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Opinions expressed by the authors of studies do not necessarily reflect the official viewpoint of the Oesterreichische Nationalbank or of the Eurosystem.

Call for applications: Visiting Research Program

The Oesterreichische Nationalbank (OeNB) invites applications from external researchers (EU or Swiss nationals) for participation in a Visiting Research Program established by the OeNB's Economic Analysis and Research Department. The purpose of this program is to enhance cooperation with members of academic and research institutions (preferably postdoc) who work in the fields of macroeconomics, international economics or financial economics and/or pursue a regional focus on Central, Eastern and Southeastern Europe.

The OeNB offers a stimulating and professional research environment in close proximity to the policymaking process. Visiting researchers are expected to collaborate with the OeNB's research staff on a prespecified topic and to participate actively in the department's internal seminars and other research activities. They will be provided with accommodation on demand and will, as a rule, have access to the department's computer resources. Their research output may be published in one of the department's publication outlets or as an OeNB Working Paper. Research visits should ideally last between three and six months, but timing is flexible.

Applications (in English) should include

- a curriculum vitae,
- a research proposal that motivates and clearly describes the envisaged research project,
- an indication of the period envisaged for the research visit, and
- information on previous scientific work.

Applications for 2019 should be e-mailed to *eva.gehringer-wasserbauer@oenb.at* by May 1, 2019.

Applicants will be notified of the jury's decision by mid-June 2019.

Nontechnical summaries in English and German

Nontechnical summaries

Digital money

Paul Pichler, Alexander Schierlinger- Brandmayr, Martin Summer

Interest in the digitalization of money has received a new and strong impulse from the public discussion of Internet-based electronic value transfer systems like Bitcoin. This focus sometimes makes us forget that a huge part of the money we use in everyday transactions today already is digital money. Nevertheless, there still does not exist a form of digital central bank-issued currency. We discuss the potential of systems like Bitcoin to be useful for such a new form of digital money. Based on a step-by-step analysis of the technology and economics behind Bitcoin, we argue that it is very unlikely that crypto coins like Bitcoin and related systems will be the future face of money. After all, they lack key features of money: They do not simultaneously serve as a medium of exchange, a store of value and a unit of account. Issues of scalability also limit the widespread adoption of crypto coins. This does not make crypto coins an attractive means of payment. We argue that the future economic role of private crypto coins will be strongly linked to the future economic potential of fully decentralized blockchain applications, because this is the context within which crypto coins find their most natural role. We argue that public blockchains are very expensive to maintain not only because of their high energy consumption but also for incentive reasons. This limits public blockchain applications beyond a pure crypto coin context. We finally discuss the potential role for central bank-issued digital currencies. The current discussion suggests that the case for introducing such a currency seems to be not very strong.

A primer on peer-to-peer lending: immediate financial intermediation in practice

Wolfgang Pointner, Burkhard Raunig

Peer-to-peer (P2P) lending is a relatively new competitor to traditional bank lending; it is based on Internet platforms that facilitate the flow of funds between individual investors and borrowers. This article offers an overview of the size and scope of these so-called fintech credit markets in several economies, including Austria. We compare traditional bank lending with P2P lending, describe how lending platforms handle portfolio diversification and address information asymmetry, and summarize the characteristics of P2P platform users.

P2P lending is fast-growing, yet lending volumes are still extremely small compared to traditional bank lending. Original P2P lending prevails in countries like the U.K., where granting P2P loans does not require a banking license. Bank-funded and balance sheet P2P lending prevails in countries such as Germany and the U.S.A., where loan origination does require a banking license.

To be able to compete with traditional banks, P2P lending platforms must offer ways of reducing adverse selection and moral hazard problems. Strategies for assessing and reducing credit risk include credit risk assessments before a loan application is listed, the provision of "hard" and "soft" information about borrowers and the implementation of tools for the diversification to reduce risk.

As P2P lending has only started relatively recently, not all regulatory frameworks have been adapted to fit this new kind of credit market. We provide a summary of the Austrian experience and show how legislators and competent authorities have amended regulations to facilitate P2P lending without compromising investor protection.

Almost all P2P platforms started their business in an environment of extremely low interest rates that enabled them to offer attractive rates of return to lenders. Whether lending platforms are able to compete with traditional banks in "normal" times remains to be seen. A trend of institutional investors increasingly using P2P platforms to connect with borrowers is already visible, with balance sheet P2P lending becoming more common as well. Hence, the original P2P lending concept seems to be moving more in the direction of traditional bank lending with more sophisticated interfaces available to borrowers.

How Austrians bank and pay in an increasingly digitalized world – results from an OeNB survey

Doris Ritzberger-Grünwald, Helmut Stix

The digital transformation in banking and payments has important consequences for both the financial industry and consumers. Nevertheless, there has been limited empirical evidence about the diffusion of financial innovations among consumers in Austria. This paper presents the results of a representative survey that asked Austrians about their banking habits, their use of innovative payment methods and services/products ("fintech") as well as their ownership and awareness of crypto assets. Thus, the survey results facilitate a stocktaking of consumers' use and awareness of technological innovations both in banking and payments – which is important as digital innovations increasingly blur the dividing line between these two fields. This view is compared with information on consumers' attitudes toward cash; this comparison is crucial because cash still plays an important role in Austria and in many other European economies. Moreover, the survey allows us to determine the share of Austrians that already use innovative products/services and also the share of those who have not come across or used innovations at all so far.

Overall, the results reveal a "digital divide" in the population with respect to banking and payment products. On the one hand, 58% of Austrians aged 14 or over use online banking, and 36% use their mobile devices for banking activities. One-third of Austrians visit a bank desk at most once a year. Contactless payments (without entering a PIN, for amounts of EUR 25 or less) are conducted by roughly one-half of Austrians. The use of several fintech services/products and ownership of crypto assets (2%) is confined to a much smaller share of Austrians. On the other hand, a share of 45% of the population still prefer to use cash for a payment of EUR 50, and 43% of Austrians visit a bank desk at least once a month.

Furthermore, we discuss the socioeconomic characteristics of users and nonusers of digital banking and payment services and conduct regressions to identify the drivers of adoption. We find that the key variables that determine the use of new products and services are trust in the safety of a product, age, financial risk tolerance and interest in technology. For instance, we find that the median age of digital banking and payment users is between 33 and 39. In contrast, persons that prefer cash are 56 years of age in the median. Moreover, our results show that the stated cash use among persons who pay already contactless is significantly lower than among those who do not pay contactless. These findings suggest that it is quite likely that the use of cash for transactions will decline in the near future, which would be in line with what we see in many other countries. Nevertheless, an overwhelming majority of Austrians hold a very positive view of cash and also want cash to remain.

Nontechnical summaries in German

Digitales Geld

Paul Pichler, Alexander Schierlinger- Brandmayr, Martin Summer

Das Interesse an Fragen der Digitalisierung von Geld hat einen neuen und starken Impuls aus der öffentlichen Diskussion von internetbasierten elektronischen Werttransfersystemen wie Bitcoin erhalten. Dieser Fokus lässt uns manchmal vergessen, dass ein großer Teil des Geldes, das wir heute im täglichen Geschäftsverkehr einsetzen, bereits digitales Geld ist. Allerdings gibt es bis heute keine Form einer digitalen, von einer Zentralbank herausgegebenen Währung. Wir diskutieren das Potenzial von Systemen wie Bitcoin für eine solche neue Form des digitalen Geldes. Wir argumentieren, basierend auf einer schrittweisen Analyse der Technologie und der ökonomischen Anreize des Bitcoin-Systems, dass es sehr unwahrscheinlich ist, dass Kryptowährungen wie Bitcoin eine mögliche zukünftige Währungsform sein werden. Dazu fehlen die wesentlichen Merkmale von Geld: Kryptowährungen dienen nicht gleichzeitig als Tauschmittel, als Wert- und Recheneinheit. Probleme der Skalierbarkeit begrenzen auch ihre weit verbreitete Akzeptanz. Dies macht Kryptowährungen als Zahlungsmittel wenig attraktiv. Wir argumentieren, dass die zukünftige wirtschaftliche Rolle privater Kryptowährungen eng mit dem zukünftigen wirtschaftlichen Potenzial von vollständig dezentralisierten Blockchain-Anwendungen verknüpft sein wird, da in diesem Kontext Kryptowährungen ihre natürlichste Rolle finden. Wir argumentieren, dass öffentliche Blockchains nicht nur aufgrund des hohen Energieverbrauchs, sondern auch aus Anreizgründen sehr teuer sind. Dies beschränkt öffentliche Blockchain-Anwendungen auf einen reinen Kryptowährungskontext. Wir diskutieren schließlich die mögliche Rolle für von Zentralbanken ausgegebene digitale Währungen. Die aktuelle Diskussion legt nahe, dass es kaum gute Gründe gibt, die Einführung einer solchen Währung in Erwägung zu ziehen.

Peer-to-Peer-Kredite: direkte Finanzintermediation in der Praxis

Wolfgang Pointner, Burkhard Raunig

Peer-to-Peer (P2P)-Lending ist eine relative neue Alternative zu traditionellen Bankkrediten, die auf Internetplattformen beruht, welche Finanzierungen zwischen einzelnen Investoren und Kreditnehmern vermitteln. Dieser Artikel bietet einen Überblick über das Ausmaß und die Bandbreite dieser so genannten Fintech-Kreditmärkte in einigen Volkswirtschaften, darunter auch Österreich. Wir vergleichen traditionelle Bankkredite mit P2P-Lending, beschreiben, wie die Plattformen Risiken diversifizieren und mit asymmetrischer Information umgehen, und fassen die Eigenschaften der Nutzer von P2P-Lending zusammen.

P2P-Lending wächst zwar sehr dynamisch, die vergebenen Kreditvolumina sind aber immer noch bescheiden im Vergleich zum herkömmlichen Bankgeschäft. In Großbritannien hatte P2P-Lending bereits früh einen erheblichen Umfang erreicht, weil dort keine Banklizenz für die Vergabe bestimmter Darlehen erforderlich war. In Ländern wie den USA oder Deutschland, wo Banklizenzen erforderlich sind, sind auch beim P2P-Lending oft Banken in die Kreditvergabe involviert.

Wie traditionelle Banken versuchen auch P2P-Plattformen Kreditrisiken richtig einzuschätzen und dabei auftretende Informationsprobleme zu lösen. Die Plattformen bemühen sich daher, die potenziellen Kreditnehmer zu überprüfen und verschiedene Daten und Zusatzinformationen über diese online zu stellen, damit sich die potenziellen Investoren ein besseres Bild von deren Kreditwürdigkeit verschaffen können.

Da P2P-Lending ein relativ neues Phänomen ist, war der regulatorische Rahmen nicht auf dieses Geschäftsmodell abgestimmt. Wir zeigen am Beispiel Österreichs, wie Gesetzgeber und zuständige Behörden verschiedene Regulierungen angepasst haben, um diese Art der Kreditvermittlung zu erleichtern, ohne den Anlegerschutz zu gefährden.

Praktisch alle P2P-Plattformen haben ihren Geschäftsbetrieb in einer Niedrigzinsphase begonnen, in der sie für die Kreditgeber eine willkommene Alternative zu Bankeinlagen darstellten. Ob die Plattformen auch bei höheren Zinsen mit Banken konkurrieren können, wird sich erst zeigen. Wir sehen einen Trend, dass auch institutionelle Investoren zunehmend über P2P-Plattformen nach Schuldnern suchen und P2P-Lending sich mehr in Richtung des traditionellen Bankgeschäfts mit innovativeren Schnittstellen zum Kunden entwickelt.

Nutzung von Bankdienstleistungen und -produkten und Zahlungsverhalten in Österreich in Zeiten der Digitalisierung – Ergebnisse einer OeNB-Umfrage

Doris Ritzberger-Grünwald, Helmut Stix

Die digitale Transformation im Bereich Bank- und Bezahldienstleistungen hat wichtige Auswirkungen auf Banken und Finanzdienstleister sowie für Konsumentinnen und Konsumenten. Wenngleich bereits eine Vielzahl von finanziellen Innovationen zur Verfügung stehen, gibt es bisher wenig Daten über deren tatsächliche Nutzung. Die vorliegende Studie präsentiert Ergebnisse einer von der OeNB beauftragten repräsentativen Umfrage, mit der erhoben wurde, wie Bankgeschäfte durchgeführt werden, in welchem Ausmaß innovative Bank- und Zahlungsdienstleistungen genutzt werden und welche Verbreitung sogenannte Kryptowährungen aufweisen. Sie liefert damit eine Bestandsaufnahme der Bekanntheit und Nutzung digitaler Technologien sowohl bei Bank- als auch bei Zahlungsdienstleistungen – zwei Bereiche, deren Trennlinie durch verschiedene Innovationen zunehmend verschwimmt. Ergänzt wird diese umfassende Perspektive mit Daten zur Einstellung zu bzw. zur Nutzung von Bargeld, das sowohl in Österreich als auch in vielen anderen europäischen Staaten nach wie vor eine bedeutende Rolle einnimmt. Darüber hinaus erlaubt diese Gesamtbetrachtung festzustellen, wie viele Österreicher bereits ein digitales Produkt im Bereich Finanz- und Bezahldienstleistungen nutzen – und, wie viele noch nicht mit Innovationen in Berührung gekommen sind.

Insgesamt zeigen die Ergebnisse eine „digitale Kluft" auf: Einerseits nutzen 58% der Österreicherinnen und Österreicher über 14 Jahren Onlinebanking und bereits 36% verwenden dazu ein mobiles Endgerät. Ein Drittel besucht einen Bankschalter höchstens einmal im Jahr. Kontaktlose Zahlungen ohne Eingabe eines PIN-Codes (für Beträge unter 25 Euro) werden von etwa der Hälfte der Befragten durchgeführt. Die Nutzung verschiedener von Fintechs angebotenen Produkten und Dienstleistungen sowie sogenannter Kryptowährungen (2%) liegt deutlich darunter. Andererseits gibt es eine große, eher traditionell eingestellte Gruppe: 45% der Befragten bezahlen einen Supermarkteinkauf für 50 EUR am liebsten bar und 43% besuchen zumindest einmal pro Monat einen Bankschalter. Des Weiteren zeigen Regressionsanalysen die Schlüsselfaktoren für die Nutzung digitaler Bank- und Zahlungsprodukte. Es handelt sich dabei um die wahrgenommene Sicherheit eines Produkts, das Alter der Befragten, die Bereitschaft finanzielle Risiken einzugehen und das Interesse an neuen technologischen Anwendungen. Beispielsweise liegt das Medianalter von Nutzerinnen und Nutzern innovativer Produkte je nach Produkt zwischen 33 und 39 Jahren, wohingegen Personen mit einer Präferenz für Bargeld ein Medianalter von 56 Jahren aufweisen. Bezüglich der Bargeldnutzung deuten die Ergebnisse darauf hin, dass jene, die kontaktlose Zahlungen durchführen weniger Bargeld verwenden als Personen, die keine kontaktlosen Zahlungen tätigen. Dies lässt darauf schließen, dass, einem internationalen Trend folgend, die Bargeldverwendung für Transaktionen auch in Österreich in den nächsten Jahren abnehmen wird. Nichtsdestotrotz hat die überwiegende Mehrheit der österreichischen Bevölkerung eine sehr positive Einstellung zu Bargeld und möchte, dass Bargeld weiterhin eine wichtige Rolle spielt.

Analyses

Austria's economy set to grow by close to 3% in 2018

Gerhard Fenz,
Friedrich Fritzer,
Fabio Rumler,
Martin Schneider[1]

Economic growth in Austria peaked at the end of 2017. The first half of 2018 saw a gradual return to average growth. According to the most recent figures of the OeNB's Economic Indicator of September 2018, this trend is set to continue in the second half of the year. Based on its quarterly forecasting exercise, the Oesterreichische Nationalbank (OeNB) expects real GDP in Austria to rise by 0.6% in the third quarter and by 0.5% in the fourth quarter of 2018 (quarter on quarter; adjusted for seasonal and working-day effects), and thus to remain above the long-term average growth rate of 0.4% until year-end. Thanks to particularly strong growth early in the year, the predicted growth rate for 2018 as a whole is 2.8%, slightly higher than in 2017. External economic uncertainties such as the further course of international trade conflicts and the Brexit negotiations represent a downside risk to the present forecast.

Inflation is expected to remain on a steady course over the next few years. The OeNB forecasts a HICP inflation rate of 2.2% for both 2018 and 2019, followed by a slight decline to 2.0% in 2020. The fact that inflation is set to remain above 2% for the time being can be attributed mainly to favorable economic trends and robust growth in unit labor costs. HICP inflation is not expected to slow until 2020, when crude oil prices are likely to decline. Falling rates of inflation in the energy products market are expected to be largely balanced out by rising inflation rates in the services sector over the forecast horizon. As a result, core inflation (excluding energy and food) is projected to rise from 2.0% in 2018 to 2.3% in 2019 and level off at 2.2% in 2020.

1 Austria's economy maintains growth momentum in first half of 2018

Austria's economy continued to grow strongly in the first half of 2018. According to the most recent national accounts data, real GDP growth stood at 0.8% in the first quarter and 0.6% in the second quarter of the year (quarter on quarter; in real terms, trend-cycle component adjusted for seasonal and working-day effects) and thus remained above the long-term average of 0.4%. However, the growth momentum has slowed slightly from the peak recorded in the fourth quarter of 2017 (0.9%).

The main driver of growth was domestic economic activity. Household consumption went up by 0.5% (quarter on quarter) in each of the first two quarters of 2018, while businesses stepped up their investment spending by approximately 1% in each quarter. Somewhat unexpectedly, both investment in construction and investment in plant and equipment accelerated slightly from the second half of 2017. Despite challenging and uncertain external conditions, Austrian exports of goods and services were up by 1.1% in the first and second quarter of 2018, putting export growth slightly above import growth.

On the output side, the industrial sector recorded the greatest momentum: With average growth rates of 1¼% in the first two quarters, gross value added in industry was nearly twice as high as in the economy as a whole. The services sector continues along a steady path, with growth rates of about 0.5%.

