencies (as of September 2016).³⁴ The design of other cryptocur-

»» Bitcoin is the most prominent representative of the cryptocurrencies, with a market share of roughly 80%.

rencies is very similar to that of bitcoin in some respects. For these reasons, we will limit our analysis in the following to the macroeconomic implications of bitcoin and its underlying technology.

We will examine the macroeconomic advantages and disadvantages and assess the probability that bitcoin or another cryptocurrency could win out against the current monetary system.

³⁴ See Statista (2017): <https://de.statista.com/statistik/daten/studie/660529/umfrage/markanteil-bitcoin-an-kryptowachrungen-weltweit/>.

Macroeconomic implications

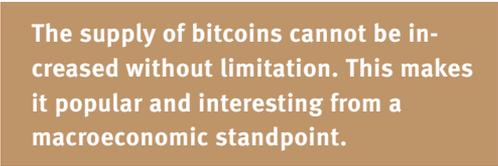
The further acceptance of cryptocurrencies and fintechs would give rise to fundamental macroeconomic and regulatory challenges.

Cryptocurrencies / bitcoin

Bitcoin design: Decentralised creation and fixed money supply

Bitcoin is based on two essential design principles that are no longer characteristic of traditional currencies of the kind we know today. First, there is no central monopoly on the creation of bitcoin, unlike euros, dollars etc., which are created by central banks. Second, its design only allows for a fixed money supply in the long term. From a macroeconomic perspective, these two factors have far-reaching implications and consequences, which will be discussed below.

The so-called *miners* are an important part of the bitcoin universe. These are users of the bitcoin network that compete with each other to verify the transactions blocks of a blockchain using the computing power of their computers. See (see also box blockchain technology, p. 49) for further details about blockchain technology. Verification of the individual blocks of a blockchain prevents *double spending*, meaning the risk that one user could use the same bitcoin for two different transactions. In exchange for their verification work, the miners receive newly created bitcoin from the system. Thus, bitcoin are created decentrally among the users (see also chapter (see chapter transaction costs and risks, p. 54 seq.). In this case, the profit earned on money creation, that being the difference between the value of the created bitcoin and the costs of creating it (*seigniorage*), does not accrue to the state, but to the private sector on a decentralised basis.³⁵ This is a major difference from the seigniorage of central banks.



The supply of bitcoins cannot be increased without limitation. This makes it popular and interesting from a macroeconomic standpoint.

The practical inability to enlarge the supply of bitcoin comes with advantages and disadvantages

The elimination of the ability of a central authority such as a central bank to create money is what has made bitcoin so popular among some and so interesting from a macroeconomic perspective. Let us assume for a moment that bitcoin would replace all forms of legal tender and become the sole payment medium in an economy. In that case, the state's monopoly on money issuance and the unlimited printing of money in times of crisis would be eliminated. On the flip side, however, it would be impossible to control the money supply through monetary policy measures. At the present time,

³⁵ See Ali et al. (2014).

new bitcoin are constantly being created, albeit in relatively small quantities; however, the algorithm of the bitcoin protocol will cease to create new bitcoin once the limit of 21 million has been reached. Thus, the quantity of bitcoin in circulation is growing annually by a certain percentage, but this growth rate will diminish automatically over time. It is estimated that the maximum limit will be reached in the year 2040, at which time the growth rate will fall to nil.³⁶

This automated money supply growth is reminiscent of a proposal by Friedman (1959, 1969) that the money supply should be allowed to increase at a constant annual rate. However, Friedman did not envision a constant money supply in the long term, which presents potential risks. For example, what would happen in an economy that only used bitcoin if the real economy grew at a substantially faster rate than the quantity of bitcoin in circulation? In such a case, the demand for money would increase faster than the supply of money. If the demand for bitcoin is substantially greater than the supply of bitcoin, its value would rise very rapidly, leading to serious deflation risks for the economy. Prices of goods and services would fall in bitcoin terms. Depending on the intensity of this effect, the expectation that prices will continue to fall would cause economic actors to postpone consumption, setting off a deflationary spiral.

In such a scenario, it would not be possible to adapt the money supply flexibly to the changing demand for money. This would lead to greater volatility of prices and real economic activity (i.e. the economic cycle) and represent a loss from the standpoint of welfare theory. The central bank would not be able to intervene to smooth out the economic cycle, much less to avert a full-blown financial or economic crisis because it would have no sovereignty over the money supply. Although proponents of such a monetary system argue that the probability of crises would at any rate be lower because the money supply could not increase exorbitantly and create bubbles. However, this argument falls short of the mark because crises can also be triggered by other factors.

Monetary policy aspects

In contrast to the substantial deflation risks in such a bitcoin economy characterised by a fixed supply of money in the long term, the inflation risks are manageable. Because exorbitant money supply growth is ruled out by design, prices would rise moderately as long as the real economy does not grow faster than the money supply, as discussed above. However, this advantage is tempered by the observation that the connection between

³⁶ See Ali et al. (2014).

Blockchain technology – The public, decentralised, and digital posting system



Blockchain refers to a decentralised or distributed database that serves as an account system or posting system. Blockchain technology was first implemented by its inventor Satoshi Nakamoto in the form of bitcoin software in 2009.³⁷ Nevertheless, it also forms the key technical basis for other cryptocurrencies. Blockchain technology is first and foremost a new information technology and its potential applications are not limited to cryptocurrencies.

Under this technology, all transactions (such as bitcoin transactions, for example) are entered and documented in a blockchain. This is done one block at a time. One or more transactions are aggregated into a block and added to the blockchain. This happens every 10 minutes. Each block is created by means of a decentralised consensus process (proof of work) and only added to the chain if it is consistent with the preceding block and if the new block has been verified. As a result of this decentralised creation and sequential storage within the chain, the cost of subsequent manipulation would be prohibitively high. Thus, the blockchain features a high degree of data integrity. The oldest and longest blockchain is that of the bitcoin. It has a size of roughly 126 GB and is stored on roughly 6,700 so-called nodes (as of March 2017).

The so-called hashes and hash functions represent another important element of the bitcoin system. A hash is the result (output) of a transformation from data or information input. The hash function itself is a mathematical algorithm that performs the transformation. A cryptographic hash function performs a very complicated transformation that is hard to reverse. In other words, it is very difficult to determine the input data from the output or hash value at the end of the transformation. This makes cryptographic hash functions *collision-resistant*.³⁸ It also reduces the chance of manipulation and enhances the security concept of the blockchain.

³⁷ This is likely a pseudonym and it is not even known if it refers to a person or a group.

³⁸ See Pilkington (2015).



Until the invention of blockchain technology, all known payment systems based on electronic money (digital cash) were »tripartite«. Besides the payer and the payee, a third, central, controlling instance is required. An intermediary such as a bank, for example, is needed to verify the transaction. Blockchain technology makes it possible to reduce payments to a bipartite system. Verification is performed decentrally in the system of users.³⁹ This also allows for much lower transaction costs, to the benefit of consumers.

Whereas our conventional monetary and payment systems depend on trust in banks and other intermediaries such as PayPal, etc., in a purely bipartite system without intermediaries trust must be placed in mathematical algorithms and the decentralised system of storage and verification. This trust is a crucial factor for the spread and acceptance of bitcoin technology.

Although bitcoin is the most prominent application, the use of blockchain technology is most certainly not limited to cryptocurrencies. Because it is cost- and time-efficient, it holds the potential of harmonising digital payment protocols across the global financial system. It also holds potential in other areas besides financial services and economic applications. Already now, for example, pilot projects involving the execution of political elections are being conducted.⁴⁰ It could also be used to trace the (global) supply chain of a good in order to determine whether the good fulfils environmental or ethical standards at every stage of production, for example. This would enhance the transparency and authenticity of products, especially for the end user.⁴¹

³⁹ See Pilkington (2015).

⁴⁰ See Miller (2014).

⁴¹ See Pilkington (2015).

money supply growth and inflation has recently come under scrutiny. Since the outbreak of the financial crisis, many of the world's largest central banks have expanded the money supply to such an extent that critics have expected a dramatic increase in inflation for years already. In fact, the development of inflation in recent years suggests that the money supply itself is not the sole cause of inflation, which must be affected by other factors as well.

Therefore, the excessively rigid supply of bitcoin is a shortcoming from the standpoint of macroeconomic and economic policy considerations. Whereas the cryptocurrencies

Primecoin and Peercoin are based on the idea of bitcoin insofar as they are created decentrally in the network, the underlying algorithm allows for unlimited growth of the money supply. In the case of Peercoin, however, the annual growth rate is limited to approximately 1%, which makes it vulnerable to the criticisms expressed above.

If it were even possible to speak of a monetary policy in connection with the introduction of such a cryptocurrency as the sole payment medium, it would be a fully automated monetary policy based on monetary indicators that would be unaffected by the state of the real economy. Blockchain technology makes it possible to document every single transaction and its nominal volume. This could serve as a precise monetary indicator. Based on this indicator, which would be available almost in real time, it would be possible to determine the money supply growth rate that best matches the demand for money on the basis of transaction volumes. Even under these conditions, however, a precise forecast of the demand for money as the basis for determining the appropriate growth rate of the money supply would be difficult, just as it is under our current monetary system. Furthermore, the question of the exact relationship between money supply growth and inflation would remain unanswered, as in the current system.

To summarise, blockchain technology would allow for an automated monetary policy based on monetary factors. However, because the blockchain does not document the real value of a transaction in many cases, including for example which good was purchased, there is absolutely no link with the real economy. This is opposite to the current design of monetary policy, which is based on the consideration of real economic activity and an explicit inflation target, which can also be communicated more easily to the public in this form.

Blockchain technology makes it possible to document every single transaction.



Functions of money: A comparison of bitcoin with other value assets

As explained above, different goods have been used historically as value assets or money. The development in the direction of legally anchored paper or fiat money that is only partially backed or not at all by an asset of equivalent value (gold) is not without reason. The better a monetary concept fulfils the following three functions of money, the more it can prevail against other monetary concepts. From a macroeconomic perspective, money must perform three functions (see also page 17):

1. It must be accepted as a medium of exchange or payment.
2. It must serve as a unit of account.
3. It must serve as a means of value preservation.



»Usefulness« of different value assets based on the functions of money (rank)			
	Payment medium	Means of value preservation	Unit of account
	transportable, divisible, fungible	secure and convertible	stable and scarce
Bartering	4	4	4
Gold	3	1	2
Fiat currency	2	2	1
Bitcoin	1	3	3

Source: Based on Ametrano (2014), HWWI.

Tab. 3

In Table 3, we compare bitcoin (as the most prominent example of cryptocurrencies) with other possible value assets in an economy and evaluate them on the basis of the three functions of money. The number »1« refers to the highest rank and »4« refers to the lowest rank of considered value assets.

In order for a value asset to function as a payment medium, it must be transportable, divisible, and fungible. The latter criterion refers to the quality of being easily exchanged for other goods and even asset classes. Although bitcoin is not (yet) very widely accepted as a payment medium, its divisibility (the smallest unit being a satoshi, equal to 0.00000001 bitcoin) and transportability are unrivalled. The same cannot be said of gold and natural produce. Transporting larger quantities of gold or natural produce for larger transactions is costly and sometimes unsecure. Furthermore, it is not

as divisible as bitcoin. From a conceptual standpoint, therefore, bitcoin is preferable to fiat currencies as a payment medium; of course, that does not mean this is already the case today. The current significance of bitcoin as a payment medium is still very limited.

The function of a means of preserving value is fulfilled when the form of money in question is secure and convertible. Natural produce and especially foodstuffs are not very conservable. The conservability of bitcoin, on the other hand, depends on maintaining the right hardware. Gold is best at meeting this criterion because it has the best storage qualities. With respect to security, cryptocurrencies are still subject to serious concerns regarding cyber-criminality or the theft of bitcoin by hackers.

A value asset fulfils the function of a unit of account if its value is (at least temporarily) relatively stable and if it is subject to a certain degree of scarcity. Some economists even consider the unit-of-account function be the most important characteristic of money,⁴² so that central banks should prioritise this characteristic in their policies.⁴³ Because cryptocurrencies and most especially bitcoin are still subject to wide price fluctuations within a short period, they cannot be said to have true value stability. Figure 7 shows the daily price fluctuations of bitcoin in US dollars (USD per BTC) compared with the euro-US dollar exchange rate in percent during the period from July 2010 to early April 2017. Whereas the value of the dollar against the euro rises or falls by up to 2.6% on volatile days, the value of bitcoin against the US dollar can swing by up to 81% on a single day.

42 See Ali et al. (2014).

43 See Woodford (2013).

Daily price fluctuations of bitcoin in US dollars and euro/USD exchange rate

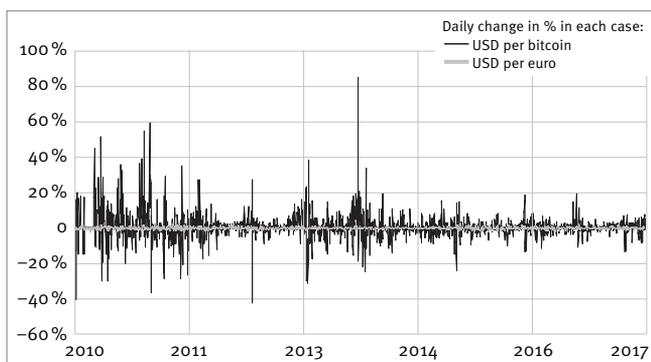


Fig. 7

Source: Macrobond, HWWI.

On the other hand, bitcoin scores well on the criterion of long-term scarcity because the maximum limit of bitcoin creation is set by design at 21 million bitcoin. On the other hand, excessive scarcity is also not beneficial (see chapter bitcoin design, p. 47 seq.). However, this does not necessarily apply to other cryptocurrencies like Primecoin and Peercoin, which allow for steady growth of the money supply. And while bitcoin, like gold, is relatively scarce and therefore superior to fiat currencies in this respect, the value of both gold and the fiat currencies is considerably more stable than bitcoin.⁴⁴ For this reason, they are better at fulfilling the unit-of-account function.