In the most recent data published by Statistics Austria, historical national accounts data have been revised, in some cases substantially. The new data now indicate stronger momentum in 2016, at the beginning of the current cycle;

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Table 1.1

National accounts data for Austria as of September 25, 2018

	GDP	Private consumption	Government consumption	Gross fixed capital formation	Of which: Construction investment	Residential construction investment	Nonresidential construction investment	Investment in plant and equipment
	Change on previous period in %							
Q1 17	+0.7	+0.3	+0.4	+1.3	+0.9	+1.0	+0.8	+2.1
Q2 17	+0.6	+0.4	+0.2	+0.8	+0.5	+1.0	+0.3	+1.1
Q3 17	+0.7	+0.5	+0.1	+0.7	+0.6	+0.7	+0.5	+0.6
Q4 17	+0.9	+0.5	0.0	+0.7	+0.7	+0.7	+0.7	+0.6
Q1 18	+0.8	+0.5	+0.2	+1.0	+0.8	+0.8	+0.8	+1.3
Q2 18	+0.6	+0.5	+0.5	+1.0	+0.7	+0.8	+0.7	+1.7
2014	+0.7	+0.2	+0.9	–0.2	+0.5	–0.1	+0.9	–1.4
2015	+1.1	+0.4	+0.8	+2.1	–0.3	+0.8	–1.0	+4.2
2016	+2.0	+1.4	+1.7	+4.2	+0.5	+2.4	–0.8	+9.7
2017	+2.7	+1.7	+1.5	+3.8	+3.2	+3.3	+3.1	+4.8
Data revised since July 30, 2018								
	Percentage points							
Q3 17	–0.1	0.0	0.0	–0.7	0.3	0.3	0.3	–2.2
Q4 17	0.0	0.0	–0.1	–0.5	0.2	0.2	0.1	–1.6
Q1 18	0.0	0.1	0.1	–0.3	0.1	0.2	0.0	–0.6
Q2 18	–0.1	0.0	0.2	–0.1	0.2	0.4	0.0	0.0
2014	–0.2	–0.1	–0.1	0.4	0.3	0.3	0.4	0.4
2015	0.1	–0.1	–0.5	1.1	–1.1	0.4	–2.2	2.8
2016	0.5	–0.1	–0.3	0.4	–0.8	1.6	–2.4	1.1
2017	–0.3	0.1	0.3	–1.1	1.0	1.2	0.9	–4.1

Source: WIFO, OeNB calculations.

Table 1.2

National accounts data for Austria as of September 25, 2018

	Investment in transport equipment	Machinery investment	Exports	Imports	Domestic demand (excluding changes in inventories)	Net exports	Changes in inventories	Statistical discrepancy
	Change on previous period in %				*Contribution to GDP growth in percentage points*			
Q1 17	+5.4	+0.9	+1.6	+1.6	+0.6	+0.1	–0.1	+0.1
Q2 17	+2.8	+0.4	+1.3	+1.3	+0.4	0.0	+0.2	0.0
Q3 17	+0.4	+0.6	+1.3	+0.7	+0.4	+0.3	0.0	0.0
Q4 17	–2.2	+1.6	+1.6	+0.7	+0.4	+0.5	0.0	0.0
Q1 18	+0.1	+1.8	+1.1	+0.9	+0.5	+0.2	+0.2	–0.1
Q2 18	+4.1	+0.9	+1.1	+1.1	+0.6	+0.1	–0.1	0.0
2014	–7.0	+0.6	+3.0	+2.6	+0.3	+0.3	0.0	+0.1
2015	–0.8	+6.2	+3.5	+3.2	+0.8	+0.3	0.0	0.0
2016	+18.9	+6.8	+3.0	+3.7	+2.1	–0.2	+0.1	+0.1
2017	+11.1	+2.6	+4.6	+4.5	+2.0	+0.2	+0.3	+0.2
Data revised since July 30, 2018								
	Percentage points							
Q3 17	–1.3	–2.5	0.1	0.0	–0.1	0.1	–0.1	0.0
Q4 17	–3.5	–0.8	0.1	0.0	–0.1	0.1	0.0	0.0
Q1 18	–1.0	–0.4	0.1	0.1	0.0	0.0	0.0	–0.1
Q2 18	3.6	–1.2	0.2	0.2	0.0	0.0	–0.1	0.0
2014	–0.2	0.5	–0.1	–0.2	0.0	0.1	–0.2	–0.1
2015	–0.3	4.1	0.5	0.2	0.1	0.2	–0.2	0.0
2016	4.9	–0.1	0.6	0.1	0.0	0.3	0.0	0.2
2017	4.6	–7.0	–0.7	–0.6	–0.1	–0.1	–0.1	–0.1

Source: WIFO, OeNB calculations.

against this higher baseline, the growth momentum weakened in 2017. Real GDP growth for 2016 was revised upward by 0.5 percentage points, to 2.0%, whereas the figure for 2017 was revised downward by 0.3 percentage points, to 2.7% (or 2.6% in non-seasonally adjusted terms). This revision primarily results from changes in estimates of export and investment activity, which now records stronger growth at the beginning of the current economic cycle in 2016 but weaker growth in 2017. The pattern is even more pronounced for investment in plant and equipment, where there have also been significant internal shifts between transport equipment and machinery. In contrast, the figures for residential construction investment have been raised substantially for both years and now reflect stronger growth than those for the wider economy in both 2016 and 2017.

2 Strong export growth despite challenging environment

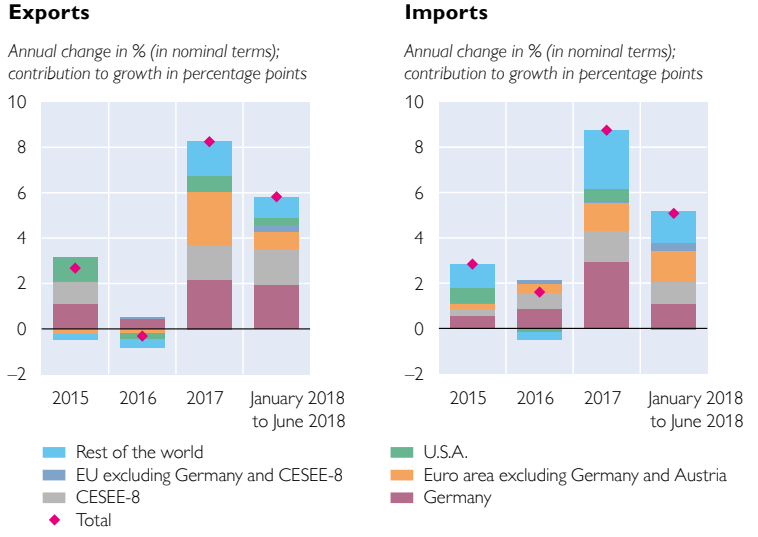
Austria's exporters faced increasingly challenging conditions in the first half of 2018. Trade policy conflicts and economic turmoil in emerging economies weighed on the global economy. In Europe, concerns about Italy's future economic and budget policy strategies and the further course of the Brexit negotiations have been mounting. At the same time, the euro area posted disappointing growth figures at the beginning of the year, not least in key export markets such as Germany, France and Italy.

Against this backdrop, Austria has posted strong export growth so far this year, with nominal goods exports up by 5.8% in the first six months of 2018. The breakdown of Austrian exports by region shows that this is a broad-based trend: Austria's businesses have been able to sell more goods to all key export markets with the exception of France and Russia in the year to date. Trade with Central, Eastern and Southeastern Europe (CESEE) performed particularly well. Austrian goods exports to CESEE expanded by 10% in the first half of the year, twice as much as other exports, which went up by 5%. Although only 18% of goods exports went to the CESEE-8[2] countries, they accounted for 28% of Austria's entire export growth. Exports to Germany saw slightly above-average growth of 6.3%.

It is not possible to draw firm conclusions about future export trends from the leading indicators currently available. The most recent figures of the OeNB's Export Indicator, which is based on truck mileage data, suggest that export growth over the summer was roughly in line with the average for the first half of 2018. Indications about the further course of the year are contradictory, which is likely to reflect uncertainties in the external environment.

Chart 1

Growth composition of goods exports and imports by regions



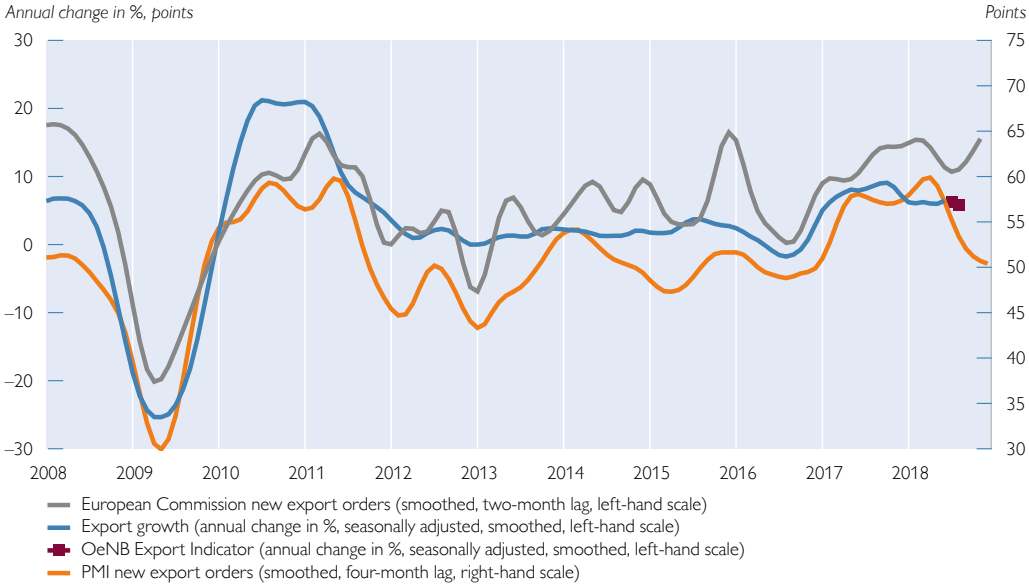
Source: Statistics Austria.

Note: CESEE-8: Bulgaria, Czech Republic, Croatia, Hungary, Poland, Romania, Slovenia, Slovakia.

[2] *Bulgaria, Czech Republic, Croatia, Hungary, Poland, Romania, Slovakia, Slovenia.*

Chart 2

OeNB Export Indicator and leading indicators for foreign trade



Source: Statistics Austria, ASFINAG, Bank Austria, OeNB.

While purchasing managers' recent assessment of export order trends was relatively cautious, the data collected by the European Commission on new export orders suggest that export trends are following a steady course or even accelerating slightly. The latent trade conflicts and the ongoing Brexit negotiations give rise to exceptionally high forecast uncertainty.

Growth of goods imports stood at 5.1% in the first six months of the year and thus lagged behind growth of goods exports, unlike in 2017. The weaker growth of goods imports is partly attributable to the fact that imports of vehicles have so far remained roughly at last year's level. This also explains the low growth rate for imports from Germany.

Exports in the services sector expanded by 5.8% over the first six months of 2018, roughly on a par with the goods sector. Business services recorded above-average growth, while transport services grew at a slightly below-average rate. Once again, tourism was the main driver of growth in this sector. The number of overnight stays by visitors from abroad rose by 4.7% in the first seven months of 2018, reaching an all-time high of 70.7 million. Visitors from Germany – by far the most significant country of origin, accounting for approximately 50% of all overnight stays – played a particularly significant part in this good result, with a rise of 6.6%. Overall, tourism services exports were up by 7.1%, which contributed to above-average inflation in this sector.

Thanks to the positive trends in both the goods and the services sector, the current account balance continued to improve. The current account surplus rose by EUR 1.8 billion year on year in the first half of 2018, reaching EUR 6.3 billion, or 3.3% of GDP. The outlook for the second half of the year is favorable. As a result, we expect the current account surplus for 2018 as a whole to exceed last year's figure of 2.0% of GDP.

3 Above-average growth of investment and industrial production

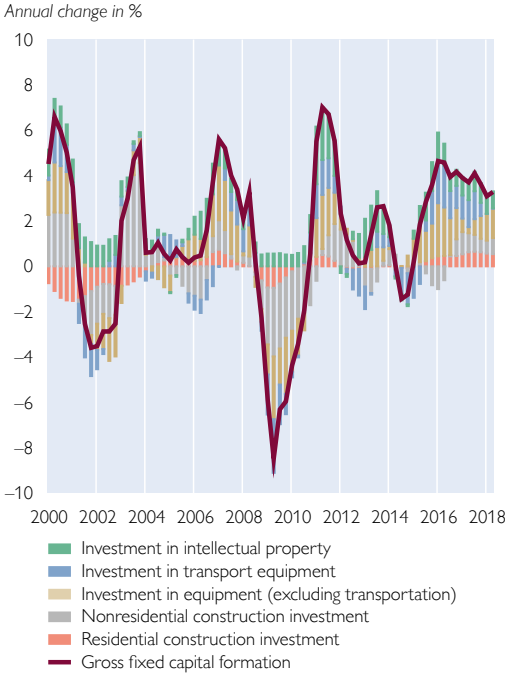
Domestic demand is currently lively and represents a key driver of economic activity, alongside export activity. Consumption and investment are contributing substantially to economic growth in Austria. As of the second quarter of 2018, the current investment cycle is among the longest and strongest of the past two decades, and there is still no end in sight. Businesses' assessment of their own capacity utilization in the third quarter stands at almost 89%, thus remaining above the long-term average and only very slightly below all-time record levels. This suggests a need for additional investment in plant and equipment in the second half of the year. Financing conditions are still favorable, which continues to have a positive impact. However, heightened external risks could curb domestic businesses' propensity to invest. Residential construction investment has returned to an even growth path in recent quarters. National accounts data have posted year-on-year rises of up to more than 3% for six quarters in a row, including the most recent upward revision. The outlook for the next six months remains favorable, as sentiment indicators and hard facts (such as order books and building permits) are both on an upward trajectory. Overall, the investment cycle is expected to level off only gradually.

Robust exports and investment activity are also the drivers of Austrian industry. Measured in terms of gross value added in the national accounts, industrial output has been rising by more than 6% year on year since mid-2017, twice as strongly as Austria's economy as a whole. This is a typical feature of boom periods. Although leading indicators for industry suggest that industrial output has already peaked, growth is still expected to be above average in the second half of the year.

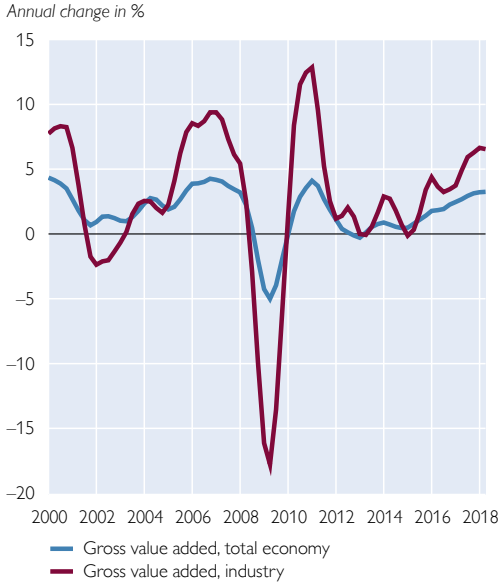
Chart 3

Investment and industry

Investment cycle leveling off only gradually



Robust industrial activity



Source: WIFO.

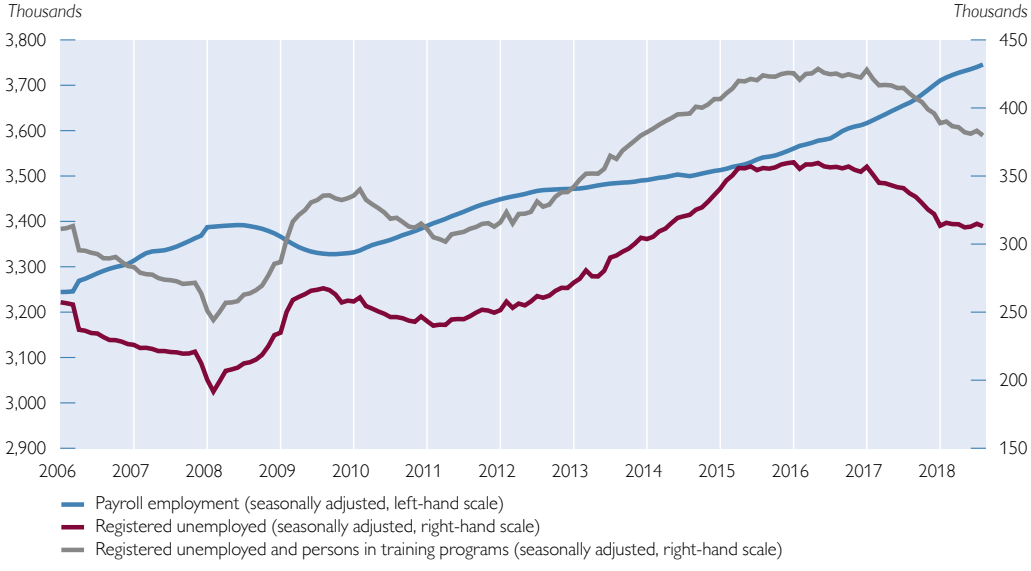
4 Strong rise in employment, but no change in unemployment level in 2018

Households are expected to have scope for additional private consumption in the coming months. Wages settlements are higher than in 2017, pushing up real wages in Austria despite the commodity price-related rise in inflation. Moreover, labor market trends have been very favorable. The number of individuals in payroll employment continued to record a very strong year-on-year rise of nearly 2½% over the summer months. Unlike in the immediate post-crisis years, full-time positions currently account for the entirety of employment growth, while the number of part-time jobs is declining. The rise in employment is especially high in sectors with above-average remuneration, including industry and the information and communication sectors. The sharp increase in the number of registered vacancies indicates that employment growth will remain robust over the next few months. As a result, households' disposable incomes can be expected to rise significantly.

Austria's seasonally adjusted unemployment rate (national definition) stood at 7.7% in August, 0.8 percentage points below the August 2017 level. The unemployment rate according to the Eurostat definition was 4.9% in July (down 0.5 percentage points year on year). However, trends in seasonally adjusted employment and unemployment figures over the course of the year indicate that, in keeping with trends in the wider economy, the conjunctural peak on the labor market is already behind us. The seasonally adjusted number of registered unemployed persons has no longer been declining in the year to date, and employment growth has slowed somewhat. The falling number of individuals in training programs is one of the reasons why the high employment momentum has not been accompanied by a further decline in unemployment (see chart 5).

Chart 4

Rising employment and stagnating unemployment levels in the first half of 2018



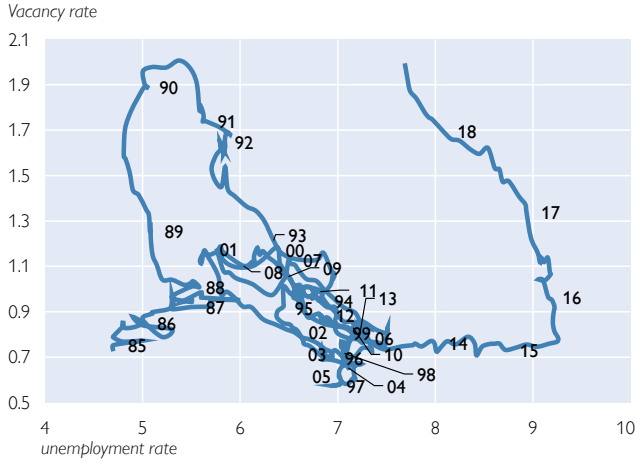
Source: AMS, Main Association of Austrian Social Security Institutions, authors' calculations.