The foregoing descriptions and evaluations make it clear that the cryptocurrencies are not yet comparable with the qualities of fiat currencies. If their value stability and scarcity (neither too scarce nor too flexible) were to improve and if security concerns could be assuaged, they could become a serious competitor to our current monetary system (also see the chapter competition between (parallel) currencies, p. 59 seq.). In actuality, therefore, bitcoin is used today only as a »means of preserving value« or actually more as a »speculative asset« due to its high price volatility.

Transaction costs and risks

One advantage of bitcoin consists in the low or non-existent transaction costs compared with conventional payment media such as credit cards or »traditional« currencies. This is an important argument for retailers to accept bitcoin as a payment medium, in principle.⁴⁵ The low transaction costs result from the fact that miners are rewarded with new bitcoin for their work in verifying the transactions in the blockchain (see also chapter bitcoin design, p.47 seq.). Because the value of these bitcoin is substantially higher than the costs of verification, most miners charge only low or no transaction or verification costs.

Potential »mining« problems

Considering the specific design of bitcoin, however, it can be expected that transaction costs will rise over the course of time due to the fact that the quantity of bitcoin will eventually remain constant at 21 million. If, however, the number of miners rises and therefore competition among them intensifies over time, the verification cost of paying with bitcoin could fall or even reach nil at some point in time. This would cause the miners themselves to charge the transaction costs of verification to users. In this case, the

⁴⁴ In this case, we are referring to major global currencies or the currencies of industrialized nations, including (for example) the US dollar, euro, Swiss franc, and similarly stable currencies. Naturally, this conclusion does not necessarily apply to the inflationary currencies of some emerging-market or developing countries.

⁴⁵ See Ali et al. (2014).

miners would compete with each other on the basis of cost. In addition, they would also compete with the designers of other payment systems. Because the marginal costs in this decentralised system with many minors would be higher for every individual than the marginal costs in a system with centralised, monopolistic currency issuance, some miners would need to drop out of the market so that others could still operate profitably on the basis of economies of scale. As a result of such a consolidation process, only few minors or even just one miner could remain in the end. This trend can be observed already now. In the early days of bitcoin, mining was performed by individuals on their private computers. As the algorithms became more complex, requiring more computing power, verification work was increasingly performed by so-called cloud mining and mining pools.⁴⁶ However, this centralisation harbours the risk of dominance by only a few miners, which would run counter to the original design of decentralised bitcoin creation, as the most important argument cited for the cryptocurrency compared with our traditional currencies.⁴⁷

As long as miners expect that the value of the newly created bitcoin with which they are paid will be greater than the marginal costs of transaction verification, there will be no reason for them to change anything at all. Therefore, when and to what degree transaction costs will rise also depends on the (expected) value development of bitcoin. Under these conditions, miners also have an incentive to promote the use of bitcoin as a payment medium. If the demand for and thus the value of bitcoin rise, the compensation of miners will increase accordingly. As long as the expectation predominates that the bitcoin system will expand and gain broader acceptance and the value of bitcoin will rise, transaction costs will remain low.

Another important point in this context relates to transaction risks. Unlike traditional payment media such as credit cards, it is not possible to reverse a bitcoin transaction. If a credit card payment is unjustified or erroneous, it can be cancelled and credited back. This is not possible with blockchain due to the complexity of the transaction process. Although buyers and sellers could agree to take back or simply reverse the transaction voluntarily, there is no unilaterally imposable mechanism for reversing the transaction. It can be expected that this non-reversibility will be a major factor influencing the acceptance and spread of bitcoin. In all probability, consumers will prefer payment systems in which transaction reversibility is easily possible, so that they would not be powerless in the face of undesired or even fraudulent transactions.⁴⁸

⁴⁶ See Pilkington (2015).

⁴⁷ See Ali et al. (2014).

⁴⁸ Vgl. Boehme et al. (2105).

On the other hand, this non-reversibility could also represent an opportunity for many merchants seeking to establish business relationships with countries in which credit card fraud and fraudulent chargebacks are prevalent and could pose a serious risk for the merchants. In this case, the non-reversibility of transactions in the blockchain system would serve to protect merchants.⁴⁹

Regulatory questions and financial market stability

The regulation of cryptocurrencies such as bitcoin is subject to the same trade-off as with many other innovations in the financial sector: too early or too intense regulation could potentially choke off innovations or drive them off to other countries. Too late or inadequate regulation could give rise to serious risks.

Cryptocurrencies and the bitcoin universe in particular present some new regulatory and (tax) legal questions. How should profits earned in bitcoin be taxed? Are the providers of bitcoin services financial services institutions or do they offer a digital service? These questions lead back to a more fundamental question: what is bitcoin ultimately considered to be from a legal and regulatory standpoint? A currency, an investment, a commodity, or just a digital service?⁵⁰ Even though the public authorities of many countries are grappling with this question today and the markets of cryptocurrencies are now being largely monitored, also due to the criminal machinations of some bitcoin platforms, this question has remained largely unanswered.

Starting points for regulation

The position and definition of cryptocurrencies must be clarified particularly for the purpose of preventing criminal machinations. The starting points for this kind of regulation can be divided into three categories.⁵¹ The first category pertains to bitcoin-specific crimes, including the theft of bitcoin through hacking attacks, but also exchange rate manipulation. In this case, appropriate regulation is particularly difficult because it is not always clear which regulatory authorities have jurisdiction. The second category pertains to money laundering. In this respect, the blockchain design of bitcoin proves to be an advantage because the origin and destination of financial flows are permanently recorded and documented. Therefore, the publication of the blockchain would also need to be supervised by the responsible authorities, which may first need to be established. The third category pertains to crimes facilitated by the existence of cryptocurrencies. This includes purchases of illegal goods such as drugs and weapons, for example. Precisely

⁴⁹ Vgl. Barber et al. (2012).

⁵⁰ Siehe Scott (2016).

⁵¹ Siehe Boehme et al. (2015).

the low level of regulatory intervention to date could tempt criminals to conduct such illicit transactions in cryptocurrencies. Besides these three points, the question of appropriate taxation must also be addressed. The uncertainties surrounding the taxation of cryptocurrencies make it possible for tax evaders to circumvent the progress made in »combating« tax havens. In a sense, cryptocurrencies themselves can serve as tax havens.⁵²

Many of these cases represent supranational as opposed to national problems and therefore call for a comprehensive global approach. It can be expected however, that countries will develop different approaches to solving these problems. Furthermore, they can be advised not to adopt bitcoin-specific regulations, but comprehensive regulations applicable to the entire market of digital currencies and cryptocurrencies.⁵³

Cryptocurrencies raise new regulatory and (tax) legal questions. They must be regulated on a supranational basis because they are used globally, in principle.



Finally, the question of data privacy and consumer anonymity needs to be addressed. Many observers have pointed to the risk that bitcoin users could be identified from digital storage in the blockchain. However, this possibility is very limited because although the transactions are traceable, they are not linked to the identity of users. In this respect, bitcoin offers the same advantage as paying with cash: although every bank note has a serial number and is therefore traceable, it is not possible to determine whose hands it has passed through.⁵⁴

At the present time, monetary stability and financial market stability are not yet endangered because the use of cryptocurrencies is still too limited. There are currently around 16.25 million bitcoin (as the oldest and most prominent representative of cryptocurrencies) in circulation worldwide (as of March 2017).⁵⁵ This corresponds to a market capitalisation of approximately USD 19.5 billion.⁵⁶ This is a vanishingly small quantity compared with most traditional currencies. This assessment is even more applicable to the other cryptocurrencies.

52 See Marian (2013).

53 See Boehme et al. (2015).

54 See Pilkington (2015).

55 See Statista (2017): <https://de.statista.com/statistik/daten/studie/283301/umfrage/gesamtzahl-der-bitcoins-in-umlauf/>.

56 See Statista (2017): <https://de.statista.com/statistik/daten/studie/296205/umfrage/marktkapitalisierung-digitaler-zahlungsmittel/>.

Monetary stability

Due to the limited usage and the still low level of interdependence of the bitcoin universe with the rest of the global monetary and financial system, a price crash would initially only directly affect the holders of the currency. This can change, however, if the acceptance and use of cryptocurrencies would increase substantially. The following effects could heighten the risk posed by cryptocurrencies to the financial system and its stability.⁵⁷

First, someone who owns bitcoin increases his bitcoin position by borrowing money from someone else. In the event of a price crash, this additional business relationship or interdependence would mean that not only the owner of bitcoin, but also the lender would sustain potential losses. Second, systemically relevant banks would hold substantial, unsecured positions in bitcoin. In this case, systemic risks could materialise as a result of pronounced price volatility of the kind that we can observe in some cases even now with respect to bitcoin. Third, financial instruments such as derivatives could be designed on the basis of bitcoin. In this case, not only bitcoin owners, but also other financial market participants could build up substantial leverage in trading with bitcoin. The market position in bitcoin would be many times higher than the value of the bitcoin underlying these trades. In this case, a price crash could cause shock and instability in the financial system and in other parts of the economy. However, all these scenarios are either not yet possible or only to such a small extent that there is currently no risk to the stability of financial markets.

Monetary stability would be threatened only if central banks could no longer influence aggregate demand by means of monetary policy transmission via the traditional currency (and interest rate channel) of their countries. This would be the case if the bitcoin market would expand substantially. In the extreme case of a »regime change«, meaning that bitcoin would be regarded as the primary payment medium and currency and the traditional currency of a country would only be held for the purpose of conducting currency-specific transactions (such as paying taxes), neither the monetary policy authorities nor the banks would be able to influence monetary developments. However, based on the design characteristics of cryptocurrencies and the resulting problems that are discussed in this study, such a scenario is improbable in the near future (see the scenario analysis, p. 59 seq.).

⁵⁷ See Ali et al. (2014).

Competition between (parallel) currencies

Unlike many other goods in our economy, money is issued by the central bank as a monopolist and legitimised as legal tender by the government. One advantage of this centralisation is that everyone knows that the money will be accepted everywhere as a payment medium because the state has prescribed this. On the other hand, this state monopoly has the same disadvantages as any other monopoly. To quote from Hayek's work »The Denationalisation of Money«: »The consumer must use this good even if it is not satisfactory, and it prevents the implementation of better (monetary concepts) which the monopolist has no incentive to discover.«⁵⁸ Therefore, there is no competition between competing currencies that would lead to the best or most efficient monetary or currency concept.

It is interesting to note that until Hayek (1977), hardly any thought was given to competing currencies as an alternative to the state's currency monopoly and even less was written about this subject in the economic literature. Why not allow competition between different currencies? According to Ametrano (2014), bitcoin and the underlying blockchain technology laid the cornerstone for a breakthrough in this direction in that it allows for competition between many digital currencies created in the private sector. In addition, however, these digital currencies are competing with traditional payment media and systems.

The money issuance monopoly of central banks is challenged by the new digital currencies.



Moreover, more recent theoretical discussions have suggested that a monetary system with many competing currencies created in the private sector can ensure price stability. However, this situation also causes problems for monetary policy, which we have already touched on.⁵⁹

Outlook: Scenario analysis on the development of cryptocurrencies

Cryptocurrencies (particularly including the prominent bitcoin) are a relatively new phenomenon in our current monetary system. Their design is intrinsically different from that of the traditional fiat currencies we are used to. The underlying principles of decentralised money creation and the fixed money supply in the long term (at least in the case of bitcoin) have far-reaching macroeconomic implications, including both opportunities and risks.

The current design problems and the associated incentive problems would need to be solved in order to ensure the sustainable spread and acceptance of the cryptocurrency in the long run. The question of whether the crypto-

⁵⁸ Hayek (1977).

⁵⁹ See Fernández-Villaverde and Sanchez (2016).

currencies will continue their triumphal march and eventually revolutionise and supplant our traditional monetary system depends on a few spheres and factors of influence. Based on an assessment of the development tendencies of the most important factors, we will proceed to formulate two scenarios that outline the potential development paths.

Spheres and factors of influence

Basically, we can delineate five spheres of influence or better said, target groups which are influenced or will be influenced in the near future by the market for cryptocurrencies. These are retailers, consumers, banks, the central bank, and regulatory institutions (see table 4, p. 61). Factors that in our opinion will play the central role in their respective spheres of influence are ascribed to these target groups. Three critical factors influence the target groups of retailers and consumers: the acceptance of bitcoin as a medium of exchange, transaction costs, and transaction risks. One factor influencing



The future development of bitcoin will depend essentially on its acceptance and on its transaction costs and risks.

banks is current and future price volatility. Central banks will influence the development of cryptocurrencies indirectly if they do not succeed in maintaining price stability and therefore trust in the stability of traditional

currencies through their monetary policies. Conversely, however, monetary policy itself will be influenced by the growing acceptance and supply of cryptocurrencies, which will detract from their influence on aggregated demand and price stability. Finally, the regulatory institutions can exert considerable influence on the development of cryptocurrencies through their regulation.

Current status and importance of each factor

Before we proceed to assess the development tendencies of these factors, we would first like to describe the current status of these central factors and evaluate their importance. This should enable us to determine which of these factors will have the biggest impact on the development of the market for cryptocurrencies.

At the present time, there is still very little willingness on the part of retailers worldwide to accept bitcoin as a payment medium. Only a few tens of thousands, mostly online merchants, allow payment with bitcoin. This vanishingly small proportion shows that bitcoin is not yet an important payment medium. The few acceptance points include some prominent examples such as the software forge Microsoft, the Internet browser provider

Mozilla, and the computer maker Dell.⁶⁰ There is also much scepticism still on the part of consumers. According to a survey conducted in 2011, two thirds of consumers consider bitcoin acceptance to be low.⁶¹ In another study from the same year, 63% of respondents said that it is improbable or highly improbable that they will use bitcoin in the coming year.⁶² In Germany, 53% of respondents answered no to the question of whether digital currencies such as bitcoin represent the future of payment on the Internet.⁶³ Another indication for the low level of acceptance as a payment medium is the number of transactions per user in a given time period. Because this number cannot be easily determined, it is often approximated by the number of transactions per »wallet«, meaning per bitcoin account. The number of transactions increased appreciably both at the launch of bitcoin and at the introduction of the bitcoin betting platform »Satoshi Dice« 2012. More recently, however, the number of transactions has been very low,⁶⁴ suggesting that bitcoin is being used more as a speculative investment than has a payment medium for everyday use.⁶⁵