The fact that unemployment remains relatively high despite strong employment growth raises questions to do with matching efficiency and labor shortages on the Austrian labor market. Labor shortage estimates are currently considerably higher than they were in the first half of 2008, toward the end of the last economic boom. In the third quarter of 2018, 18% of industrial companies cited labor shortages as a limiting production factor. Ten years ago, less than 10% identified this as a problem. The number of "shortage occupations" – i.e. those in which the number of job seekers per job vacancy is less than or equal to 1.5 – rose to 86 in August 2018. This figure never exceeded 80 during the previous economic boom. This is especially remarkable given that the unemployment rate is significantly higher today than it was in 2008. Moreover, there a signs of declining matching efficiency

Chart 5

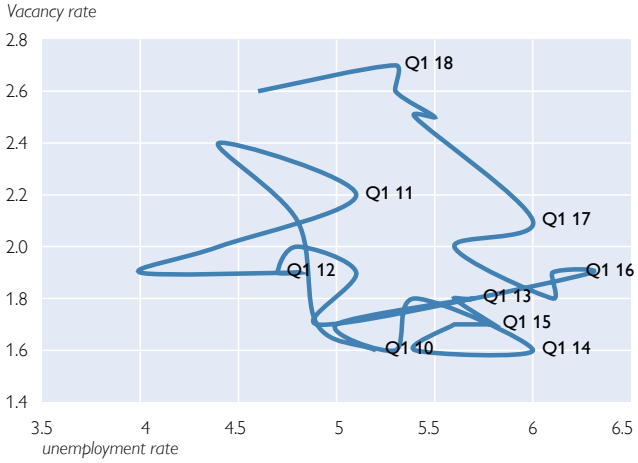
Declining matching efficiency and rising labor shortage

Beveridge curve based on AMS data
(January 1985 to July 2018)



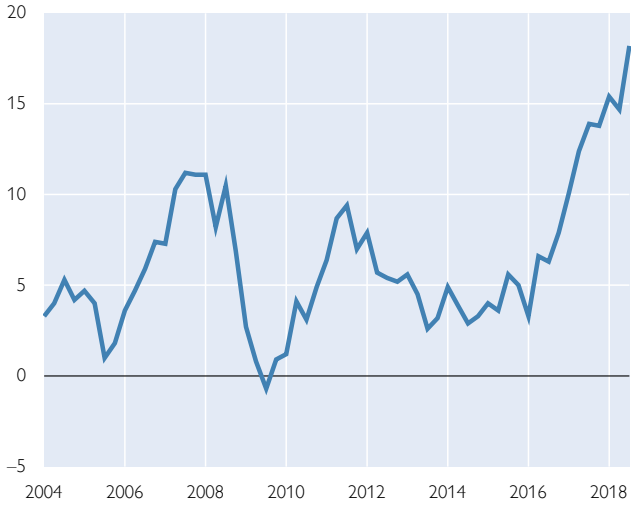
Source: Eurostat.

Beveridge curve based on Eurostat data
(first quarter of 2010 to second quarter of 2018)



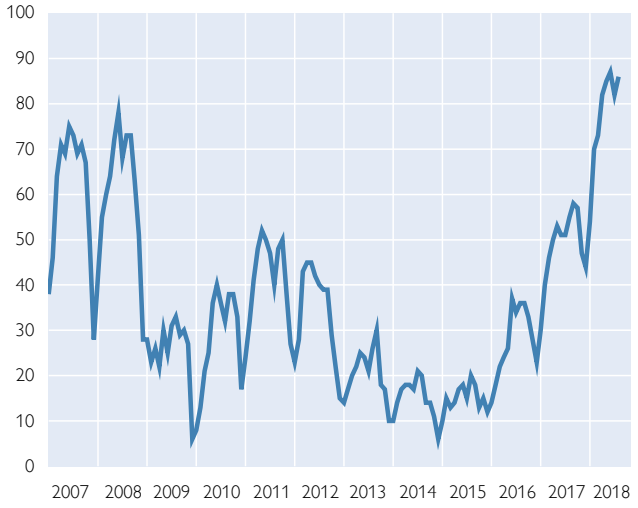
Source: AMS.

Labor shortages as a limiting production factor



Source: Eurostat.

Shortage occupations (NACE four-digit codes)



Source: AMS.

on the Austrian labor market. The Beveridge curve, which charts the negative correlation between the unemployment rate and the vacancy rate, has shifted outward, signaling a deterioration of the job matching process. Although this shift is overstated due to a change in the way vacancies are recorded in AMS (Public Employment Service Austria) data, it is also reflected in Eurostat data, where no such methodological changes have occurred. Improvements in matching can be achieved by means of investment in the education system (in the long term) and training programs (in the short and medium term).

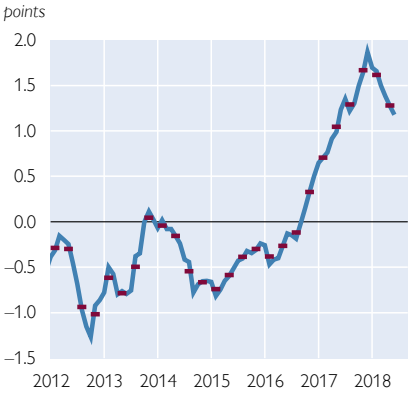
5 Economic indicators stabilizing at a high level

Following record highs at the turn of the year, sentiment indicators and economic indicators for Austria have declined over the course of 2018. The most pronounced correction was recorded by the Purchasing Managers' Index (PMI), which fell from 64.3 points in December 2017 to 56.4 points in August 2018. All index

Chart 6

Confidence indicators for the Austrian economy

Mean value across the five confidence indicators



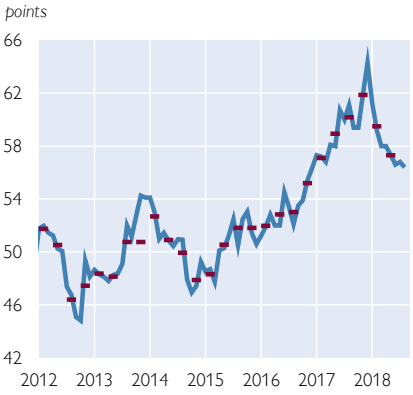
Source: Authors' calculations.

Note: Standardized mean of ESI, PMI, WIFO leading indicator, WIFO economic climate indicator and Bank Austria's economic indicator.

European Sentiment Indicator (ESI), European Commission

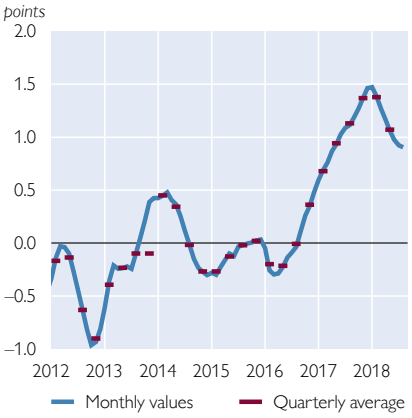
Source: European Commission.

Purchasing Managers' Index (PMI)



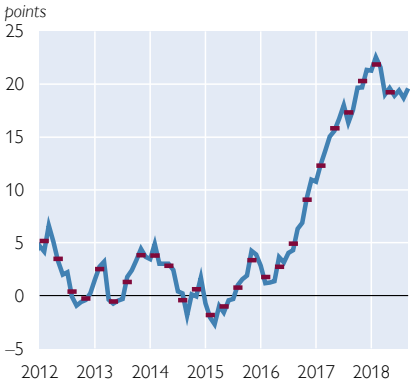
Source: Bank Austria.

WIFO leading indicator



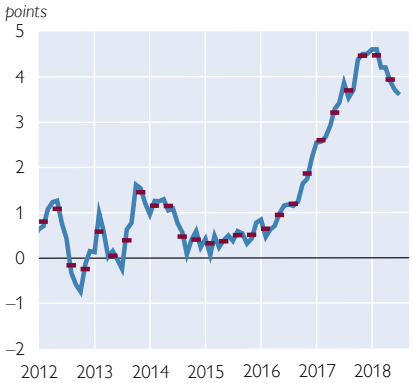
Source: WIFO.

WIFO economic climate indicator



Source: WIFO.

Bank Austria economic indicator



Source: Bank Austria.

subcomponents contributed to this decline, with the assessment of new export orders exhibiting the strongest downward trend. This reflects heightened external uncertainties. The Economic Sentiment Indicator (ESI) charted a similar, albeit less pronounced, course: it fell from 119.3 points in December 2017 to 112.7 points in August 2018. Nevertheless, the PMI and the ESI remain considerably above their long-term averages.

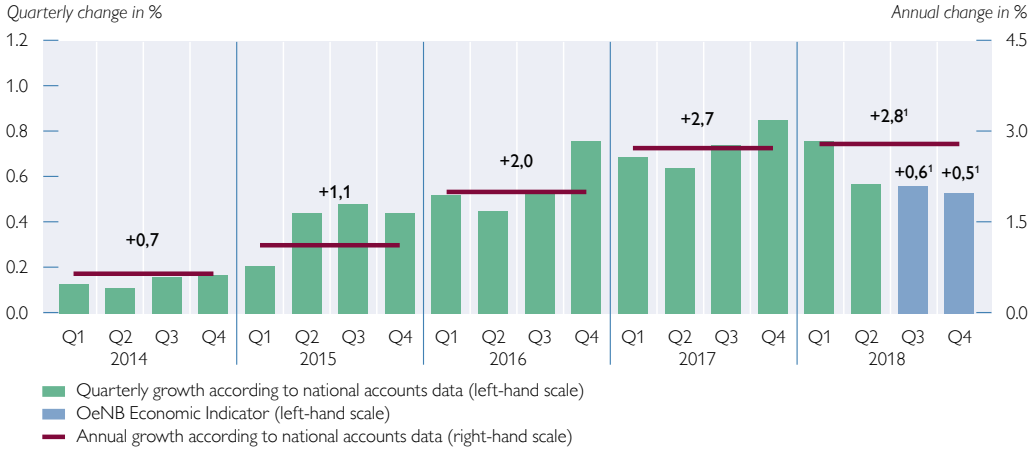
The deterioration of sentiment indicators slowed significantly in mid-2018. In fact, some indicators, including WIFO's economic climate indicator, have recently even recorded slight improvements. Overall, indicators appear to have plateaued at a relatively high level. Lower risks in the external environment have played a role here. Partly because of the tentative deal reached in the trade conflict between the U.S.A. and the EU, the ifo index for Germany has once again improved, and domestic exporters have become somewhat more optimistic about new order trends. Overall, the available leading indicators suggest that the Austrian economy will grow at a slightly above-average pace over the next few months.

6 Austria's economy set to grow by close to 3% in 2018

Based on the available economic indicators, it is likely that the current economic cycle peaked at the turn of 2017/2018. The first half of 2018 saw a gradual return to average growth. According to the most recent results of the OeNB's Economic Indicator of September 2018, this trend is set to continue in the second half of the year. Based on its quarterly forecasting exercise, the OeNB expects real GDP in Austria to rise by 0.6% in the third quarter and by 0.5% in the fourth quarter of 2018 (quarter on quarter; adjusted for seasonal and working-day effects), and thus to remain above the long-term average growth rate of 0.4% until year-end. Thanks to particularly strong growth early in the year, the predicted growth rate for 2018 as a whole is 2.8%, slightly higher than in 2017. External economic uncertainties such as the further course of international trade conflicts and the Brexit negotiations represent a downside risk to the present forecast.

Chart 7

Outlook for Austrian real GDP for the third and fourth quarters of 2018 (seasonally and working-day adjusted trend series)



Source: OeNB Economic Indicator, interim update of September 2018; WIFO.
¹ Forecast.

7 Austria's inflation rate at 2.3% since June

Austria's HICP inflation rate remained at 2.3% over the last three reporting months. It stood at 1.9% at the beginning of 2018 and then gradually declined to 2.3%, where it remained from June until August 2018. The decline in food price inflation, which was especially pronounced in August (the most recent reporting month), was balanced out by a simultaneous rise in services inflation, resulting in a practically unchanged headline inflation rate. The energy component of HICP inflation, on the other hand, has maintained a relatively steady high level for several months. Core inflation (excluding energy and food) has fluctuated around the 2% mark since the beginning of the year and stood at 1.8% in August 2018.

Overall, Austria's inflation rate in August continued to be somewhat higher than those of the euro area and Germany. The recent fall in inflation in Germany and the euro area meant that Austria's inflation gap vis-à-vis Germany and the euro area widened to 0.4 and 0.3 percentage points, respectively. However, these figures are still significantly lower than in 2017 and early 2018, when Austria's inflation rate doggedly remained more than half a percentage point above that of the euro area.

8 Inflation outlook: slight fall to 2.0% anticipated by 2020

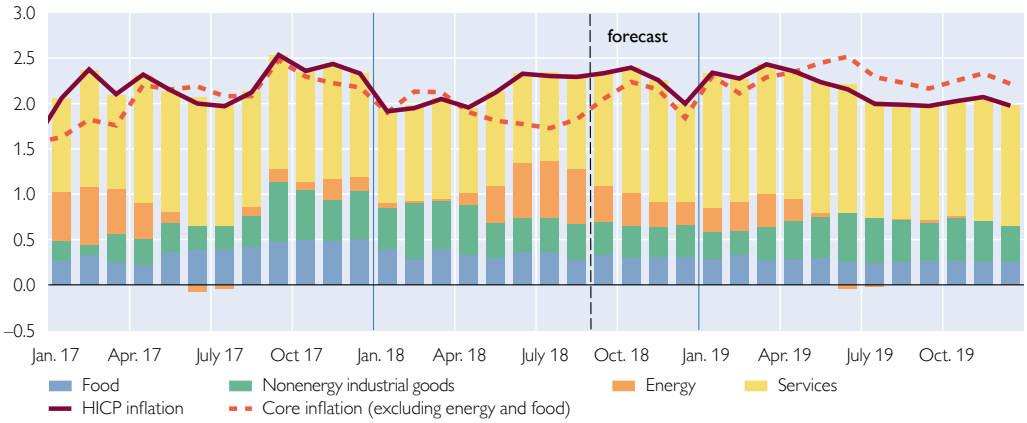
According to the OeNB's September 2018 inflation forecast, HICP inflation will largely follow a steady path until 2019. Thanks to the favorable economic situation and the anticipated surge in unit labor costs, inflation is expected to persist at 2.2% in 2018 and 2019.

The rise of nonenergy industrial goods prices is predicted to remain above average in 2018 and 2019 due to favorable trends in consumer demand and the acceleration of unit labor cost growth. Services inflation is likely to climb significantly over the forecast horizon, primarily as a result of the anticipated rise in labor costs (see chart 8). The HICP inflation rate is predicted to drop to 2.0% only in 2020, on the back of a slight dip in crude oil inflation, a fall in food inflation, and the gradual end of the current economic cycle. Favorable trends in

Chart 8

Contributions to Austrian HICP and core inflation

Inflation rates in %; contributions to inflation in percentage points



Source: Statistics Austria, OeNB.
Forecast: September 2018 to December 2019.

Table 2

Assumptions of the OeNB inflation outlook of September 2018

		Assumptions			Revisions since June 2018		
	2017	2018	2019	2020	2018	2019	2020
Energy and exchange rates					*change in %*		
Crude oil price (EUR/barrel)	48.2	60.7	62.6	60.3	–2.3	0.9	4.0
USD/EUR exchange rate	1.1	1.2	1.1	1.1	–1.7	–3.4	–3.4
Nonenergy commodity prices							
EU producer prices, food	107.2	106.5	109.3	109.7	–0.7	0.6	1.3
World market prices, food	133.5	130.2	133.7	140.9	–5.6	–8.3	–5.0
World market prices, metallic raw materials	122.9	125.3	118.6	123.2	–8.4	–14.2	–14.5
Interest rates	*in %*				*change in percentage points*		
Three-month interest rate	–0.3	–0.3	–0.2	0.0	–0.0	–0.1	–0.2
Ten-year government bond yield	0.6	0.7	0.8	1.0	–0.1	–0.2	–0.3

Source: Eurosystem.

Note: June 2018 (cutoff date for data: May 23, 2018); September 2018 (cutoff date for data: August 23, 2018).

domestic economic factors, including domestic demand and unit labor costs, are expected to cause core inflation (excluding energy and food) to rise to 2.3% by 2019 (see chart 8).

The predicted annual inflation rate for 2018 has remained unchanged since the last forecast, published in June 2018. However, the forecast HICP inflation rates for 2019 and 2020 have been revised upward by 0.2 and 0.1 percentage points, respectively. These upward revisions are based on anticipated rises in producer prices for food and in crude oil prices (see table 2). Services inflation also saw a slight upward revision as unit labor costs increased somewhat more strongly than expected in the last forecast.

Digital money

We provide a brief overview of the most popular forms of money available to the general public today, with a particular emphasis on digital money. We contrast current monetary arrangements with privately issued crypto coins, such as Bitcoin, and argue why the latter will likely never be able to perform the economic functions of money well. We relate our discussion to the current international debate on the potential introduction of central bank-issued digital currencies as a new form of digital money.

JEL classification: E5, E58, E50, E59
Keywords: digital money, Bitcoin, blockchain, digitalization

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The term *money* is ubiquitous in everyday conversations: we use money to purchase goods and services, we have money in our wallets and save it in the bank, we refer to rich people as those having a lot of money or earning a lot of money. These examples show that the term money often denotes very different things, for instance cash, wealth or income. In economics, however, the term money is not used as a synonym for wealth and income, and it also includes more than just cash. The popular undergraduate textbook *The Economics of Money, Banking and Financial Markets by Frederic Mishkin (2015)* refers to money as *"anything that is generally accepted in payment for goods and services and in the repayment of debts."* More broadly, economists define money by its three economic functions: being a widely accepted *medium of exchange*, a *store of value* and a *unit of account*. Anything that satisfies all of these three functions qualifies as money, irrespective of its particular representation.

The aim of this article is to provide an overview of the different forms of money used for everyday transactions today, with a particular emphasis on *digital money*. We proceed as follows. In section 1 we discuss currency and deposit money, arguably the two most popular faces of money today. In section 2 we discuss privately issued crypto coins, focusing on Bitcoin, and we discuss whether such crypto coins could become the popular face of money in the future. In section 3 we discuss the current international debate on the introduction of central bank-issued digital currencies. Finally, in section 4 we draw conclusions.

1 Currency and deposits: the two popular faces of money today

The most visible face of money, with which even young children are familiar, is currency: coins and banknotes. Today currency is mostly produced by or on behalf of central banks and is issued only by these institutions.[2] Modern money is firmly embedded in a strict set of legal rules that regulate its creation and the way it is distributed.[3] The intrinsic, material value of banknotes and coins is far below its nominal value. As a rule, central banks are not obliged to exchange coins and

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[2] *In the euro area, the central banks of the participating countries have the sole right to produce and distribute coins and banknotes.*

[3] *See Weber (2018).*

Refereed by:
Santiago Fernández de Lis, BBVA Research

banknotes in circulation for other assets, such as gold, silver or foreign currencies. They are merely obliged to exchange banknotes and coins for new banknotes and coins, which in turn they can produce at virtually zero cost. For this reason, modern money is often referred to as *fiat* money.

Why is it then that people accept currency in exchange for goods and services? The answer is surprisingly simple: because they trust that they will be able to use the same currency in the future to purchase goods and services themselves. They trust that currency has economic value. This faith is rooted in the trust in the economic strength of the issuing state. It is crucial for the stability of the economic value of fiat currency. Fiat currency depends on people's trust in sound future policymaking and, with that, the future value of currency as a means of payment. This, in turn, is crucial for the current economic value of fiat currency. After all, nobody would accept intrinsically worthless currency today if they had any doubts about whether this currency could be used to make purchases tomorrow.

The economic value of currency depends not only on trust in government institutions, but also on technology. In order to have any value, banknotes and coins must be difficult, if not impossible, to forge, because their value hinges on their scarcity. If the state cannot ensure a limited supply of banknotes and coins, for example because they can easily be reproduced illegally, the economic value of currency in circulation will quickly erode. To prevent such a scenario, central banks today use modern materials and state-of-the-art security techniques in the production of currency. The euro banknotes, for example, have a variety of security features such as watermarks, holograms and security threads.

The second face of money all of us are familiar with is the *deposit money* we hold in our bank accounts. Even though this form of money has no physical representation, we can use it to make payments by asking our bank to debit our own account while crediting the bank account owned by the recipient of the payment. Transfers of deposit money thus essentially boil down to changes in a system of registers maintained by banks.

Deposit money held in the account of a particular bank is a liability of this bank. This is because deposit money reflects the promise of a commercial bank to deliver physical currency on demand, and unlike the central bank, it cannot produce coins and banknotes itself. Therefore, physical currency plays an important role in the functioning of deposit money in our current monetary system: it ultimately defines the content of most claims vis-à-vis commercial banks.[4] Accordingly, the economic value of deposit money hinges directly on the economic value of currency. However, it also critically depends on people's trust in the banking system. People are willing to hold and use deposit money only if they trust in the ability of banks to fulfill their financial promises, and if they trust in the integrity of bank accounts and payment system technology. To establish and maintain this trust, policymakers have, over time, introduced a complex set of legal rules and a sophisticated system of regulation and supervision. The ultimate aim of this system is to provide a safeguard for the public that banking and payment systems function correctly, which ensures that – like currency – deposit money is safe and cannot be "forged" easily.[5]

[4] *See Hellwig (2018).*

[5] *For a more detailed description of the modern monetary system and its "hybrid" nature of central bank money creation through the issuance of banknotes and the creation of reserves as well as private money creation by banks through deposit money, we refer interested readers to chapter 2 in Weber (2018).*

Unlike coins minted from precious metals and banknotes made from cotton paper or similar materials, deposit money issued by banks has no physical representation. It exists only as entries in the ledgers maintained by the banking system. Deposit money serves as a medium of exchange because holders can always ask their banks to transfer funds to the account of someone else, possibly with another bank. Whereas in the past, such orders relied on paper (transfer orders, checks etc.), today transactions are mostly initiated via payment cards, online banking or banking apps for smartphones. Banks and payment card providers use state-of-the-art secure data transmission technologies and sophisticated cryptographic techniques to ensure the legitimacy of all transactions. Thus, modern deposit money is *digital money*, i.e. money that exists only as bits and bytes in a network of interconnected computers.

The ECB's payment statistics[6] illustrate the increasingly important role of digital payments in the EU. In 2016, the number of cashless payments in the EU increased by 8.5% to a total of 122 billion transactions, corresponding to more than 3,800 transactions per second. Of these 122 billion transactions, 59 billion were made using payment cards, suggesting an increase by more than 12% compared to 2015. The total value exchanged via card payments amounts to roughly EUR 3 trillion in 2016, i.e. approximately EUR 50 per payment. While both the number of payment cards in circulation and the number of card payments has been increasing continuously over the last years, the number of ATMs provided by banks in the EU has been declining slowly but steadily. This reflects the increased usage of digital money rather than physical currency for everyday transactions.

This trend is likely to gather momentum in the future. To make digital payments even more convenient, the Eurosystem has developed its TARGET Instant Payment Settlement (TIPS) service. Starting in November 2018, TIPS will offer payment service providers final and irrevocable settlement in central bank money in real time and around the clock, 365 days a year. This will provide the basis for new and better payment services offered to end users, such as instant person-to-person mobile payments. Still, the efficiency of international transactions sent to jurisdictions not covered by TIPS is still relatively slow, and cross-border transactions to these areas are expensive. That said, these transactions amount to only 1% of total transactions. The significant increase in the convenience and speed of euro payments will likely contribute to a further rise in digital payments in the EU.

While modern deposit money is mostly digital, there is still no digital form of official (central bank-issued) currency. When we want to transfer money online, for example to pay for online shopping, we have no choice but to use the services offered by private financial intermediaries, such as commercial banks and payment card providers. Moreover, digital payments cannot be made truly anonymously, as the identities of senders and receivers of deposit money need to be known to the banks which act as financial intermediaries. This lack of anonymity, together with a loss of trust in the banking system in the midst of the global financial crisis, has spurred a private initiative to establish a decentralized electronic cash system: Bitcoin.

[6] *The Payment Statistics for 2016 are available at http://sdw.ecb.europa.eu/reports.do?node=1000004051*

2 Bitcoin and beyond: are privately issued crypto coins the new face of money?

Bitcoin was introduced in late 2008, first to a small community of cryptographers and IT specialists, by the publication of a white paper explaining its key working principles (Nakamoto, 2008). The scientific paper was accompanied by the open source client software *Bitcoin core*, which allows users to exchange Bitcoin tokens and engage in activities to create new tokens. Up until the time of this writing (July 2018), more than 17 million Bitcoins had been created and the market capitalization of Bitcoin amounted to approximately EUR 100 billion.

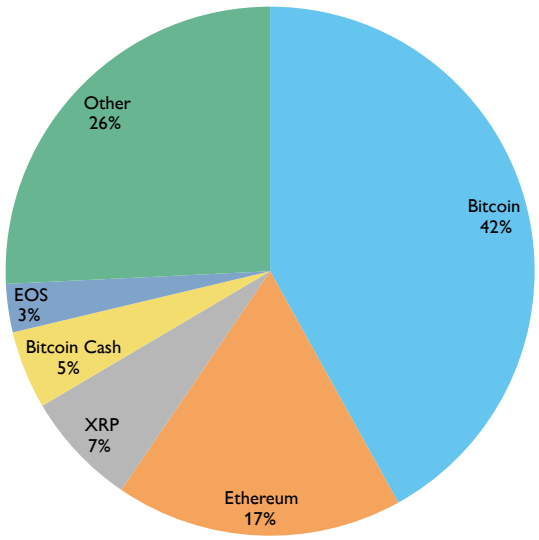
Moreover, in recent years, hundreds of other crypto coins (also referred to as *altcoins*) have been developed, some of which have turned out successful in raising investor funds and achieving high market prices. Today, the total market capitalization of all crypto coins together amounts to roughly EUR 240 billion. Three-quarters of this amount are accounted for by the five largest players on the crypto coin market (Bitcoin, Ethereum, XRP, Bitcoin Cash and EOS), as is visualized in chart 1.

2.1 The technology behind Bitcoin

Bitcoin set out to establish an electronic cash system that allows for truly anonymous and completely nonreversible payments over the Internet. Similar to bank deposits, Bitcoin tokens have no physical representation but are merely entries in a digital ledger. Unlike deposits, however, this ledger is not maintained by a central institution such as a bank but rather maintained jointly by all participants in the Bitcoin system. Each single participant can keep a local copy of the ledger and can propose changes to the ledger. This technology of using a *distributed ledger* raises a fundamental problem: if everyone can make changes to the ledger, how to reach a consensus about the true state of the ledger at a given point in time? How to ensure that the same money is not spent twice? After all, given the absence of a central authority that sees and verifies all transaction requests, fraudulent behavior by an individual who may ask different participants in the network to send the same Bitcoin token to different recipients may not be detected in time.

Chart 1

Market shares of crypto coins



Source: https://coinmarketcap.com, data retrieved on July 5, 2018.

The key innovation of Bitcoin is that it establishes a set of rules and economic incentives that solve the double-spending problem and allow for reaching consensus about a distributed ledger, even though the true identities of all participants in the Bitcoin system are well hidden behind pseudonyms. This is achieved by resorting to cryptographic techniques and game theoretical concepts.

2.1.1 The Bitcoin network

Bitcoin is organized as a decentralized peer-to-peer network of users (nodes). To enable anonymity, the Bitcoin led-

ger does not contain any information about the true identity of a user but only lists transactions (flows of Bitcoins) between alpha-numeric addresses, which are similar to bank account numbers. By means of the Bitcoin core software any user can create Bitcoin addresses anonymously and in unlimited quantity. Contrary to the opening of a bank account, opening a "Bitcoin account" does not involve a third party. Hence, no one except the initial creators themselves are eventually able to link a Bitcoin address to their true identity.

All nodes in the network are equal and can communicate with each other. The Bitcoin protocol only restricts the format of messages that can be exchanged over the Bitcoin network. Any owner of Bitcoins who wishes to transfer funds from their address to another address can do so by sending a message requesting the transaction to its neighboring nodes in the Bitcoin network, which in turn pass on this message to their own neighbors, etc. Over time, the message will spread over the entire network provided that the network is not partitioned. As transaction requests are broadcasted through an unsecure peer-to-peer network, where they can in principle be manipulated by nodes passing on the message, it becomes essential that all nodes can easily verify the legitimacy of a message they receive. The Bitcoin system allows for easy verification of transaction legitimacy by using asymmetric cryptography (which is also used with traditional card payments and in e-commerce) to digitally sign messages and validate signatures.

2.1.2 Verifying legitimate transactions: the role of cryptography

Every Bitcoin address is associated with a private key and a public key, both consisting of a relatively long series of characters. The private key is known only to the creator of a Bitcoin address, whereas all nodes have access to the public keys associated with all Bitcoin addresses. The public and the private key of a particular address are linked through a signature algorithm, a mathematical procedure for digitally signing messages and validating signatures. Any message sent on behalf of a given address, such as a transaction request, is considered legitimate by other Bitcoin nodes if and only if it is digitally signed with the private key associated with the address. The digital signature can be verified fast and easily by any user with access to the public key. The mathematical procedure employed in this process relies on trapdoor functions. These are functions that are easy to evaluate, yet extremely difficult to invert. The use of these functions is important because it makes it possible to decrypt a given signature using the public key of an address, but it is still impossible to generate a signature with the public key alone. Messages that are correctly digitally signed have thus almost surely been initiated by someone with access to the private key of the sending address, and hence they have almost surely been initiated by the legitimate owner of funds.

2.1.3 Avoiding double spending

Because many nodes in the Bitcoin network receive the same transaction requests, it is difficult to select a node that is allowed to incorporate the (verified) transaction into the ledger. Selecting one node to do this is important to ensure that the same transaction is not incorporated twice or more often by different nodes. Moreover, if transactions were incorporated on a one-by-one basis, the ledger would have to be updated several times per second, and it would be almost impossible for all network nodes to have the same version of the ledger at a given point in

time. The Bitcoin protocol addresses this problem by not handling transactions individually but bundling them in blocks, and by ensuring that subsequent blocks cannot be added to the register too quickly. This provides ample time for sharing a new block across the network before the next block arrives.

2.1.4 The blockchain

Blocks usually contain up to a few thousand transactions and are added to the ledger one after the other. When a new block is created it needs to contain a reference to the state of the ledger to which the new block is linked. The Bitcoin ledger thus essentially forms a chain of blocks of transactions and is hence referred to as the *blockchain*. The reference to the previous block is computed from the precise contents of the newly created block and a random nonce using hash functions. Hash functions are irreversible trapdoor functions that take a piece of information of any length and transform it into a unique set of numbers and letters of a fixed length, a so-called hash value.[7] Each modification of the block contents or the nonce change the hash value in an unpredictable way, and it is impossible to design the input to the hash function, e.g. the random nonce, in such a way that the hash value has certain desired characteristics. As will become clear soon, this is an important property employed by the Bitcoin protocol to reach a consensus about the true state of the ledger.

2.1.5 Bitcoin mining

The creation of blocks requires computing power. Each participant in the network can individually decide whether and how much computing capacity they are willing to provide for the creation of blocks. Nodes which provide this capacity and produce blocks are referred to as *miners*. Bundling transactions in new blocks is technically trivial and can be done extremely fast, even with standard desktop computers. This creates a problem for reaching a consensus about the true state of the ledger. If it were possible for every miner to just add a block of transactions whenever they wish, there would be no time to exchange the new version of the ledger across nodes fast enough to ensure, e.g., that the same transactions are not incorporated multiple times. Different versions of the ledger would then coexist, and it would be impossible to judge which version of the ledger is the correct one. To allow for consensus, the process of adding blocks to the blockchain must thus be slowed down artificially. The Bitcoin protocol achieves this by accepting only blocks to the blockchain whose identifier fulfills certain hard-to-satisfy characteristics. It requires that the hash value must begin with a certain number of leading zero bits. The required characteristics (i.e. the required number of leading zero bits) are updated regularly so as to ensure that the entire mining community manages to compute a block with an identifier that satisfies those characteristics only every ten minutes on average, which usually leaves ample time to globally exchange the updated ledger after the inclusion of a new block and before the next block arrives. However, there is still the possibility that two blocks are added

[7] *Lancaster (2016) provides a good illustration. The hash function used by Bitcoin would for instance take the entire text of James Joyce's Ulysses and transform it into the hash value 6ff1c1a80b68b5414423a7e2e061d5f2fc09f7c4e86c4987e573bebc4e4991dd. When you want to check whether the text was transformed correctly you just have to run the function and check the output. It would, however, be impossible given current computer technology to take this hash value and reconstruct the text of Ulysses from it, i.e. the hash function is irreversible.*

(almost) simultaneously to the same referenced block, which would result in two competing versions of the ledger. To resolve potential disputes in such a situation, the Bitcoin protocol stipulates that the valid version of the ledger is the longest chain of blocks only. Accordingly, when the next block is added to either of the two competing blocks mentioned above, the other one becomes invalid and the transactions bundled in the invalid block are reversed.

2.1.6 Incentivizing honest behavior: the role of game theory

Due to the use of cryptography as described above, any node in the Bitcoin network is *able* to verify the legitimacy of the transactions it receives and *able* to propose changes to the ledger by computing new blocks. But this still leaves open the question of why they should be *willing* to engage in block creation activities and to make sure that only legitimate transactions are included in the ledger. The Bitcoin protocol solves this problem by providing nodes with the proper economic incentives, building on key insights from game theory.

Whenever a node has successfully created a block satisfying the required characteristics, it is granted a certain amount of newly created Bitcoin tokens. The income generated from this so-called coinbase transaction, and any fees a miner might collect from the transactions in their new block, compensates the miners for the work (computing power) they had to invest upfront in order to create the new block. If, however, their block at some point in the future is no longer part of the longest chain, the miners again automatically lose their compensation (and all transactions in the block become reversed). This can happen, for example, because other miners agree that the block contains illegitimate transactions such that these miners choose to extend the blockchain from a different block onward. This easy way of punishment through the (honest) community provides incentives for every individual miner to behave honestly. Specifically, if more than half of the computing power employed in mining is controlled by honest nodes, then the longest chain will eventually be the one containing only legitimate transactions. Behaving honestly therefore is the optimal strategy for any miner who believes that most other miners behave honestly themselves. This establishes a Nash equilibrium where all miners behave honestly. Only if dishonest nodes who cooperate to attack the system control the majority of mining power, illegitimate transactions are sustainable. This incentive structure, referred to as Bitcoin's "proof-of-work" concept, is the key innovation that allows for a fully decentralized verification of transactions in the Bitcoin network.

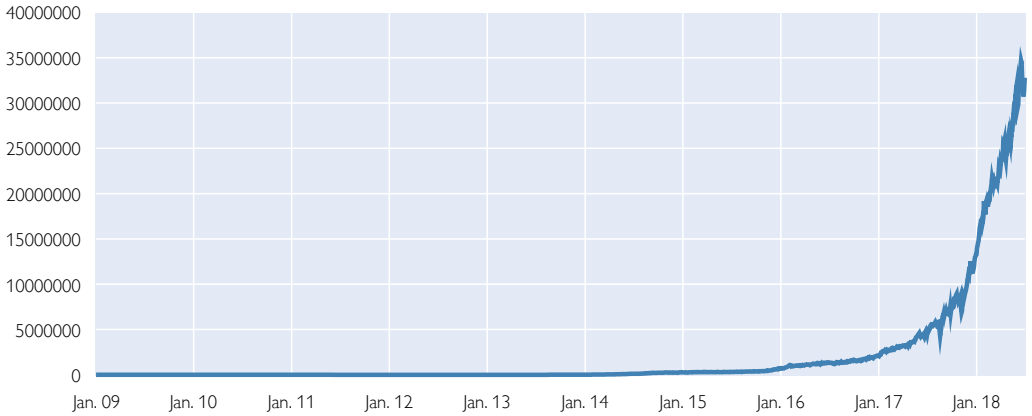
2.1.7 The downside of anonymity and decentralization

While decentralization and anonymity may be appealing at first, unfortunately they come at a high price for society, which is not fully reflected in the price of Bitcoin. To allow for a decentralized consensus, the Bitcoin protocol must ensure that subsequent blocks are not created too quickly, and it does so by dynamically adjusting the difficulty of computing a block. Accordingly, the more aggregate computing power is devoted to mining, the harder it must be to create blocks, and hence the more energy must be devoted to the involved computations in order to keep the expected time between blocks constant at ten minutes. This property, which is key to the functioning of the decentralized consensus mechanism, has led to a massive rise in the energy consumption of the Bitcoin network over the last

Chart 2

Hash rate

Estimated number of tera hashes per second (trillions of hashes per second) that the Bitcoin network performs



Source: www.blockchain.com.

years.[8] By the end of 2018, Bitcoin mining is expected to use 0.5% of the world's energy, which is comparable with the energy consumption of a country like Austria. This massive level of energy consumption exceeds the energy needs of the traditional payment system by several orders of magnitude, and it contributes significantly to environmental pollution and climate change (De Vries, 2018).

2.2 Are privately issued crypto coins the new face of money?

Do privately issued crypto coins such as Bitcoin or Ethereum constitute the new and modern face of money today? To discuss this question in an economic context we need to go back and look at the three fundamental economic functions of money: It is a widely accepted *medium of exchange*, a *store of value* and a *unit of account*. Do private crypto coins fulfill these three functions well?

Looking at the current situation, the quite obvious answer to this question is *no*. First, while crypto coins do technically allow users to exchange value over the Internet, at present they are certainly far from being widely accepted as a means of payment by the general public. It is still almost impossible to use Bitcoins, let alone other crypto coins, for daily purchases of goods and services, except at some small online shops and retailers (who arguably accept these currencies mostly for marketing reasons.) Second, due to their extremely volatile prices, crypto coins do not function well at all as a store of value.[9] In fact, their inherent volatility makes crypto coins attractive means of financial speculation rather than a means of payment. Indeed, empirical evidence suggests that most owners of crypto coins today are hoarding coins in the hope of future price increases rather than using them to make purchases. Finally, hardly anywhere are prices of goods and services denominated and shown in units of crypto coins, i.e. these currencies are not being used as a unit of account. To conclude, privately issued crypto coins clearly do not

[8] *Chart 2 visualizes the energy consumption of the Bitcoin network by showing the number of tera hashes that the network computes per second. Data source: www.blockchain.com.*

[9] *Stablecoins such as Tether (USDT) are a notable exception in this regard. Price stability is achieved, for example, by pegging the crypto coins against the U.S. dollar or other fiat currencies.*

perform the three economic functions of money today, and hence do not qualify as *money* in the economic sense of the term.