Overview of the expected development tendencies of the influencing factors					
Sphere of influences	Influencing factor	Measurement indicator	Present time	Importance of the factor	Development tendency of factor (2030)
Retailers	Acceptance	No. of accepting merchants worldwide	Low	High	↑
	Transaction costs	Number of miners (and competition)	Low	Low	↑
	Transaction risks	Incidents of fraud with bitcoin transactions	Medium	Medium	↑ or ↓
Consumers	Acceptance	Surveys and transactions per wallet	Low	High	↑
	Transaction costs	No. of miners (and competition)	Low	High	↑
	Transaction risks	Incidents of fraud with bitcoin transactions	Medium	Medium	↑ or ↓
Banks	Price volatility	Price (bitcoin/USD or similar)	High	Low	↓
Central bank	Trust in the current monetary system	Inflation or price stability	High	Medium	Constant
Bitcoin providers (e.g. platforms)	Regulation	Number of laws already enacted	Low	High	↑



Tab. 4

Source: Own representation, HWWI.

60 A more extensive list of bitcoin acceptance points in the German-speaking countries can be found here: <https://www.btc-echo.de/bitcoin-akzeptanzstellen/>.
 61 See Statista (2017): <https://de.statista.com/statistik/daten/studie/216462/umfrage/akzeptanz-von-virtuellen-waehrungen-aus-anbieter-und-verbrauersicht/>.
 62 See Statista (2017): <https://de.statista.com/statistik/daten/studie/605609/umfrage/nutzungsabsicht-von-virtuellen-waehrungen-in-deutschland/>.
 63 See Statista (2017): <https://de.statista.com/statistik/daten/studie/313790/umfrage/haltung-zur-zukunft-digitaler-waehrungen-in-ausgewaehlten-europaeischen-laendern/>.
 64 See Ali et al. (2014).
 65 See Yermack (2014).

Nonetheless, these influencing factors, i.e. acceptance by retailers and consumers, are very important for the further development of cryptocurrencies. Only if this prerequisite is fulfilled can the market for cryptocurrencies reach a volume that would challenge the traditional monetary and payment systems. The reason for this is simple: the design of bitcoin and the blockchain is based on a decentralised system and can only be become established if at all on a decentralised basis, which is to say, by spreading among



Cryptocurrencies offer a number of advantages, in theory. However, they also have various problems that stand in the way of a ground-breaking success, at least for now.

retailers and consumers as opposed to being introduced centrally by the state.

So-called network effects and exchange costs are another driver of the decentralised spread of bitcoin. Consumers or retailers will find it worthwhile to »switch« to bit-

coin only if others do the same.⁶⁶ Therefore, it is all the more important to observe the acceptance among retailers and consumers.

Transaction costs have been very low so far (see chapter transaction costs and risks, p. 54 seq.). Assuming that retailers can pass on these costs to end consumers, transaction costs are an important influencing factor for consumers, but are less important for retailers. The level of transaction costs with bitcoin compared to other payments systems is an important factor in assessing whether or not bitcoin will become established. By contrast, the question of transaction risks entails a certain ambivalence for retailers and consumers alike. The advantage of the non-reversibility of bitcoin transactions in the blockchain is that it prevents fraudulent chargebacks (see chapter transaction costs and risks, p. 54 seq.). On the flip side, consumers and retailers are unable to protect themselves by unilaterally cancelling the bitcoin transaction if the goods or services purchased are not delivered.

The price volatility of bitcoin has been very high since its introduction (see figure 7, p.53). Although this factor plays a role in all spheres of influence, this price volatility would only be significant for banks as an investment if the value stability would increase. A value-stable bitcoin would stimulate the demand for bitcoin by banks considerably and therefore increase the relative importance of bitcoin in the financial sector. On the flip side, it should also be noted that bitcoin has not so far exhibited any correlation with traditional currencies like the US dollar or the euro, nor with gold, which makes it practically useless for risk management and very hard to hedge.⁶⁷ For this reason, we consider this influence channel, that being the possibility that

⁶⁶ See Luther (2015).

⁶⁷ See Yermak (2014).

bitcoin would be increasingly used as an investment and therefore gain in importance as a result of declining price volatility, to be less important.

The trust that central banks strive to maintain in our traditional monetary system is another factor that can help determine whether bitcoin or other cryptocurrencies gain in importance. The decentralised bitcoin system is fundamentally different from the current monetary system in which central banks are the dominant, trust-creating institutions. As long as these monetary authorities and the state can maintain trust in this system and allow only an appropriate low variability of prices, it will be hard for cryptocurrencies to become established. Therefore, we consider this influencing factor to have »medium« importance or relevance. In other words, even if the trust in our current monetary system is not shaken, the role of cryptocurrencies can increase considerably. However, a complete victory of cryptocurrencies would only be conceivable if there were a considerable loss of trust in the current system.

The final influencing factor is regulation by the regulatory authorities, of which there is very little at the present time. Many questions remain unanswered. The manner in which providers of cryptocurrencies (e.g. operators of online platforms) will be un-

dermined by regulation in the future is a question of some significance. We consider the relevance of this factor to be »medium«. The extent of regulation will decide whether or not the innovations and cost savings that bitcoin can deliver are choked off.

It is important to note that the influencing factors can and will also influence each other. For example, acceptance by consumers will also depend on the development of transaction costs. Furthermore, external shocks such as the general development of the financial markets or the economy, for example, can also influence the named factors.

In the following, we will limit our discussion to an explanation of the development tendencies of the influencing factors we consider to be important. All other tendencies are noted in table 4, p.61.

The decentralised bitcoin system is fundamentally different from the current monetary system in which central banks are the dominant, trust-creating institutions.



Potential in developing countries

In our opinion, acceptance by retailers and consumers will gradually continue to grow, but not strong enough that one could speak of widespread use, much less a regime change away from the system of fiat currencies. In this context, it is interesting to note that the acceptance of bitcoin as a payment system has recently been growing precisely in those (developing) countries in which the traditional monetary and payment system does not enjoy the trust it does in the developed industrialised nations. Such countries can be found particularly in Africa and Asia. The growing acceptance in these countries is also driven by the fact that alternative payment systems such as wire transfers and credit card payments are much more expensive than bitcoin transactions in some cases, especially for international transactions.⁶⁸



The acceptance of bitcoin as a payment system is growing precisely in those (developing) countries in which the traditional monetary and payment system does not enjoy the trust ...

Rising costs are possible

In our opinion, however, bitcoin transactions will not remain as low as they are today. Transaction costs can be expected to rise over time because it will not be possible to pay the miners with new bitcoin

after the end of the bitcoin creation process and therefore cost competition among miners will intensify (see chapter transaction costs and risks, p.54 seq). Even though the quantity of bitcoin in circulation will not be fixed until about the year 2040 (see chapter bitcoin design, p.47 seq.) and will continue to grow until that time, the growth rate will slow markedly already by the year 2030.