There are also good reasons to believe that private crypto coins will never be able to perform all three functions of money well. One reason is their limited scalability. Fully decentralized crypto coins such as Bitcoin are necessarily slow in processing transactions and have limited capacity. This is because – to reach consensus – the current version of the ledger must ideally be exchanged among all users globally before any new transactions are processed. Hence, fully decentralized crypto coins like Bitcoin will never be able to perform instant online payments, which after the full implementation of TIPS will soon be possible in Europe. This limits crypto coins' attractiveness as a means of payment also in the future. From a payment system perspective, crypto coins are thus highly inefficient compared to the systems in place at the moment: they are slow, limited in scale and – given the high energy costs associated with the consensus protocol – very expensive.

2.3 Blockchain applications and the role of cryptocurrencies

Then what is the potential future economic role of private crypto coins? The answer to this question is strongly linked to the future economic potential of fully decentralized (i.e. public) blockchain applications.[10] Various proposals for such applications have recently gained wide attention, including decentral authorization and verification, crypto assets, smart property and smart contracts (see, e.g., Berentsen and Schaer, 2017). Claims have frequently been made that public blockchain technology will fundamentally revolutionize the business world, eliminating the need for trust and making intermediaries such as lawyers or bankers completely redundant.

Even though crypto coins are inefficient for regular payments, they do fulfill a key function in the context of blockchain applications that fiat currencies cannot fulfill. In particular, the consensus mechanism employed in fully decentralized blockchains must necessarily compensate miners through payments in crypto coins rather than fiat currencies. Only in this case can the honest mining community easily punish dishonest miners in case of misbehavior, by simply extending the blockchain from a different block onward, thereby reversing all transactions in the dishonest block including the coin base transaction. If instead miners were compensated in U.S. dollars or euro, block rewards could not be easily reversed. Then, the incentive mechanism keeping up truthfulness in the consensus protocol would not work anymore.[11]

If public blockchain applications indeed revolutionized the business world, then crypto coins that support such applications (e.g. Ethereum) would likely play an important role in the future. However, there are good reasons to doubt that

[10] *It might be useful at this stage to point out that the public discussion – in particular in the media and in business circles – has led to an ambiguous use of the term blockchain. While the major innovation introduced by the Bitcoin blockchain is the feature that the distributed ledger of transactions is maintained in an anonymous and decentralized manner, it has become common in the past few years to use the term blockchain also for distributed ledgers maintained by known and trusted parties. This, however, is a standard case of a distributed database with up-to-date version control, modern cryptography and multiple access by different parties for easy search and update, a technology that has been in place for many years now and is a part of well established, standard modern database technology (see Wattenhofer, 2016). The key innovation of Bitcoin is the feature of anonymous and decentralized trust that emerges from the consensus protocol based on the proof of work (Budish, 2018).*

[11] *This is a severe problem for public blockchains, which are fully decentralized and anonymous, but a lesser problem for private or Consortium blockchains where only selected (known) nodes are allowed to update the ledger.*

this will be the case, because applying a public blockchain outside the domain of crypto coins may well be strongly limited. In a recent article, Budish (2018) analyzes the economic limits of public blockchains. He points out that the deliberate exclusion of trusted central parties is very expensive on top of the high energy costs usually discussed in the context of Bitcoin. This is because the blockchain protocol needs to provide miners with large enough economic incentives to avoid a so-called *majority attack*, where more than half of the computing power is used by cooperating dishonest nodes that seek to manipulate the ledger in their favor. Specifically, the equilibrium block reward paid to miners must be large relative to the one-off benefit of attacking the blockchain (see Budish, 2018, p. 5); the higher the one-off benefit of a possible attack, the higher must be the regular block reward for miners, and thus the higher are the costs of maintaining a public blockchain.

In the case of Bitcoin and other applications where only crypto coins are traded via the blockchain, the one-off benefit of a majority attack is relatively small. After all, the value of the crypto coins would likely collapse to zero after a successful majority attack, so any stolen coins would essentially be worthless. If, however, property rights for assets with a clear fundamental value, e.g. real estate, diamonds or gold, are traded over a public blockchain (in a legally binding way), the benefits of a majority attack will be potentially very large. Even if the crypto coins used on the blockchain become worthless after an attack, the attackers will still be in the possession of valuable real assets. This shows that, for applications beyond crypto coins, the block rewards paid to miners must likely be large relative to the value of the assets traded on the blockchain, which makes solutions based on public blockchains very expensive in most real-world applications. Distributed databases with trusted third parties seem to be cheaper and more attractive for most businesses and also the public sector.

Let us finally note that when access to the blockchain is limited, for instance when anonymous miners are replaced by an authorized consortium of known participants, the size of block rewards necessary to reach consensus in a blockchain could be significantly reduced. However, in this case there is also no longer a compelling reason to compensate miners through crypto coins rather than fiat currencies.

3 Central bank digital currencies

The public hype about crypto coins and the blockchain technology has also spurred a growing international debate about central banks issuing digital currency (CBDC). The key question in this debate is whether the state should provide to its citizens an official digital means of payment similar to banknotes and coins so that online payments do not necessarily have to go through private financial intermediaries. There is a growing literature and also a policy debate on central bank digital currencies. An in-depth discussion of this issue would require a paper on its own and we cannot cover the literature here.

Instead we would like to highlight some of the key issues in the context of our discussion by referring to recent Bank of Canada staff discussion paper by Engert and Fung (2017). This paper provides an in-depth overview of possible motivations for a central bank to issue digital currency and explores the possible implications of such a step, assuming that the central bank issues digital currency in addition to, rather than instead of, coins and banknotes (and central bank reserves).

According to the authors, there are six possible reasons why a central bank might want to make CBDC available to the general public: (1) to ensure adequate central bank money for the public and preserve central bank seigniorage revenue; (2) to reduce the lower bound on interest rates and support unconventional monetary policy; (3) to reduce aggregate risk and improve financial stability; (4) to increase contestability in payments; (5) to promote financial inclusion; and (6) to discourage criminal activity. The authors also clearly point out that a central bank digital currency might also work using current payment system technology and the blockchain technology is not a necessary ingredient of a CBDC.

With regard to advanced economies and in particular Canada, Engert and Fung (2017) consider only one of these six possible reasons for a CBDC to be plausible and well founded: increasing contestability in payments. Providing a digital alternative to banknotes, checks, debit cards and credit cards, they argue, may increase competition and improve the efficiency of existing payment systems.[12] The remaining five possible reasons are not viewed as compelling. The supply of adequate central bank money to the public and central bank seigniorage revenue are both not at risk in most advanced economies, since the value of outstanding banknotes is not declining.[13] Supporting unconventional monetary policy and promoting financial inclusion can be achieved by means other than CBDC in a potentially better way. Finally, according to the authors, the effects of CBDC on financial stability and criminal activity are ambiguous a priori, and likely depend on the specific attributes of CBDC.

The international debate is mostly focused on two different possible implementations of CBDC, reflecting the two popular faces of money we have discussed in the beginning of this article. The first implementation closely mimics physical currency. Proponents of this implementation envision CBDC to become legal tender and to be denominated in the local currency, convertible at par to banknotes and deposits with unrestricted access around the clock for all citizens, anonymous and non-interest-bearing. The second implementation more closely mimics bank deposits. Notably, the central bank is then assumed to pay interest on its digital currency, or even earn interest when it sets negative interest rates.

Regarding the desirability of introducing currency-like CBDC, Engert and Fung (2017) conclude that there will likely be no significant implications for central bank seigniorage revenue, monetary policy or the banking system. There may be some efficiency gains in retail payments, but on the other hand currency-like CBDC would also facilitate criminal activity due to its anonymity features, which in turn would bring about social costs. Regarding the desirability of introducing deposit-like CBDC, Engert and Fung (2017) arrive at a very similar conclusion. Neither will monetary policy be notably affected by interest-bearing CBDC, as the interest paid on reserves and CBDC will likely be similar due to arbitrage opportunities. However, they caution that interest-bearing CBDC might lead to a modest contraction of intermediation and increased financial volatility; the possibility that households and firms can more easily shift from bank deposits to CBDC in times of stress may present a challenge to financial stability.

[12] *However, the resulting benefits may still be small so that efficiency enhancements may not be a sufficient motivation to issue CBDC (Fung and Hallaburda, 2016).*

[13] *Sweden is a remarkable exception in this regard. Globally, the demand for cash is still high. For empirical evidence, see Jobst and Stix (2017).*

Overall, the analysis by Engert and Fung (2017) suggests that the case for introducing CBDC in most advanced economies is not very strong. This assessment is currently shared by most central banks including the Bank for International Settlements (BIS),[14] the Federal Reserve System,[15] and the Bank of Australia,[16] among others. A notable exception, however, is Sveriges Riksbank. Unlike in most advanced economies, currency in circulation in Sweden has steadily declined over the past decade.[17] As Sweden is moving toward a cashless society, the Riksbank has launched a project aimed at examining whether the krona should not only be issued in physical form but also in an electronic form, referred to as the *e-krona*. The e-krona would not replace cash but rather act as a complement to cash, with the main benefit being that *"by functioning independently from the infrastructure used by the commercial bank system, the e-krona system could also make the payment system more robust in the event of disruptions to, for instance, the system for card payments"* (Riksbank, 2017). While it is not yet clear on what technology the digital currency would be based, for example whether it would be based on blockchain technology, the main working principles of a potential e-krona have already been agreed upon. For example, the e-krona would primarily be intended for smaller payments between consumers, companies and authorities, and it would constitute a direct claim on the Riksbank that does not accrue any interest. The Riksbank's investigation into the topic is expected to be finalized by the end of 2019, with one potential outcome still being that the Riksbank could decide not to issue an e-krona after all.

In its March 2018 report from the Committee on Payments and Market Infrastructures and the Markets Committee, the BIS argues that the issuance of CBDC could challenge the two-tier banking system, as it gives the central bank a greater role in credit allocation. This might well impede the use of decentralized knowledge in society and cause economic losses. Moreover, the BIS points out that for currencies widely used in cross-border transactions, the issuance of CBDC would come with international externalities, including first-mover advantages and economies of scale. In some economies, the cross-border availability of a foreign CBDC could lead economic agents to substitute away from the domestic currency, which could pose severe challenges to domestic monetary policy. A CBDC available globally could lead to large international capital movements and thereby affect exchange rates and asset prices in undesired ways. Finally, for token-based CBDC it might become hard if not impossible to impose anti-money laundering regulations or measures to combat the financing of terrorism. All these complications would likely arise if residents and nonresidents would be allowed to hold and transact in CBDC already in normal times, but even more so in times of economic stress and generalized flight to safety.

[14] *See the March 2018 report from the Committee on Payments and Market Infrastructures (CPMI) and the Markets Committee, available at https://www.bis.org/cpmi/publ/d174.htm.*

[15] *See Brainard (2018).*

[16] *See Lowe (2018).*

[17] *In 2017, the average value of banknotes and coins in circulation in Sweden amounted to only SEK 57 billion, while in 2013 the average value was SEK 88 billion. This reflects a decrease of 35% over a five-year period.*

4 Conclusion

Interest in the digitalization of money has received new and strong impulse from the public discussion of Internet-based electronic value transfer systems such as Bitcoin. This focus sometimes makes us forget that a huge part of the money we use in everyday transactions today is already digital money. Still, there does not yet exist a form of digital central bank-issued currency. We discuss the potential of systems like Bitcoin to be useful as such a new form of digital money. Based on a step-by-step analysis of the technology and economics behind Bitcoin, we argue that it is very unlikely that crypto coins like Bitcoin and related systems will be the future face of money because they lack key features of money: They do not simultaneously serve as a medium of exchange, a store of value and a unit of account. Issues of scalability also limit their widespread adoption. This makes crypto coins not very attractive as means of payment. We argue that the future economic role of private crypto coins will be strongly linked to the future economic potential of fully decentralized blockchain applications because this is the context within which crypto coins find their most natural role. We argue that public blockchains are very expensive to maintain not only because of their high energy consumption but also for incentive reasons. This limits public blockchain applications beyond a pure crypto coin context. We finally discuss the potential role for central bank-issued digital currencies. The current discussion suggests that the case for introducing such a currency seems to be not very strong.

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A primer on peer-to-peer lending: immediate financial intermediation in practice

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Peer-to-peer (P2P) lending markets are young but fast-growing. Furthermore, P2P lending competes with traditional bank lending. Several questions arise: How big are fintech credit markets currently? How do the most common P2P lending models work? What are the risks and who bears them? How do platforms try to mitigate information asymmetries between lenders and borrowers? Who is using P2P platforms? Will P2P lending replace traditional bank lending in the future? This article addresses these issues and summarizes the empirical research on the topic, with a particular focus on developments in Austria.

JEL classification: G20, G23, G28
Keywords: fintech, peer-to-peer lending, crowd funding, bank lending

Peer-to-peer (P2P) lending – a subcategory of crowd funding – is a relatively new internet-based financial activity. Borrowers, usually individual consumers or small to medium-sized enterprises (SMEs), apply for loans on a lending platform. Lenders can screen listed loan requests as well as all the information provided by the borrower and then decide whether they want to lend money. Loans usually consist of small contributions from a large number of lenders and are often either short-term or medium-term as well as unsecured.

P2P lending does not involve traditional bank intermediation. Because of this exceptional feature, it has often been argued that P2P lending "disrupts" traditional finance.

Lending platforms advertise their services as having lower costs than traditional banks. The operators of lending platforms argue that they can therefore offer cheaper credit to borrowers while promising higher returns to lenders. The relatively low price for borrowers and high return to lenders constitute the main economic rationales for P2P lending.

However, unlike banks, lending platforms usually do not take on any credit risk. It is the participants in P2P transactions themselves who bear these risks. Thus, in contrast to traditional saving, P2P lending is essentially fixed-income investing with real risks to both capital and interest.

Fintech credit markets (of which P2P lending is just one form) are young, yet fast growing. In some European countries, the annual growth rates of these markets have exceeded 100% (CCAF, 2016d). Moreover, P2P lending competes directly with traditional bank lending. These observations raise numerous questions.

How big are fintech credit markets? How do the most common P2P lending models work? What are the risks and who bears them? How do platforms try to mitigate information asymmetries between lenders and borrowers? Who is using P2P platforms? Will P2P lending ultimately replace traditional bank lending, as some authors (e.g. McMillan, 2014) speculate? This article addresses these questions and summarizes the empirical research findings.

P2P lending is just one way of investing online. Further possibilities include various other forms of crowd funding, online real estate lending and invoice trading. Box 1 provides a short description of the different forms of fintech credit activities

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Box 1

Definitions of various components of fintech credit markets

- *P2P consumer lending: individuals or institutions provide loans to individuals*
- *P2P business lending: individuals or institutions provide loans to businesses (often SMEs)*
- *P2P real estate lending: individuals or institutions provide loans secured against property to consumers or businesses*
- *Equity-based crowd funding: investors purchase equity issued by businesses*
- *Real estate crowd funding: individuals or institutions invest in real estate*
- *Reward-based crowd funding: contributors expect to obtain nonmonetary rewards*
- *Donation-based crowd funding: donors have philanthropic motives and do not expect any monetary or nonmonetary returns*
- *Profit-sharing crowd funding: investors purchase securities from a business and share in its profits*
- *Debt-based securities: individuals or institutions invest in debt-based securities at a fixed interest rate*
- *Balance sheet consumer lending: platform entity lends directly to consumers and holds loans on its balance sheet*
- *Balance sheet business lending: platform entity lends directly to businesses and holds loans on its balance sheet*
- *Invoice trading: businesses sell invoices or receivables to individuals or institutional investors at a discount*
- *Pension-led funding: SME owners/managers invest their accumulated pension funds in their own business*
- *Community shares: investment into community shares issued by cooperative societies, community benefit societies and community-based charitable organizations*
- *Mini-bonds: bonds marketed directly to investors and not listed on any stock exchange*

currently available on the market. The taxonomy essentially follows Cambridge Centre for Alternative Finance (CCAF) (2016a to 2016d) definitions.

This article focuses on P2P consumer and business lending since these segments of fintech credit markets compete most directly with traditional bank lending[2]. However, most of the statistics presented here also contain information about the other fintech credit markets in order to facilitate comparing P2P consumer and business lending with other fintech credit activities.

This article is structured as follows. Section 1 describes and compares the size and scope of fintech credit markets of major economies and economic areas. Section 2 compares traditional bank lending with P2P lending. Section 3 describes how lending platforms try to cope with problems of information asymmetry, which accompany any form of lending. Section 4 summarizes what is known about users of P2P platforms, and section 5 outlines the regulatory framework concerning fintech and P2P lending in Austria. The final section presents some thoughts on the future of P2P lending.

1 Fintech credit markets

P2P lending began in 2005, when Zopa, the first P2P platform worldwide, started offering loans to U.K. consumers. In early 2006, the U.S. lending platforms Prosper

[2] *These are also the fintech credit market segments that are relevant for Austria; according to CCAF (2018), donation-based crowd funding in Austria amounted to EUR 300.000 in 2016, while some of the fintech forms mentioned in box 1 were non-existent.*

and Lending Club started business, with many others following. Ten years later, in 2015, there were more than 370 P2P platforms in China, over 140 in the U.S.A., over 90 in the U.K. and more than 220 in the rest of Europe (CCAF, 2016a to 2016d).

Fintech credit is a recent phenomenon. As a result, no detailed official statistics are available about fintech credit activities. Probably the most comprehensive data have been collected by the Cambridge Centre for Alternative Finance (CCAF). These data come primarily from responses to electronic surveys the CCAF sends out to P2P platforms. The CCAF carefully validates these self-reported data and uses secondary data sources and web scraping methods to verify and complement the reported survey data. Most of the statistics presented in this article have been compiled from various reports released by the CCAF.

Table 1 shows market volumes of fintech credit for China, the U.S.A., the U.K. (the three largest markets) and Europe (without the U.K.). All figures are for 2016, the most recent year for which comparable figures for all markets are available.

As table 1 shows, China is by far the largest fintech credit market, followed by the U.S.A. and the U.K. It is striking that in China, the volume of equity-based crowd funding is significantly smaller than that of funds available for P2P lending. In its 2017 Financial Sector Assessment Program, the IMF attributed this fact to regulatory gaps and recommended that securities regulators prioritize work on equity crowd funding.[3] Taken together, the European fintech markets (without the U.K.) had a volume of about EUR 2 billion in 2016 and were still considerably smaller than the U.K. market.

In all four economic areas, P2P consumer lending is typically the most important type of fintech credit. In the U.K. (albeit only there), P2P business lending is slightly higher than P2P consumer lending in terms of volume. Balance sheet business and consumer lending, on the other hand, are important in the U.S.A. and China. Crowd funding activities and invoice trading also contribute substantially to the total volume of fintech credit.