Regulation will retard growth

Regulation by the regulatory authorities plays both an active and a passive role, for which reason it is difficult to assess the relevant importance of this factor compared with the other factors. On the one hand, regulation will intensify as the importance of cryptocurrencies rises; on the other hand, the importance of cryptocurrencies could be crimped by over-regulation. Basically, we expect regulation to intensify, which will have a moderating effect on the growth of the market for cryptocurrencies.

⁶⁸ Vgl. <https://www.bitwala.io/bitcoin-developing-countries/>.

Bundling of development tendencies into scenarios

We have derived the following two scenarios from the development tendencies of the influencing factors described above. In the first scenario, cryptocurrencies occupy a niche where they can exploit their advantages; in the second scenario, they gain so much in importance as a result of a loss of trust in the traditional monetary system as to trigger a »regime change« to cryptocurrencies.

Scenario 1 (primary scenario):

Cryptocurrencies gain in importance, but do not rise above the level of peripheral currencies

The acceptance of cryptocurrencies by retailers and consumers will grow steadily. As a considerably less costly alternative, Bitcoin and Co. will become more popular particularly for international transactions and will replace cost-intensive payment systems such as bank transfers and credit card payments. In this respect, the bitcoin design advantage that transactions cannot be easily reversed (see chapter transaction costs and risks, p.54 seq.) will also play an important role. This advantage will lead to new international business relationships that would otherwise not have been forged due to a lack of trust. On the other hand, this trend will be limited by rising bitcoin transaction costs. Central banks are still able to maintain trust in the current monetary system. Furthermore, the continued popularity of cash will reduce the wish to hold more cryptocurrencies. In addition, the network effects (it is worthwhile for individual users to switch to cryptocurrencies only if other users do the same) and switching costs are too great to bring about a system change.⁶⁹ In short, cryptocurrencies will siphon off certain business activities of the banks and conquer a niche market, but will not supplant the entire traditional monetary system. This is our most probable scenario.

Scenario 2 (secondary scenario):

Monetary instability of the current monetary system leads to the triumph of cryptocurrencies

Price volatility will diminish as the money supply of cryptocurrencies increases and consumers come to accept them not only as a speculative investment, but also as an everyday payment medium. This development will be reinforced by the effect that the ability to manipulate the price of bitcoin will be reduced as a result of more bitcoin users. Bitcoin will become more stable. At the same time, considerable instabilities will arise in the traditional

⁶⁹ See Luther (2015).

financial and monetary system as a result of very expansive monetary policy or the bursting of price bubbles. Central banks will no longer be able to guarantee the value stability of traditional currencies, having exhausted the instruments at their disposal. This loss of trust will reinforce the demand of individuals for cryptocurrencies, which will supplant to old monetary system without the need for a state-led currency reform. Those cryptocurrencies with designs that best suit the preferences of consumers and best address the macroeconomic problem of the fixed money supply over the long term will prevail in competition. This is a rather improbable scenario.

Forecast risks or risks of the scenarios

The scenarios described herein are subject to the following, not inconsiderable risk: the question of whether bitcoin as the most prominent example of cryptocurrencies becomes established in the long term is hard to answer because according to forecasts, the »special case« for bitcoin will only occur at around the year 2040. Only then will the growth of the bitcoin money supply reach nil and the money supply will reach the fixed limit planned by the algorithm. The exact consequences of this event are hard to predict in advance.

The economic importance of fintechs

Although the term "fintech" is new, technology has delivered substantial productivity gains to the financial sector already in the past.

Development over time

In order to assess the economic relevance of the fintech phenomenon, it is important to remember that the latest innovations only represent another link in a long chain of technology-driven transformation processes in the financial sector. Technology was always a driving force behind the restructuring of financial transactions. In this context, Arner et al. (2015) distinguish different historical phases in which business models in the financial sector were shaped by certain technologies. Accordingly, the authors describe the phase beginning with the invention of the telegraph and the laying of the first transatlantic undersea cable in the 19th century as »Fintech 1.0«. The resulting ability to conduct real-time communication across long distances greatly diminished the importance of physical proximity in conducting financial transactions. From this point onward, the shorter reaction time enabled investors to exploit spontaneous price fluctuations in the markets in a more targeted manner and perform both time arbitrage and geographical arbitrage. This had the effect of steadily increasing both the number of market participants and the degree of interlinkage between markets for different assets over time. From a macroeconomic standpoint, falling transaction costs made trading more efficient, for one thing, but the rising degree of interlinkage also increased the systemic risk. Price distortions in individual markets in the form of speculative bubbles, for example, could now spill over more quickly to other financial products due to the interrelationship of markets.

The next milestone can be said to be the first-time use of automated teller machines in the 1960s, which further lowered the transaction costs of liquidity stocking from the standpoint of bank customers. However, Arner et al. (2015) believe that the true beginning of a second fintech revolution did not occur until the 1990s. This decade was characterised by the digitalisation of further areas of the service sector in the Western countries. Financial services played a special role in this development because information had always been handled in a highly standardised manner in the financial sector.⁷⁰ For this reason, banks and insurance companies were on the front line of digitalisation from the very beginning. In the United States, for example,

⁷⁰ See Dapp (2014).

the financial industry has been the biggest demanders of IT services already since the mid-1990s.⁷¹ This development entailed massive changes to the internal organisational structures and the required qualifications of employees in the banking sector. Moreover, this development also changed the parameters of financial markets regulation. For example, the emergence of e-banking fundamentally gave rise to the risk of an electronic bank run. Because the frictions associated with physical withdrawals were eliminated, there was much less time for regulators to take emergency measures. At the same time, the improved market overview resulting from the use of digital technologies created more efficiency-promoting competition; on the other hand, the growing competition enticed many financial institutions to shift their portfolio structures in the direction of higher-yielding risky investments. Ultimately, this trend laid the cornerstone for the development that culminated in the global financial crisis of 2008/2009.



Fintech is a vogue word of our time. However, the associated technological transformation processes in the financial sector are not new, but date back to the 19th century.

Finally, Arner et al. (2015) identified the latest market transformation, the beginning of which roughly coincided with the end of the last crisis, as the third phase of the Fintech-Revolution. The chief characteristic of this

phase is no longer the use of fundamentally new technologies, but mainly the consistent application of these technologies to satisfy the specific needs of individual customers. The growing digital interlinkage of consumers is being used for the purpose of creating many new kinds of financial services based primarily on personal address or new interaction channels between users, as in the case of crowdfunding and peer-to-peer lending. Moreover, an essential particularity of this innovation process is the fact that, unlike the preceding phases, established financial institutions have not been the main drivers of progress. Instead, innovations have been introduced primarily by start-ups, whose DNA is more closely grounded in the IT sector than in the financial sector. These actors benefitted from the substantial loss of trust by consumers in the traditional providers of financial services in the wake of the last financial crisis. In a survey conducted by the Federal Association of German Banks (Bundesverband Deutscher Banken), 47 % of respondents said that their trust in banks generally was badly shaken in the course of the financial crisis.⁷² Accordingly, the actual take-off of the fintech sector occurred roughly in 2013, as can be seen from the development of investment volumes presented in figure 8, p.69.

⁷¹ See Arner et al. (2015).

⁷² See Bankenverband (2011).

Volume of worldwide investments in fintech enterprises through 2016

US-Dollar billions

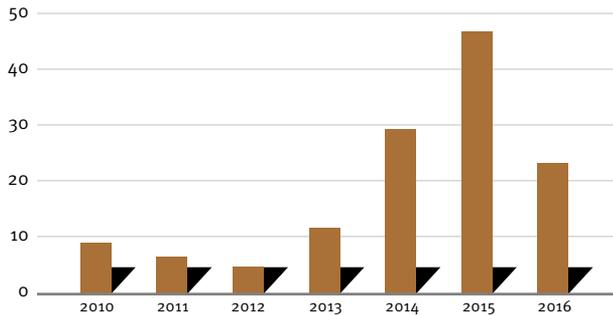


Fig. 8

Source: KPMG (2017).

Regionally, however, the triumphal march of fintechs was anything but homogeneous. Within Europe, the UK established itself as a clear regional hot spot, as can be surmised from the origin of operators of innovative financing platforms (see figure 9, p. 70). The reasons for this include the major importance of the financial sector for the British economy and the comparatively lax regulatory restrictions in the UK. Furthermore, the strong presence of US technology enterprises at locations in Ireland and the UK very likely contributed to this development through know-how transfers. Germany has lagged behind in this respect and ranks below France in terms of the offering of financing platforms, for example. Relative to their populations, even countries like the Netherlands and Switzerland have substantially more activity in this sector. Nevertheless, dynamic growth has occurred also in the German market in the last few years (see figure 10, p. 70).

Customer acceptance is an essential factor for the market penetration of digital financial offerings. Precisely because consumers do not yet have many years of experience in dealing with these offerings, personal trust in the integrity of the provider and in the technical safeguards against abuse is critically important. Ultimately, the basis for such trust is the general degree of familiarity with the new possibilities of the digital world to a not inconsiderable degree. Therefore, fintech usage is also a generational question. Indeed, a Statista survey from the year 2016 found large differences in the attitudes towards fintech services between age groups in Germany (see table 5, p.71). According to the survey results, the willingness to use fintech services in the future is progressively lower in the older age groups.

Number of alternative online financing platforms in Europe in 2015, by country

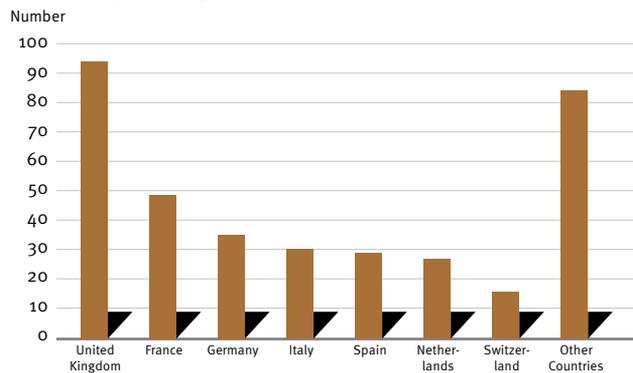


Fig. 9

Source: CJBS (2016).

Market volume of alternative online financial services in Germany through 2015

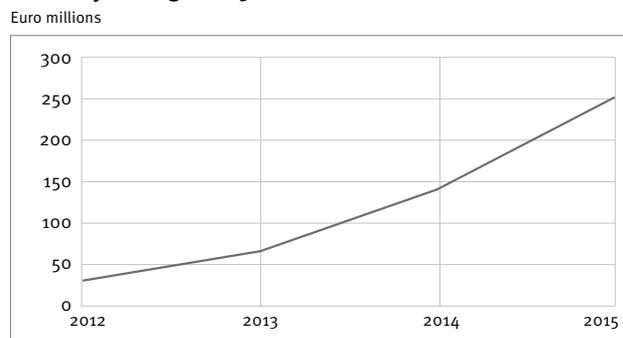


Fig. 10

Source: CJBS (2016).

Therefore, the prospects for the long-term market development are quite rosy, at the latest when the majority of the population consists of »digital natives«. After all, fintechs offer a number of advantages compared to traditional financial solutions from the standpoint of consumers. Specifically, users benefit from a combination of less administrative fees, advantageous terms, and easy, intuitive use. The transaction costs are much lower than the costs of applying for traditional loan from a branch bank, due in part to the fact that no effort is required for negotiating with the bank and disclosing one's financial situation. The customer does not need to provide substantiating evidence, which can be collected directly from digital information



**Agreement with statements regarding the use of fintechs/
mobile payment services by age, 2016**

Statement	Agreement rate by age group		
	18–29 years	30–49 years	50+ years
I can well imagine that I will conduct most of my banking activities with the smartphone 5 years from now.	46%	37%	19%
I can well imagine no longer having a credit card in my wallet 5 years from now, and paying with the smartphone at the POS terminal instead.	28%	22%	19%
I can well imagine that I will no longer manage my finances through my bank, but through fintech providers for the part, 5 years from now.	22%	16%	13%
I can't imagine any such thing	30%	45%	59%

Tab. 5

Source: Statista (2016).

sources. The personalisation of consumer interfaces can also lead to the creation of precisely tailored offerings that suit the specific preferences of different groups of people.

Furthermore, fintechs have created entirely new market models precisely in the area of financing through crowdfunding and p2p lending, which overcome the anonymity of traditional financial intermediation and utilise personal factors such as sympathy and identification as an element of transaction decision making. By this means, fintechs are becoming the drivers of progress in the financial sector. On the other hand, the resulting effect on the stability of the financial sector, particularly including its vulnerability to crisis, is an open question. After all, the fintech revolution is not only changing the competition situation of banks; as the rules of the game are changed by the introduction of new business areas, the architecture of the entire financial sector is changing.

Structural policy challenges posed by Fintech 3.0

Two critical questions need to be addressed from an economic policy perspective. The first question is what location conditions are conducive to a dynamic development of the fintech segment. The second, related question is what challenges for the financial architecture, particularly including the regulatory regime, will emerge from this development.

To answer these questions, it is important first to consider the specific mentality of the fintech sector. Unlike traditional banks, whose mind-set is based on the traditional business system of debit and credit, the technology aspect is paramount in the mind-sets of many fintechs. Accordingly, financing problems are interpreted as technology problems that can be solved with the tools of digital communication and information delivery.⁷³ Therefore, general conditions that are conducive to technology development and do not raise prohibitive barriers to the use of digital technologies for financial services are perceived as being favourable. Haddad and Hornuf (2016) examined the specific factors influencing the density of fintech start-ups in different countries. According to their analysis, the technological development stage of a country exerts a positive influence on fintech density, as can



Fintechs regard financing problems primarily as technology problems.

be expected. The size of local labour markets also plays an important role: a larger pool of workers potentially holds a greater number of IT talents, as the critical know-how ingredient for start-ups, or even a greater number of start-up founders. On the user side, Haddad and Hornuf (2016) found the number of mobile phone contracts to be a significant factor as it dictates the size of the market for mobile fintech applications such as mobile payment systems. This factor is particularly relevant in the context of developing nations.⁷⁴

Fintechs and financial market stability

Finally, the role of financial market stability is significant. The more fragile the banking system (as measured on the basis of subjective expert assessments), the greater the fintech density. This observation can be explained in different ways. First, an unstable financial sector reduces the general trust of consumers in the banks as established players. In this environment, financial start-ups can benefit from a reputation bonus as unblemished actors. Furthermore, instability implies a greater frequency of liquidity crises and therefore an increased incidence of credit crunches, i.e. massive restrictions

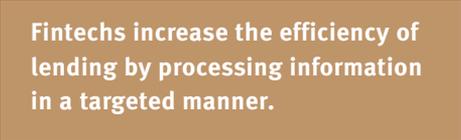
⁷³ See Federal Reserve (2016).