Table 1

Market volumes of fintech credit in 2016

	Europe	U.K.	U.S.A.	China
	EUR million			
P2P consumer lending	697	1325	17601	113897
P2P business lending	350	1396	1084	48532
P2P real estate lending	95	1300	834	5873
Equity-based crowd funding	219	308	458	384
Real estate crowd funding	109	80	673	67
Reward-based crowd funding	191	54	460	1685
Donation-based crowd funding	32	45	187	92
Profit-sharing crowd funding	8			75
Debt-based securities	23	90		209
Balance sheet consumer lending	17		2419	7883
Balance sheet business lending	59		5005	22923
Invoice trading	252	512		1919
Pension-led funding		27		
Community shares		50		
Other models			40	1919
Mini-bonds	10			
Total	2062	5188	28761	205455

Source: Cambridge Centre for Alternative Finance, authors' calculations.

Table 2 focuses on the European markets without the U.K. Overall, France is the biggest fintech credit market in continental Europe, followed by Germany and the Netherlands. Again, P2P consumer lending is the largest segment in many markets. Exceptions are the Netherlands and Spain, where P2P business lending is strong. Austria is another notable exception. In Austria, there is no classical P2P lending at all, and almost all fintech credit comes

[3] *See IMF (2017), table 9: Detailed Assessment of Implementation of the IOSCO Principles.*

Table 2

Fintech credit volumes in selected European countries in 2016

	France	Germany	Nether-lands	Nordic countries[1]	Spain	Italy	CESEE[2]	Austria
	EUR million							
P2P consumer lending	179.00	181.50	0.14	67.00	2.00	25.30	128.05	
P2P business lending	70.90	23.30	132.08	55.00	44.50	6.10	9.57	
P2P real estate lending							0.00	
P2P property lending				56.00			39.00	
Equity-based crowd funding	43.30	47.40	27.15	75.00	10.10	1.70	1.63	4.00
Real estate crowd funding	48.00	12.60		26.00	26.00		6.09	0.70
Reward-based crowd funding	51.70	31.70	9.40	22.00	13.60	20.00	9.32	3.90
Donation-based crowd funding	0.03	15.10	5.78	2.00	3.20	0.40	3.11	0.30
Profit-sharing crowd funding	0.37	0.29					0.00	7.70
Debt-based securities	6.70		14.98	0.30			0.80	
Balance sheet consumer lending					16.00		0.34	
Balance sheet business lending		10.00	4.00		0.10	40.00	0.40	5.00
Balance sheet property lending					1.00		0.00	
Invoice trading	45.00		0.67	19.00	14.40	33.60	17.74	
Mini-bonds	9.00						0.57	
Total	454.00	321.89	194.20	322.30	130.90	127.10	216.62	21.60

Source: Cambridge Centre for Alternative Finance, authors' calculations.

[1] *Denmark, Finland, Iceland, Norway and Sweden.*
[2] *Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.*

from crowd funding and balance sheet lending. We turn to Austria in more detail in section 5. (For information on fintech markets in Central, Eastern and South-eastern European (CESEE) countries, see Stern (2017).)

How big is fintech credit relative to traditional bank lending? The third row of table 3 shows fintech credit volumes, outstanding bank credit to nonmonetary financial institutions and the size of fintech credit relative to outstanding bank credit to nonmonetary financial institutions in 2016 for France, Italy, Spain, Germany and Austria. The figures show that fintech credit markets, when compared this way, are extremely small. The same is true for the much bigger U.K. fintech credit market, where the market share of fintech credit in lending to the private sector is just 0.4% (Milne and Parboteeah, 2016).

The last row of table 3 shows P2P consumer lending volumes, bank credit to consumers and the size of P2P consumer lending relative to bank credit to consumers in percentage terms for 2016. The percentage values are, once again,

Table 3

Fintech credit relative to bank lending as of end-2016

	France	Italy	Spain	Germany	Austria
Total fintech credit (EUR million)	454	127.6	131	321.9	21.6
Bank credit to non-MFIs (EUR million)	2220649	1627141	1249381	2511991	308266
Relative size of fintech credit (%)	0.020	0.008	0.010	0.013	0.007
P2P consumer lending (EUR million)	179	25.3	2	181.5	0
Bank credit to consumers (EUR million)	152596	86526	69214	184273	18924
Relative size of P2P consumer lending (%)	0.117	0.029	0.003	0.098	0.000

Source: Cambridge Centre for Alternative Finance, ECB, authors' calculations.

extremely low, but for most countries, the relative size of P2P consumer lending compared to the size of consumer credit markets is somewhat bigger than the relative size of total fintech credit compared to the size of private sector credit.

2 Bank lending and P2P lending

As mentioned above, P2P consumer and business lending are the most important forms of fintech credit in most countries. This section explains P2P lending in more detail and compares it with traditional bank lending. We start by briefly discussing some important aspects of debt to better illustrate the main issues involved in lending and to identify the major advantages and disadvantages of P2P and bank lending.

Debt entails a promise to repay the principal amount and the interest on a loan. The fulfillment of such a promise is always uncertain, to some extent. Loan agreements include, inter alia, provisions on quantity, interest (fixed or variable), maturity, collateral, default events, seniority of the claim, transferability of debt as well as call provisions (early repayment). As a result, loan agreements are highly complex and inevitably incomplete, since not all possible circumstances can be covered (see Davis (1995) for an in-depth discussion).

As already mentioned, debt always involves a certain amount of risk. For instance, a borrower might default, or inflation might unexpectedly change the real value of repayments. Furthermore, lenders and borrowers have different priorities, with lenders wanting high returns, low risk and liquidity, and borrowers prioritizing low costs and long borrowing periods.

Moreover, there is always information asymmetry between borrowers and lenders. Lenders do not know whether a potential borrower is a low risk or a high risk. Interest rates reflecting the average quality of high- and low-risk borrowers may therefore attract too many high-risk borrowers. This is the problem of adverse selection. Furthermore, once the loan has been granted, the lender does not know whether the borrower is acting against the lender's interests. This is the problem of moral hazard in lending.

2.1 Traditional bank lending

How do traditional banks organize lending? They take advantage of economies of scale. Banks transform many small and often short-term funds made available to them (e.g. via deposits) into loans which are made available to borrowers for longer terms (i.e. maturity transformation). Funds and loans appear on banks' balance sheet, with funds being listed as liabilities and loans as bank assets. This way, banks take on credit risk. On the other hand, the risk for depositors is usually limited because deposits are typically insured (up to a certain amount).

Depositors and borrowers profit from maturity transformation. Depositors earn interest and can access their funds instantly, a possibility that creates liquidity. The provision of liquidity works because the daily inflows and outflows of funds become highly predictable for the bank when the number of deposits is high. The advantage for borrowers is that they have access to long-term loans. Furthermore, by pooling many small deposits, banks can offer borrowers much larger loans than any single individual depositor may wish to lend.

Banks also reduce the credit risk in lending through specialized knowledge and diversification. They employ specialized staff to assess the riskiness of loans and to

monitor borrowers after loans have been granted. Performing due diligence before selecting creditors helps reduce credit risk and thus increases the bank's expected profits. Moreover, besides increasing private profitability, due diligence also improves social welfare as it contributes to a more efficient allocation of capital within the economy. Banks usually require collateral to further reduce credit risk. This way, bank intermediation mitigates adverse selection and moral hazard problems. Banks also reduce risk via diversification, i.e. by lending to a large variety of borrowers with different risk characteristics; this is called risk transformation.

2.2 P2P lending models

Most loans funded via P2P platforms are unsecured. Therefore, such loans are not backed by collateral or covered by deposit insurance. The P2P platform matches lenders and borrowers, and the lender directly enters into a loan agreement with the borrower, with no bank serving as an intermediary.

Most P2P lending platforms operate under one of the following business models: the original P2P lending model, P2P lending with bank funding or P2P balance sheet lending. The original P2P model prevails in countries like the U.K., where granting P2P loans does not require a banking license. Bank-funded and balance sheet P2P lending prevails in countries such as Germany and the U.S., where loan origination requires a banking license.

In the original P2P model, the lending platform matches borrowers and lenders, transfers money from lenders to borrowers after loan origination, and facilitates interest and redemption payments. As already mentioned, the P2P platform provides loan services for lenders and borrowers, but it does not take on any credit risk. The transaction fees it charges to lenders and borrowers are typically its main source of income.

In bank-funded P2P lending, the P2P platform also matches borrowers and lenders, but the loan is originated by a funding bank, with the borrower signing a promissory note to the bank. The bank originates the loan and immediately sells it to the platform, which on its part buys it with the money of the lenders. The borrower makes loan repayments to the platform, which then transfers the money to the lenders. In this case, the bank and the platform both act as intermediaries and do not take on credit risk. In the event of the borrower defaulting, the platform has no obligation to compensate the lender's losses.

Balance sheet lending comes closest to traditional bank lending. It differs from the two previously discussed strategies in that the P2P platform originates the loan and keeps the loan on its balance sheet. Thus, while the platform faces credit risk, it also profits from both the fee payments and the interest payments accruing over the life of the loan.

In their early days, P2P lending platforms often used some type of auction model, where the lenders themselves would determine the interest rate on a specific loan. This appears to have changed. Now, most leading P2P platforms set interest rates according to their own risk assessment of the borrower.

The innovation of these various P2P lending models lies in their direct alignment of borrowers and lenders, i.e. in the absence of a trusted third party. The platform acts merely as an exchange and does not perform either due diligence or any other intermediary functions, such as transformation of risk or maturities. Before the Internet enabled the existence of this technology, the transaction costs

of such an alignment process would have had a deterrent effect; even regulated exchanges such as stock markets relied on the services of brokers, who commissioned heavy fees. Searching for individual lenders, presenting a business case to each of them or providing any requested information in due time and in adequate quality would have given rise to additional expenses, thus exceeding the cost of traditional bank loans. Agrawal et al. (2014) argue that venture capital funding used to be geographically concentrated because proximity could help reduce related transaction costs. For potential lenders, the search for investment opportunities would have been much more time-consuming. Modern information technology allows a swift exchange of data and reduces search costs significantly. For lenders who are willing to do without deposit insurance, P2P lending offers an alternative to bank accounts. In the next section, we will discuss how P2P platforms try to reduce the risks for their lenders.

3 P2P platform strategies for mitigating risk and information asymmetries between borrowers and lenders

As outlined above, information asymmetries in lending create risks. In their capacity as financial intermediaries, banks apply their specialized knowledge in credit risk assessment and monitoring to manage such risks. To attract business and compete with traditional banks, P2P lending platforms must also offer ways to reduce adverse selection and moral hazard problems.

P2P platforms pursue various strategies to assess and reduce the risks for their customers. When a borrower contacts a P2P lending platform and applies for a loan, the platform usually performs its own credit risk assessment before listing the loan application. Such an assessment usually includes checks on the borrowers' identity, their credit references and any potential fraud history. The U.K. platform Zopa, for example, collects information about borrowers' credit history from two different credit reference agencies. Approval rates, as reported by the members of the Peer-to-Peer Finance Association (P2PFA, a U.K. self-regulatory body), are around 10% to 25% (Oxera, 2016). Austrian law[4] requires that P2P platforms publish the criteria according to which they select potential borrowers on their websites.

Most P2P platforms also provide "hard" information about borrowers as a way of supporting lending decisions. For instance, Prosper, the largest U.S. P2P lending platform, posts credit agency score information derived from its own scoring system as well as credit history, debt-to-income ratios and homeowner status of borrowers. Sharing information about borrowers' credit histories can be in the interest of competing lenders, as shown by Gehrig and Stenbacka (2007).

The South Korean P2P platform Popfunding has implemented a voting process. Over a period of a few days, investors can vote whether a borrower can be expected to repay the requested loan. The platform then makes the voting outcome available to investors. Yum et al. (2012) find that the voting process has a big impact on the probability of funding where there is no available credit history. Where historical information is available, however, voting does not have any significance, because then lenders rely predominantly on their own judgement of "hard" information.

[4] *See Alternative Financing Act (Alternativfinanzierungsgesetz), Article 5 para 3.*

Borrowers themselves may also provide specific information to lenders. Such information typically consists of descriptions of the loan purpose, personal information and pictures. On Prosper, borrowers can also join social media groups. Information of this kind is "soft" and cannot be easily verified.

The question of whether "soft" information is useful for investors has provided impetus for empirical research. The results are mixed. Using data from Prosper, Iyre et al. (2016) have investigated whether "soft" information helps in screening borrowers' creditworthiness, finding that it contributes to predicting their probability of default.

Also analyzing Prosper data, Freedman and Jin (2017) conclude that Prosper's social networks may help in screening and monitoring loans, but lenders seem to have difficulties in distinguishing between high- and low-quality social networks. They find that borrowers with social ties obtain funding more easily and at lower interest rates but default more often than borrowers without social ties.

As mentioned above, borrowers can post their pictures as a means of underscoring trustworthiness. Duarte et al. (2012) find that trustworthy appearance matters because it raises the chance of obtaining a loan and of paying lower interest rates. The authors also find that more trustworthy-looking borrowers have better credit scores and lower default rates on average.

In an experiment, Gonzalez and Loureiro (2014) tried to find out which attributes of a picture determine whether a loan request is successful. The results suggest that age plays a key role. Older persons are perceived to be more competent than younger persons, who tend to be penalized. Persons that are more attractive are also penalized by lenders of the same gender, resulting in a "beauty is beastly" effect[5]. There does not appear to be a gender effect when receiving funding (Barasinska and Schäfer, 2014), but Pope and Sydnor (2011) have found discrimination against black people on Prosper.

Dorfleitner et al. (2016) analyze how "soft" information contained in the descriptions of loan applications on two large German P2P platforms, Smava and auxmoney, affects both the probability of successful loan funding and the default probability on existing loans. They find that investors appear to be able to identify creditworthy borrowers with "soft" information when little or no "hard" information is available. Where such "hard" information is available, however, "soft" information becomes unimportant. Furthermore, in contrast to the findings of Iyre et al. (2016), "soft" information and default probabilities seem to be largely unrelated.

As diversification reduces risk, P2P platforms advise investors to lend smaller amounts to numerous individuals or projects. Zopa, for instance, offers a computerized strategy where a single investment is broken down into smaller units that are then spread over multiple loans. Repayments can be either automatically reinvested in new loans or withdrawn. On Prosper, investors can either decide themselves or set criteria for automatic investment, such as Prosper ratings and loan terms. The invested sum is then spread over multiple loans using computerized matching. The German platform auxmoney offers a Portfolio Builder software

[5] *This negative beauty premium has been empirically corroborated in labor economics and behavioral finance; it is based on the statistical discrimination models developed by Edmund Phelps and Kenneth Arrow in the 1970s. People who have to make a decision based on insufficient observable information seem to take any additional available information into account, regardless of whether or not it is relevant.*

that automatically diversifies an invested amount over certain auxmoney score classes based on a strategy defined by the investor.

A number of P2P platforms have a buffer fund, which is financed by a small amount of money going into it each time a P2P agreement is concluded. Such funds are meant to help compensate lenders for losses arising from default. Buffer funds mitigate risk but also reduce the returns for lenders. Furthermore, under adverse economic conditions, a buffer fund may be depleted and may not be able to cover all losses. In such a case, the lender faces credit default risk, although in some arrangements, default risk is shared among all investors.

As already mentioned, P2P lenders face a liquidity risk because loans usually have a duration of several years. As a result, some platforms provide a secondary market where investors can sell their loan obligations if they need liquidity. Liquidity does not come for free, of course. Platforms charge for secondary market access, and investors may also face losses in times of unfavorable interest rate developments. Oxera (2016) reports that secondary markets are rarely used by P2P lenders in the U.K.

Lenders also bear the risk of the lending platform failing and going out of business. In the U.K., for instance, platforms need to ensure that the fees they charge are sufficient to cover the costs of servicing loans. Resolution plans that describe how remaining loan repayments will be collected in case of failure must be in place, and minimum capital requirements specified by the regulators must be fulfilled. The specific regulatory requirements that apply in Austria are discussed in section 5.

At the end of this section, we turn to the issue of herding behavior in P2P lending. Herding effects occur when lenders imitate the investment behavior of other lenders. Such behavior may be caused by a desire to minimize search costs, but even more so by a pronounced information asymmetry between borrowers and lenders, as is the case in P2P lending. The main problem with herding is that lending decisions may largely cease to be based on borrowers' riskiness. A herding strategy can sometimes yield success, but it also means that an overall careful screening of borrowers is foregone, which may lead to higher default rates and generally to more financial instability (Käfer, 2018). Although herding behavior may be rational from the perspective of the individual investor, in aggregate it undermines the information-generating and -processing capacities of financial markets assumed in the efficient market hypothesis. Even if viewed from a purely theoretical perspective, in the case of herding, prices do not reflect all the information available in the market but merely the prevailing sentiment of market participants.

Herding behavior can occur at both the micro-listings level and at the platform level, as demonstrated by empirical studies. Wang and Tu (2016) examine data from the large Chinese P2P platform PPDai, finding herding effects in the choice of both borrowers and listings. Liu at al. (2015), also using PPDai data, find that herding works in part through online friendship opportunities offered by the platform. Using data from the U.S. platform Prosper, Greiner (2013) finds that herding existed as long as the platform used an auction model but diminished with the switch to a fixed-price model, where interest rates are pre-determined.

Jiang et al. (2018) examine data from 127 Chinese P2P platforms, finding that herding also exists at the platform level. Platforms with a larger number of initial

investors tend to attract more subsequent investors, too. Interestingly, the authors also find that government regulatory events in 2014 led to a subsequent decrease in herding. Furthermore, they conclude that platform attributes such as operation time and the composition of participants reduce herding behavior, whereas accumulated investment amounts and market share increase herding behavior at the platform level.

4 Users of P2P lending platforms

The impressive growth rates of credit granted via P2P lending platforms indicate that these platforms are indeed attractive for both lenders and borrowers. But do platform users differ from traditional bank customers?

4.1 Lenders

A CCAF report from 2017 (CCAF, 2017a) contains survey results concerning U.K. lenders. Over 2.5 million individuals and about 2,500 institutions (e.g. banks, asset managers, pension funds, mutual funds, etc.) in the U.K. used P2P platforms in 2016. About half the investors used two or more P2P platforms. Around one-quarter of lenders were female. The main motive reported by investors is financial returns, while control of the money's destination, support of alternatives to big banks and other social motives appear to be far less important.

U.K. online investors appear to be well educated, with the majority having an undergraduate degree or higher. Older lenders use P2P platforms more often than younger lenders. About 67% of U.K. online business lending and about 66% of P2P consumer lending in 2016 came from lenders aged 55 or over. Only in real estate crowd funding and equity-based crowd funding was the majority of lenders under 55.

The time spent on selecting a deal in investment-based crowd funding is between 20 minutes to one hour per week. In contrast, lenders spend little time on P2P consumer lending. Most lenders rely on computer-based selection models. If no such model is available, a mere 13% spend 20 minutes or less per week to invest in consumer credit.