⁷⁴ See Aker and Mbiti (2010).

on access to loans in the banking sector. This heightens the incentive for non-banks to develop (or broker) alternative, purely digital financing offers. Finally, the fintech sector can also benefit from the political aftermath of frequent financial crises in that stricter bank regulation for the sake of averting the next crisis creates competition niches for alternative financing offers in the high-risk segment. This very situation occurred in the Western countries after the global financial crisis of 2008/2009. In conjunction with technological progress and the generally growing use frequency of online services, this crisis created a »perfect storm«, which explains the rapid increase in the market volume of fintech services since this time.⁷⁵

Efficiency gains

From the standpoint of welfare economics, the expansion of fintech services can essentially have two positive effects on market efficiency. First, it can lower the costs of financial transactions for consumers. Financing concepts such as p2p lending, but also digital payments systems and asset management services are supplanting the traditional intermediation function of banks and the associated costs. Second, an efficiency advantage can result from the targeted use of the huge quantities of personal data that can be found in the digital sphere (»big data«), particularly with respect to the credit rating. By this means, the traditional information disadvantage of the lender compared with the borrower, which contributes to inefficiencies in lending, can be largely eliminated, thereby increasing the availability of credit.⁷⁶ Even small loans, which are not very attractive for banks, can be realised this way. Generally speaking, the reduction of complexity in financial transactions achieved through the user-friendly preparation of information, represents another gain. Market transparency will rise and barriers to entry will be lowered, improving the chances for participation by broad swaths of the population.⁷⁷



Fintechs increase the efficiency of lending by processing information in a targeted manner.

⁷⁵ See Arner et al. (2015).

⁷⁶ See Chiu (2016).

⁷⁷ See Chuang et al. (2016).

New business philosophies

From a regulatory perspective, however, it cannot be concluded from the foregoing that no limits should be placed on the expansion of fintech markets. Compared with past innovation processes in the financial sector, careful consideration must be given to one key factor: Unlike earlier times, innovation is now being driven by actors that do not have established internal compliance structures. In fact, deliberately dispensing with such structures is part of the business philosophy of many of these actors. Furthermore, increased competition in the lending business also presents risks from the regulatory perspective. The pressure placed on interest rates by these new actors heightens the incentive for established financial intermediaries to conduct more business in higher-yielding high-risk segments.⁷⁸ In conjunction with big data, new forms of market power could emerge. The possession of large customer databases will become an increasingly important asset with



Fintechs could attain formidable market power by accumulating large quantities of data.

which established players can block market access for start-ups. As a result, the problem of information asymmetry in the lending sector could be reversed: By systematically screening the digital footprints of

consumers, lenders will soon know more about potential borrowers than they know about themselves.⁷⁹ However, due to the fact that the process of data collection and analysis is unknown to the consumer, it will hardly be possible for them to detect any analysis errors and assess their consequences. Especially in the field of mobile payment systems, big technology enterprises could attain substantial market power by developing company-specific currencies with which consumers can pay for their rich offering of services.⁸⁰

The question is how regulatory authorities will be able to ensure fair competition under such conditions. The first important prerequisite is for them to have an comprehensive overview of the fintech market. Considering the dynamic development of the market environment, this task will require resources for the permanent collection and evaluation of relevant information. The concrete demands placed on a regulatory regime resemble a difficult balancing act. On the one hand, the regulatory barriers for financial start-ups should not be so restrictive as to leave no room for the development and testing of new digital services. Otherwise, the innovative capacity of the entire financial sector could be crippled, which would ultimately lead

⁷⁸ See Arner et al. (2015).

⁷⁹ See Jenzsch (2016).

⁸⁰ See Dapp (2014).

to harmful consequences for the location quality of the entire economy. On the other hand, a general loosening of compliance requirements in the banking sector would not be a good solution either.⁸¹ The last global financial crisis clearly showed the consequences of inadequate risk limitation on the part of systemically relevant actors. From a practical standpoint, moreover, the question of the national jurisdiction needs to be addressed because fintechs often operate globally.

Two regulatory approaches

Based on the fundamental philosophy of the regulatory framework, two different approaches can be identified at the present time. The first approach can be described as the »one business, one risk, one rule« principle. The same regulatory requirements and limits should be imposed on companies that operate in fields with comparable risks, regardless of differences of age and size. This is essentially the approach taken by the German bank regulator. A second, competing approach is the »sandbox« principle. Under this approach, young companies that meet certain requirements can enjoy a temporary exemption from some regulatory restrictions and reporting obligations. The idea is to create a »safe space« in which innovative start-ups can try out their business models with as little restriction as possible, under otherwise real-world conditions. If the business models prove to be successful, i.e. if a growth process commences, these companies would then fall under a different regulatory regime with stricter requirements.⁸² Thus, a »threshold value policy« is an important aspect of such a regulatory philosophy. Instead of placing specific requirements on certain financial products or business models, the scope of regulation will be oriented to the size and systemic relevance of the actor to be regulated. Therefore, regulatory activity is deliberately focused on large, market-moving players.

Such an approach should not be misconstrued as trust in the self-regulating ability of fintechs, as that would be too risky given the fact that most of them lack internal compliance structures. Instead, careful market observation is essential also in this respect. The regulatory authorities need to be ready to act at any time in response to signs of undesirable developments. Otherwise, there is a risk that start-ups could transition over time from a »too-small-to-care« status to a »too-big-to-fail« status, without being



In the future, the British regulatory philosophy could serve as a model for dealing with fintechs in Germany.

⁸¹ See Chiu (2016).

⁸² See Rudolph and Zech (2016).

noticed.⁸³ One way of preventing such a scenario would be the greater institutionalisation of innovation processes. For example, the process of developing and introducing new financial products to market could be governed by binding laws and regulations, in a manner comparable to the regulations applicable to drug testing in the pharmaceuticals industry. Furthermore, start-ups must be obligated to establish internal compliance structures at an early phase to prevent any abusive handling of data from the outset.

A necessary element of such a strategy would be to increase consumers' knowledge of the possibilities and limits of digital financial services, particularly including knowledge of their rights to data privacy. After all, precisely the young generation is at risk of underestimating the consequences and risks associated with digital financial transactions due to their generally great familiarity with digital services. Consumer advocacy groups in particular should actively inform consumers of the risks involved. Furthermore, consumer rights must be strengthened in those areas in which consumers could suffer unforeseeable harm as a result of the storage and disclosure of erroneous personal information. Among other things, the right to have such data deleted must be consistently enforced.⁸⁴

⁸³ See Arner et al. (2015).

⁸⁴ See Oehler et al. (2016).

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