Institutional investors have become important in P2P lending. In European markets, the share of institutional funding in P2P consumer lending went up to 45% in 2016, and P2P business lending rose to 29% in 2016 (CCAF, 2018). In 2016, figures for the U.K. were 32% in P2P consumer lending and 26% in P2P business lending (CCAF, 2017a). In the U.S.A., the share of institutional P2P funding is even higher. In 2016, institutional funding shares in P2P consumer lending and P2P business lending were 70% and 67%, respectively (CCAF, 2017b).

4.2 Borrowers

Currently, there is little empirical research on the characteristics of online borrowers. De Roure et al. (2016) use data from the largest German platform, auxmoney, to compare P2P lending with traditional consumer lending. They find that online borrowers are riskier for lenders than bank borrowers. Auxmoney's interest rates, which are above bank interest rates, reflect this higher risk. Moreover, auxmoney tends to lend more where banks would lend less. The authors conclude that auxmoney attracts mainly high-risk borrowers that are not served

by banks. Using data from the Lending Club platform, Jagtiani and Lemieux (2017) obtain similar results for U.S. borrowers. According to their findings, online borrowers have significantly higher debt-to-income ratios than U.S. consumers overall. Lending Club borrowers are also less likely to own a home. Just like auxmoney, Lending Club tends to provide credit to borrowers who cannot easily obtain bank credit. Lending Club interest rates are higher for such borrowers, but the authors find that these rates appear to properly reflect the related credit risk. In contrast, in an earlier study, Emekter et al. (2015) found that Lending Club interest rates were too low to compensate for higher probabilities of credit default.

Wiersch et al. (2016) focus on U.S. SMEs that try to borrow online. The authors use the results from the Federal Reserve's 2015 Small Business Credit Survey (SBCS) to compare U.S. small businesses that use P2P platforms to obtain credit with small businesses that use traditional bank credit. They find that businesses that try to borrow online are typically smaller, younger and less profitable than those that borrow from banks. The main reasons for these businesses borrowing online are coverage of operating expenses and refinancing of debt.

Findings from a survey of business borrowers on the U.K. platform Funding Circle (CEBR, 2016) suggest that the main influencing factors for SMEs borrowing online are speed (31%), simplicity (28%) and competitive interest rates (11%).

5 The regulatory framework for P2P lending in Austria

In Austria, P2P lending and, more generally, online funding play a minor role (see table 3). The total market volume of all online alternative funding was a mere EUR 3 million in 2014, but grew to EUR 22 million in 2016 (CCAF, 2018). One of the reasons for this increase in online finance can be found in the 2015 legal changes, e.g. the enactment of the so-called Alternative Financing Act (Alternativfinanzierungsgesetz – AltFG). The new law aims to allow for more P2P lending via online platforms without compromising investor protection.

Under the Capital Market Act (Kapitalmarktgesetz – KMG), any issuer is obliged to prepare a prospectus if he wants to raise capital of more than EUR 250,000 in a public offering. The prospectus should contain all the information considered relevant for investors. The costs of a prospectus for the issuer have been stated at approximately EUR 50,000, which is a rather prohibitive sum for most SMEs. These costs include the fees for control and approval as well as for legal, accounting and tax consulting services.

Several studies have observed the lack of an appropriate market for risk capital in Austria (for an overview, see Jud et al. (2013)). In December 2014, several market participants and interest groups published a common position paper with proposals for improving the legal framework for alternative SME financing in Austria. Among these proposals was the lowering of the legal threshold for preparing a prospectus (for other proposals on alternative finance, see box 1 in OeNB, 2018).

The AltFG's enactment in September 2015 reflects the government's intention to simplify the rules for P2P lending to SMEs while at the same time upholding the high standards of investor protection, especially retail investor protection. The AltFG redefined the contents of prospectuses for smaller issuances, established new rules for investor protection and specified the requirements applicable to online P2P lending platforms.

Now, to raise less than EUR 1.5 million, SMEs are no longer required to prepare a prospectus, but have to prepare a document that must include information about the issuer (address, legal form, majority owners, type of business, etc.), the issued financial instrument (legal form, price, maturity, fees, etc.) and certain clauses for investor protection. For issuances between EUR 1.5 million and EUR 5 million, the AltFG obliges issuers to publish a prospectus as defined in Annex F of the KMG, a so-called "prospectus light," which contains less information than a fully-fledged prospectus and is not subject to approval by the supervisory authorities; hence, its preparation is less costly. The local authorities are responsible for the enforcement of these rules. If more than EUR 5 million are to be raised via an online platform, the issuer has to publish a fully-fledged prospectus.

If the financial instruments issued by an SME are bonds or stocks, the prospectus is still subject to the approval of the Austrian Financial Market Authority (FMA). In addition, the issuing SME has to publish an annual financial statement (which is not always obligatory for smaller SMEs). The threshold for the requirement to publish a prospectus as defined in Article 2 KMG for the issuance of equities and bonds is EUR 250,000.

In April 2017, the Austrian Supreme Court of Justice ruled that any issuing of alternative financial instruments is subject to some obligatory publication of information, and that this obligation also applies to subordinated loans, as most investments via P2P platforms are conducted in the form of subordinated loans.

With respect to investors, the AltFG defines two groups: the professional investor who is highly experienced in financial markets and who has significant net assets, and the ordinary retail investor. The law treats institutional investors as professional investors because their experience and their liquidity should enable them to assess and bear the risks implied by their investment.

On the other hand, the legislators consider the capacity of retail investors to bear the risk of P2P lending with respect to both loss absorption and liquidity (see section 3) to be more limited. Therefore, any investment by retail investors is limited to 200% of their monthly net income or 10% of their net financial assets. It should be noted that these limits not only protect investors but also serve the interest of SMEs searching for a stable investor base, which would be negatively affected if their investors were very vulnerable to liquidity shocks.

Online P2P platforms that match investors with issuing SMEs are legally obliged to have general liability insurance, and they must identify the real issuers to prevent money laundering. P2P platforms must publish information on their legal form and their ownership structure as well as on their fees and their selection criteria for potential issuers. The platform's operators must not issue their own financial instruments via the platform, and they are obliged to inform any investor that the investment bears the risk of total loss.

According to the Austrian Federal Economic Chamber, 13 domestic P2P platforms are currently active in Austria. The majority offer crowd funding for start-ups or SMEs, with some also funding real estate projects and a few focusing more on donation-based NGO projects. Additionally, four international platforms are active in Austria, operating under a reward-based P2P model.

In June 2018, the Austrian government proposed changes to the AltFG. According to these proposals, P2P lending via online platforms should become available to all companies, not just SMEs, and the thresholds for the obligatory

Table 4

Volume and growth rates of P2P consumer and business lending in selected countries

		2013	2014	2015	2016
France	P2P consumer lending	*EUR million*			
		43	80	134,7	179
		Growth rate in %			
			86.0	68.4	32.9
	P2P business lending	*EUR million*			
		0,2	8,1	28,2	70,9
		Growth rate in %			
			3950	248.1	151.4
Germany	P2P consumer lending	*EUR million*			
		36,4	80,4	136,4	181,5
		Growth rate in %			
			120.9	69.7	33.1
	P2P business lending	*EUR million*			
			6,1	48,7	23,3
		Growth rate in %			
				698.4	–52.2
U.K.	P2P consumer lending	*GBP million*			
		287	547	909	1169
		Growth rate in %			
			90.6	66.2	28.6
	P2P business lending	*GBP million*			
		139	749	881	1232
		Growth rate in %			
			438.8	17.6	39.8
U.S.A.	P2P consumer lending	*USD billion*			
			7,6	18	21,1
		Growth rate in %			
				136.8	17.2
	P2P business lending	*USD billion*			
			0,976	2,6	1,3
		Growth rate in %			
				166.4	-50.0
China	P2P consumer lending	*USD billion*			
		3,85	14,3	52,44	136,5
		Growth rate in %			
			271.4	266.7	160.3
	P2P business lending	*USD billion*			
		1,44	8	39,6	58,2
		Growth rate in %			
			455.6	395.0	47.0

Source: Cambridge Centre for Alternative Finance, authors' calculations.

publication of a prospectus and "prospectus light" should be raised in accordance with the new EU prospectus regulation. As the legislative process is still ongoing at the time of writing, we cannot asses the effects of these changes.

6 Outlook

For several reasons, any statements about the future of P2P lending must remain highly speculative at this point. First of all, the industry is still very young. After an initial boom phase, it now appears to be in a state of consolidation.

In the U.K., for instance, the number of new platforms entering the market has declined sharply since 2014, and 35 platforms are now most probably inactive. Furthermore, some (often smaller) platforms have failed. The most likely reasons for this development are problems with risk assessment processes leading to unacceptable default rates, difficulties in finding quality borrowers and the inability to comply with regulatory rules (see Oxera (2016) for further details). A similar trend of declining entry rates of new platforms can be observed in the U.S. market (CCAF, 2017b).

More generally, growth of P2P credit volume has slowed down in many important markets. Table 4 summarizes the development of growth rates in P2P consumer and business lending for the U.S.A., the U.K. and selected large European economies.

Another factor that makes predictions difficult is the rather special economic environment in which most P2P platforms started. Many central banks responded to the last, extraordinarily deep economic crisis by setting extremely low or even zero nominal interest rates. Moreover, banks consolidated their balance sheets, which reduced credit supply, even in the case of acceptable credit risks. In such an environment, P2P platforms were able to promise attractive rates of return to lenders. Whether lending platforms are able to compete with traditional banks in "normal" times remains to be seen. It also remains to be seen whether P2P lending is mainly just a substitute for bank credit in times of crisis (Havrylchyk et al., 2018) or whether it truly expands credit to more risky borrower classes that would not be served by banks otherwise.

Another great unknown is the performance of credit scoring models used by online lenders over the credit cycle. Only very few P2P platforms (i.e. Zopa, Lending Club, Prosper) were already in operation during the last crisis. Moreover, at that time, they operated at a small scale and in borrower segments that may not represent important future borrower segments. The historical experience is thus very limited.

More generally, there are issues related to scalability (i.e. profitability and efficiency at growing lending volumes). Will there be enough lenders to make, or keep, P2P lending profitable when economic conditions worsen and credit risk increases? In a similar vein, will the costs of funding in P2P lending remain competitive when interest rates rise and adverse selection becomes more severe?

Which trends are visible at the moment? As already mentioned, institutional investors increasingly use P2P platforms to connect with borrowers. Furthermore, balance sheet lending is becoming more common. This usually requires the platform to have a banking license, but in that case, income is generated not just from fees but also from periodic interest rate payments. Hence, the original P2P lending concept seems to move more in the direction of traditional bank lending with more sophisticated interfaces available to borrowers.

A possible scenario for the near future may be that P2P platforms engage mostly in bank-type balance sheet lending, with banks cooperating with lending platforms or running platforms themselves and with pure P2P platforms serving certain niche markets.

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How Austrians bank and pay in an increasingly digitalized world – results from an OeNB survey

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The digital transformation in banking and payments has important consequences both for the financial industry and for consumers. Nevertheless, there has been limited empirical evidence about the diffusion of financial innovations among consumers in Austria. This paper presents the results of a nationally representative survey. The survey covers questions about how Austrians conduct banking, their use of innovative payment methods and services/products in the realm of financial technologies (fintech) as well as their ownership and awareness of crypto assets. Regression analyses are conducted to identify drivers of adoption of such services and products. The key variables across products are trust in the safety of a product, age, financial risk tolerance and interest in technology. Overall, the results reveal that the way Austrians bank and pay has been changing considerably. In particular, 58% of Austrians aged 14 or over use online banking and 36% use their mobile devices for banking activities. Contactless payments (without entering a PIN) are conducted by roughly one-half of Austrians. The use of several fintech services/products and ownership of crypto assets (2%) is confined to a much smaller share of Austrians. Despite the relatively widespread use of digital banking and payment products/services, the results also show that a sizeable share of the population does not use innovative financial products, still visits bank branches and has a preference for using cash for daily purchases. Also, an overwhelming majority of Austrians (including those who use financial innovations) want cash to remain.

JEL classification: E41, G20, O31, O52
Keywords: financial digitalization, banking, payment, fintech, innovations, cash, digital currency, Bitcoin, adoption

The history of digital financial innovations in banking and payments is relatively short. In Austria, wages were paid out in cash up until the mid-1970s, the first ATMs were installed in the 1980s and the use of payment cards gained ground only in the early 2000s. Studies of the payment behavior of Austrian consumers show that the vast majority of consumer purchases are still settled in cash (Bagnall et al. 2016; Esselink and Hernandez, 2017). Moreover, several studies have shown that payment behavior changed only slowly over the past 20 years, despite the increased availability of cashless payment options (Mooslechner, Stix and Wagner, 2012; Rusu and Stix, 2017).

Over the past few years, the pace of financial innovation accelerated on the back of two developments which have reinforced each other: (1) the development of new financial technologies and services and (2) the ubiquity of mobile phones along with fast Internet connections. The scope of digital innovation is broad, ranging from new forms of access to existing services/products (e.g. mobile

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banking), new financial services (e.g. automatized financial advice) to new payment methods (e.g. by mobile phones). These innovations (e.g. banking apps to make instant payments) increasingly blur the dividing line between the once quite distinct fields of financial services on the one hand and payments on the other. Some of these innovations are initiated by banks, some are driven by small start-up companies and some are pushed by tech giants like Google or Apple, which have also entered the payments market. So-called cryptocurrencies have been advanced by the Internet community and do not require any trusted third parties at all. Some observers conjecture that this overall development has the potential to fundamentally change the banking and payment services industry.[2]

The development of online banking exemplifies how new technologies have triggered profound changes in the financial industry. According to results of OeNB surveys, 7% of Austrians used online banking at the beginning of this century, compared to 58% today. This new technology has had profound implications for the organization and the business conduct of banks (e.g. re-dimensioning of the branch network, investments in technology, development of new channels to communicate with online customers). Moreover, new players have entered the market, e.g. online banks or providers of apps for financial services, and banks have been faced with the threat that segments of their businesses are being taken over by new competitors. For example, Deutsche Bank has classified bank segments and products according to their risk of being challenged (Forest and Rose, 2015, referring to a survey among banks conducted by Roland Berger; Streissler, 2016): The payment sector is exposed most, followed by simple saving products and a normal bank account. Products with the lowest risk are loans and specialized saving products.

How far has digitalization in banking and payments already progressed? The empirical evidence on the adoption and use of digital financial services and products by consumers is limited. Often, assessments about the market potential of a service/product are based on observed growth rates (which can be very high, in particular when their overall importance is still modest). Published adoption rates of digital financial innovations are often based on surveys of a subsample of the population (e.g. Internet users), and survey details (which can be very important) are often not well documented. Moreover, published survey results are often confined to narrow market segments, which renders it difficult to assess the overall situation.

Against this backdrop, the Oesterreichische Nationalbank (OeNB) has commissioned a nationally representative survey among Austrian consumers about their use of and their attitudes toward digital financial services (see box 1 for details about this survey, the OeNB-Barometer Q2/2018). The survey offers a stocktaking of consumers' use and awareness of technological innovations in the field of banking and payments. This view is contrasted with information on consumers' attitudes toward cash, a comparison that is crucial because cash still plays an important role in Austria and in many other European economies despite the availability of a multitude of cashless options (Bagnall et al. 2016; Esselink and Hernandez, 2017). As cash plays a less important role in other European economies, we would like to

[2] *Digitalization can be defined as the "use of digital technologies to change a business model and provide new revenue and value-producing opportunities, it is the process of moving to a digital business" (www.gartner.com/it-glossary/digitalization, accessed July 24, 2018).*

analyze whether the prevalence of cash in Austria is associated with a low uptake of digital financial products. The broad perspective of the survey allows us to determine the share of Austrians that already use innovative products/services and also the share of those who have not got in touch with innovations at all so far. Finally, person-specific information on important background variables, like age or risk attitudes, provides insights into the drivers of adoption.

The paper is structured as follows. Section 1 discusses important prerequisite for the use of financial innovations, such as the ownership of technical devices, Internet usage and interest in technology. In section 2 we look into how Austrians conduct banking activities. To ease comparison across different financial innovations, we express most results in percent of the population aged 14 or over.[3] The adoption and use of payment instruments is discussed in section 3. Results on the use and awareness of new financial technologies (fintech), which stand between banking and payments, are the focus of section 4. Section 5 discusses ownership of and attitudes toward crypto assets. Information on the socioeconomic drivers of adoption are presented in section 6. In section 7, we discuss the role of cash, and section 8 concludes. We wish to point out that our focus of attention, in general, is on the overall pattern of results and not on exact values. This is justified as specific questions might have been difficult to understand for some respondents. The overall pattern of results should not be affected by such difficulties.

Box 1

Description of the OeNB survey on the use of financial innovations by Austrian consumers (OeNB-Barometer)

Our study's results are derived from the "OeNB-Barometer Q2/2018," a survey commissioned by the Oesterreichische Nationalbank (OeNB) and conducted by the polling company IFES. The sample consists of 1,381 persons that were selected randomly via a multi-stage clustered random sampling procedure. Interviews were carried out face-to-face (computer-assisted) from April 11 to May 22, 2018. All reported results in this paper are weighted to render them representative of the Austrian population aged 14 or over with respect to region, age, gender and size of respondents' home town.

As these sociodemographic aspects are not necessarily the only important variables driving financial and payment innovations, we verified that the sample is not biased with respect to other important variables by conducting a series of comparisons with external information.

***Internet usage:** In our sample, 83% of the population uses the Internet for private purposes. This number compares to 86% found in the Austrian Internet Monitor (Barth and Cerny, 2017) and 80% according to the Eurobarometer 464a (European Commission, 2017); both these studies are based on survey data. In our sample, 72% of the population uses the Internet at least daily. This compares to 71% in the Austrian Internet Monitor and 70% in the Eurobarometer 464a (European Commission, 2017).*

***Ownership of technical devices:** 85% of Internet users in the OeNB-Barometer and the Eurobarometer (ibid.) use a desktop computer/notebook and 86% of Internet users in both surveys use a smartphone (tablet: 31% in the OeNB-Barometer and 43% in the Eurobarometer (ibid.).*

[3] *Whenever we refer to percent of Austrians or percent of the population, we refer to the Austrian population aged 14 and over.*

Online banking: *In the OeNB-Barometer, 70% of Internet users (or 58% of the population) conduct online banking, which compares with 70% in the Euro-Barometer (ibid). A recent survey of Erste Bank[1] reports that 58% of the Austrian population conducts online banking.*

Banking relations and card ownership: *Banking relations are difficult to compare with external information as external data often refer to households while the OeNB-Barometer refers to individuals. According to the Household Finance and Consumption Survey (European Central Bank, 2017), 5.4% of Austrian households own shares, which compares with 7.3% of respondents in our sample. 41% of the population owns a credit card according to the OeNB-Barometer, which compares to 39% in the Eurobarometer.*

Overall, this cross-validation with other surveys suggests that the sample of the OeNB-Barometer Q2/2018 is broadly comparable to results from other surveys with respect to several important background variables of financial innovations.

In this paper, we present statistics for socioeconomic groups or other subsamples. For some of these groups, the number of observations is rather low (see table A2 in the annex for descriptive statistics and for group sizes). Hence, it is necessary to exert some caution when interpreting these results. In such cases, we focus on the pattern of results (e.g. differences across groups) rather than on exact values. In general, some of the financial innovations are used by a small share of respondents, which further calls for some caution when interpreting results. For ease of exposition, the tables and charts will not present confidence intervals for mean values; we will mention them in the text for key variables instead.

[1] *https://futurezone.at/digital-life/erste-bank-oesterreicher-finden-fintechs-nicht-interessant/400064768, accessed 11.7.2018.*

1 Use of the Internet, mobile devices and interest in technology

The most important prerequisite for using new mobile payment and banking services is the adoption of the underlying technologies. Table 1 shows that almost three-quarters of the Austrians over 14 possess a smartphone, one-quarter has a tablet and almost one-fifth has a smart TV. Smartwatches, which have a potential for mobile payments, are currently only owned by 3%. Similarly, Internet usage is high. About 83% use the Internet, 72% access the Internet at least daily and 8% at least weekly (but less frequently than daily).

According to the Digital Economy and Society Index of the European Commission (2018), Austria ranks close to the EU-28 average with respect to Internet usage.[4] An international comparison shows that smartphone ownership in Austria is slightly lower than in the U.S.A. (77% in 2015) and slightly higher than in Germany (Austria: 86% of Internet users; Germany and EU-28: 79%).[5]

When discussing the future of payments and a society which uses cash for payments much less than today, universal access to electronic devices which enable such payments is a precondition (abstracting from payment cards). How

Table 1

Ownership of technical devices and Internet usage

	% of the population
Ownership of technical devices	
Notebook or desktop computer	70.6
Tablet	25.7
Smartphone	73.2
Smartwatch	2.8
Smart TV	19.8
None of above	15.2
No tablet, smartphone, smartwatch	24.9
Internet usage	
Several times a day	56.2
Once a day	15.6
At least once a week	8.1
Less often	2.5
Never	17.5

Source: OeNB-Barometer Q2/2018.

[4] *In Germany 85% of the population are Internet users, which compares with 80% in Austria and 79% in the EU-28 (European Commission, 2017). Luxembourg, Denmark, Sweden and the Netherlands reach values above 90%.*

[5] *Sources: Federal Reserve Board (2016) and European Commission (2017).*

far away are we from universal access? Currently, 15% of Austrians possess none of the technical devices listed in table 1, and 25% possess no mobile device (tablet, smartphone or smartwatch). For some sociodemographic subgroups, the non-possession rates of mobile devices are high: 33% for respondents in the lowest income tercile, 50% for respondents with a low level of education, 28% for those aged between 51 and 65 and 72% for those aged 66 and over (the sociodemographic variables are defined in the annex). A very similar picture emerges for nonuse (or infrequent use) of the Internet, with quite high rates for respondents with low incomes or a low level of education and older survey respondents.

Another factor driving the adoption of financial innovations is people's interest in technological developments. Therefore, the survey posed the following question: "How would you assess yourself in relation to technological developments, e.g. new devices or applications? Which of the following statement best applies to you?" Respondents could choose between "Highly interested, I would like to try new devices or applications immediately," "I am interested but would not want to buy or try new devices or applications immediately," "I buy new devices or applications only if I see a benefit," "I am not interested in technological developments and only buy new devices when I need them."

Table 2

Interest in technology

	Highly interested, I would like to try new devices or applications immediately	I am interested, but would not want to buy or try new devices or applications immediately	I buy new devices or applications only if I see a benefit	I am not interested in technological developments and only buy new devices when I need them
	% of the population			
Total	11	34	28	27
Gender				
Female	6	29	33	33
Male	16	39	23	21
Age				
14 to 35	23	42	24	11
36 to 50	9	44	32	16
51 to 65	6	31	36	27
66 and over	3	14	19	64
Household income terciles				
Lowest	10	22	28	39
Middle	9	34	28	29
Highest	14	48	29	10
Level of education				
Low	7	24	14	56
Medium	9	33	32	27
High	18	42	27	13
Size of respondent's home town				
< 5,000 inh.	10	34	27	30
5,000 to 50,000 inh.	9	34	29	28
>50,000 inh.	14	34	28	24

Source: OeNB-Barometer Q2/2018.

Note: The table shows the answers to the question „How would you assess yourself in relation to technological developments, e.g. new devices or applications? Which of the following statement best applies to you?" (1) for all respondents (total) and (2) for sociodemographic groups. Possible answers are shown in columns, hence each row summarizes to 100%.

Table 2 summarizes the responses for all respondents as well as for selected sociodemographic subgroups. 11% of the population says they have a high interest in technological developments, 34% have some interest (even if they do not see a clear benefit), 28% have an interest only if they can expect a benefit from a new technology and 27% have no interest unless they really need a new service/product. For ease of exposition, we aggregate the first two categories in the following analyses (termed as "high interest" applying to 45%). As expected, answers strongly depend on income, age and education. For example, 56% of those with a lower level of education as well as 64% of those aged 66 or over are not interested. A sizeable difference can also be discerned between genders, with men being more inclined to early adoption than women.

Overall, these results reveal that a sizeable share of the population is either not interested in adopting new technologies or does not possess the respective technical devices. This applies, in particular, to respondents who are older, who have a lower level of education and who have lower incomes. As a result, a significant part of the population is excluded from the current trend of digitalization and will remain so in the coming years. At the same time, we observe much higher adoption rates and interest in technology among respondents who are younger, who have a higher level of education and higher incomes.

How does overall digitalization in Austria compare to other countries? The DESI report of the European Commission (2018) tracks the progress made by Member States in terms of their digital performance. It is structured in five chapters: connectivity, human capital, use of Internet services, integration of digital technology and digital public services. Over the last years, Austria has, overall, progressed roughly in line with both the EU average and the average of the cluster of medium-performing countries, ranking 11th in 2017. Its main strengths remain human capital and digital public services, but Austria also improved its relative position regarding to both the use of Internet services by citizens, where it had been lagging behind, and the integration of digital technology by businesses, where Austria scored significantly above the European average. These improvements were achieved despite a connectivity ranking in the lower half among EU countries (although Austria's score improved considerably also in this category).

2 Do Austrians still visit bank branches? And for what reason?

With the proliferation of fast Internet connections and improvements in the safety of connections, remote access to bank accounts, i.e. online banking, has increased in importance. For consumers, online banking can improve the ease of use of banking services and can reduce time costs. For banks, online banking allows to reduce the costs of the branch network, but at the same time requires high IT investments. According to OeNB statistics, the number of bank branches has decreased considerably, falling from 4,556 in the year 2000 to 3,677 in the second quarter of 2018. This implies that today, in Austria a bank branch serves about 2,300 inhabitants on average compared with 2,400 in Germany, 5,200 in Finland and 9,600 in the Netherlands.[6] During about the same period, the share of

[6] *See also https://www.oenb.at/dam/jcr:f06dd85f-6732-4593-aa9d-46157a4559ec/facts-on-austria_april_2018.pdf and a speech by OeNB's Vice-Governor Ittner, cited in https://kurier.at/wirtschaft/seit-finanzkrise-fast-ein-viertel-weniger-banken-in-oesterreich/257.725.758 (April 11, 2017).*

Austrians (aged 14 or over) using online banking increased from about 7% in 2000 to 27% in 2008 (according to previous OeNB surveys) and to 58% today. About 23% of Austrians state that they have been affected by the closing of bank branches over the past five years (70% of this group say this was because they used the branch and 30% because they used an ATM at a branch that was closed). The share of affected persons ranges from 15% in towns with fewer than 5,000 inhabitants to 35% in cities with more than 50,000 inhabitants, reflecting that the concentration process occurred mainly in cities.

2.1 Use of online banks, online banking and access modes

In the sample, 96.2% of respondents have a current account, 1.2% use their partner's account and 2.6% have no current account. Among the persons who have a current account, about 2% have their main account with an online bank (called "Direktbanken" in German, i.e. banks which operate mainly online and which do not have a traditional branch network; in Germany this applies to 3% of the population (Deutsche Bundesbank, 2016)).

Table 3

Online banking

	% of the population
Use of online banking	58.1
	% of online banking users
Access only with desktop computer/ notebook	38.3
Access also with smartphone/tablet	61.7
	% of online banking users
Access only via web browser	51.7
Access only via app	11.4
Access both via web browser and app	33.1
Access via specialized computer program	3.8
	100.0
	% of online banking users, multiple devices possible
Use desktop computer for online banking	81.8
Use tablet	16.2
Use smartphone	53.7
Use other device	1.3

Source: OeNB-Barometer Q2/2018.

Currently, about 58% of the population uses online banking (the 95% confidence interval ranges from 55% to 62%). International comparisons on the dissemination of online banking typically refer to percent of Internet users: According to our results, 70% of Austrian Internet users conduct online banking, which compares with 61% in Germany, 61% in the EU-28 (European Commission, 2018, values refer to 2017). The top EU countries in this respect are Finland, the Netherlands, Denmark, Estonia and Sweden, with values at or above 90%.[7]

Among online banking users, the use of mobile devices has gained prevalence: 38% of online banking users conduct online banking only via a desktop computer or a notebook while already 62% also use a smartphone or a tablet to interact with their bank. In terms of point of access, the survey shows that 52% of online banking users

[7] *In this study, we define online banking as follows: First, respondents were provided with a list of technical devices and asked whether they personally use any of those (ranging from desktops and smartphones to game consoles). Only if respondents used at least one of these devices, they were asked whether they use online banking. Thus, the variable is based on a filtered question. The results are very similar, however, if respondents are directly asked about the frequency with which they conduct online banking (without prior filter).*

access online banking services only via a web browser (independent of the specific device), 33% use a web browser and banking apps and already 11% exclusively use banking apps. Another 3.8% use specialized programs, e.g. banking or accounting software.

Online banking users who do not use a mobile device for online banking were asked about the reasons for nonuse. The three most important reasons provided were that their mobile phone's screen is too small, that banking needs are met without the smartphone and concerns about security. Interestingly, the ranking of these three reasons is the same regardless of respondents' age and income.[8]

2.2 Frequency of visits to bank branches and online banking

How does the use of online banking affect the use of conventional banking, i.e. actual visits to bank branches or self-service counters? Table 4 shows the proportion of respondents who use various bank services (1) at least monthly and (2) once a year or less frequently.

The results reveal a clear dividing line: While 43% of the population still visits a bank desk at least monthly, 32% do so only once a year or less frequently. Over the last few years, self-service counters (e.g. in bank branches) have become more relevant, and this is reflected in our results. 58% of Austrians visit a self-service counter at least monthly, which is a higher value than that for bank desk visits. The highest value is found for ATMs, which are used by 88% of the population at least monthly. Table 4 also shows interaction frequencies for online banking via desktop/notebook and via smartphone/tablet. The results reveal that 51% of Austrians conduct online banking via desktop/notebook at least monthly, a value that is also higher than for bank desks. Thus, we find a higher share of the population interacting (on a monthly basis) with their bank either online or through a self-service counter than at a bank desk.

Chart 1 shows that there are marked differences in banking preferences across sociodemographic groups. Overall, 47% of the population banks more frequently online than at a bank branch or at a bank's self-service counter (95% confidence interval: 43% to 51%).[9] Among younger respondents (aged 14 to 35), 69% bank more frequently online, while for older respondents (aged 66 and over) this share stands only at 12%.[10] Strong differences are also found between education groups

Table 4

Usage frequency of different banking channels

	At least monthly	Once a year, less often or never
	% of the population	
Bank desk	43.3	32.1
ATM	88.5	8.2
Self-service area at bank branch	58.2	29.9
Contact with bank branch via phone	9.0	73.2
Online banking with desktop computer/notebook	51.1	48.9
Online banking with smartphone/tablet	34.4	65.6

Source: OeNB-Barometer Q2/2018.
Note: The table shows the percentage of survey respondents that use the services mentioned (1) at least monthly and (2) once per year, less often or never.

[8] *In the U.S.A., the major reasons for not using a mobile phone are rather similar (Federal Reserve Board, 2016), albeit in a different order. The U.S. sample ranks "no reason, banking needs are met without mobile banking" first, followed by concerns about security and the size of the screen.*

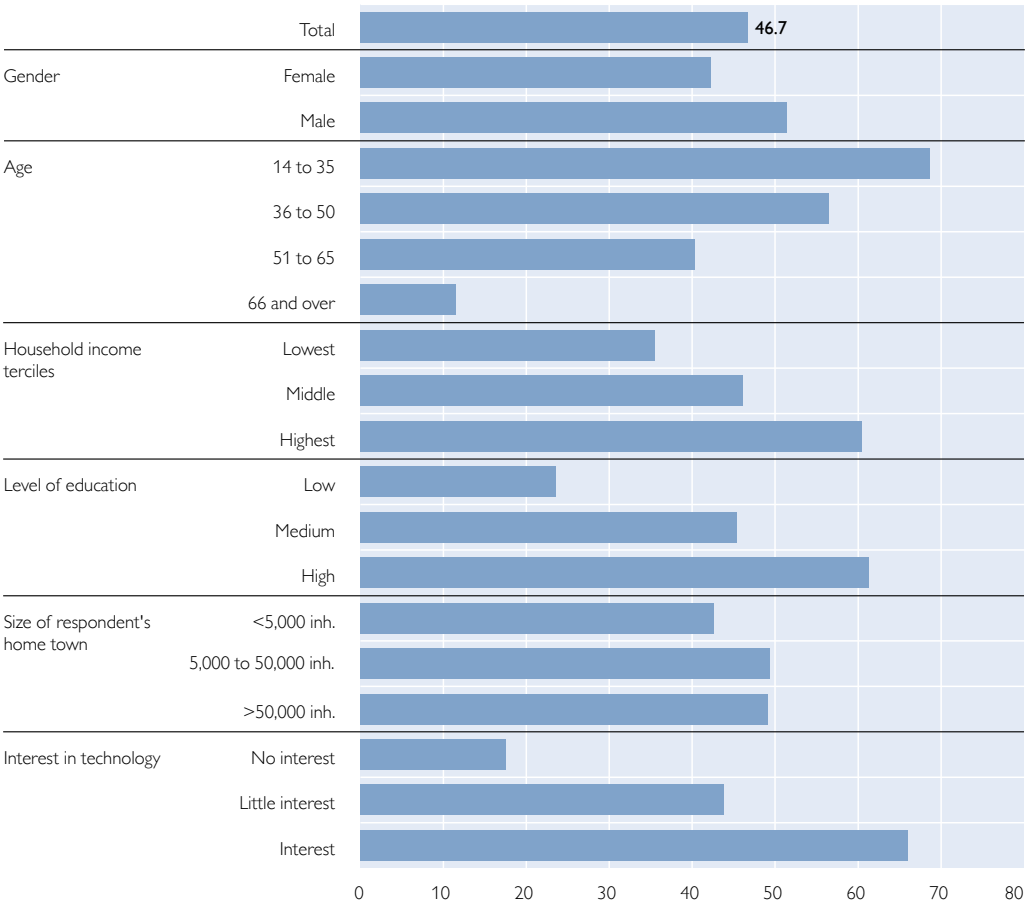
[9] *To be precise: We translate qualitative survey responses on the frequency of use (e.g. "several times a year") into a quantitative measure (e.g. a frequency per time period). This computation relies on specific assumptions (e.g. how often do respondents visit a bank if they answer "several times a year").*

[10] *Confidence intervals range from 62% to 75% for younger respondents and from 8% to 15% for persons aged 66 or over.*

Chart 1

Share of respondents using online banking more frequently than branch services

% of the population



Source: OeNB-Barometer Q2/2018.

Note: The chart shows the share of survey respondents that use online banking more frequently than desk services or self-service areas at bank branches (1) for all respondents (total) and (2) for socio-demographic groups.

and income groups.[11] The chart also shows that there are large variations of relative interaction frequencies by respondents' interest in technological innovations: Among those with no interest in technological developments, just 18% bank more often online than at a bank branch, which contrasts with a share of 66% for respondents with an interest in technological innovations. Finally, the chart shows that there are no sizeable differences between big cities and small towns.

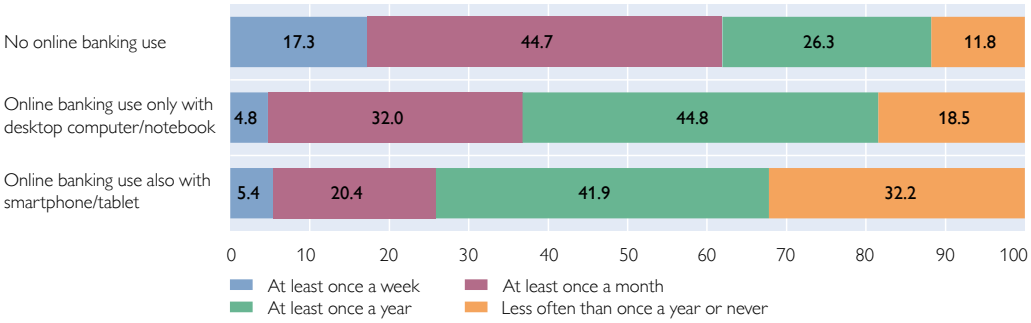
How does the use of online banking in general and the use of mobile devices for banking in particular impact on bank desk visit frequencies? This question is important for assessing the future trend (given that the use of mobile phones for banking activities can be expected to increase) and hence for banks' strategic behavior (e.g. regarding their branch network). Chart 2 summarizes visit frequencies for three types of bank customers: (1) those who do not use online banking, (2) those who only use a desktop/notebook for online banking ("traditional online

[11] *These differences are statistically significant.*

Chart 2

Frequency of visits to bank desks by groups of online banking users

% of respondents



Source: OeNB-Barometer Q2/2018.

Note: The chart shows the frequency of visits to bank branches by groups of online banking users: (1) no online banking, (2) online banking only with a desktop computer/notebook or (3) online banking with a desktop computer/notebook and a smartphone or tablet.

banking users") and (3) those who also use their smartphone or tablet for banking ("mobile banking users"). Among nonusers of online banking, 62% visit a bank desk at least monthly (17.3% at least weekly plus 44.7% at least monthly, but less often than weekly). This share is smaller among online banking users: 37% for traditional online banking users and 26% for mobile banking users. On the other hand, the proportion of those who visit a bank desk very seldom (less than once a year or never) increases across the three types of bank customers, up to 32% for mobile banking users.[12]

Not surprisingly, these results confirm that online banking is associated with a lower number of visits to bank desks.[13] If we presume that online banking will continue to grow in importance over the coming years (e.g. due to an increased use of mobile phones for this purpose), we can expect the number of visits to bank branches to decrease significantly.

2.3 Bank services and access mode

If persons state that they conduct online banking, this does not necessarily mean that all of their banking activities are conducted online. Therefore, the survey asked how respondents have conducted several typical banking activities over the past twelve months. The upper panel of chart 3 depicts the proportion of all respondents who have conducted the respective banking activity exclusively remotely (i.e. via desktop, notebook, smartphone, tablet, e-mail or telephone), exclusively nonremotely (i.e. at the bank branch or the self-service counter) or whether they have used both access modes over the past year. We see that the share of Austrians that have accessed banking services exclusively remotely is already higher than the share of those who use only nonremote access for checking

[12] *The differences across the three groups are statistically significant.*

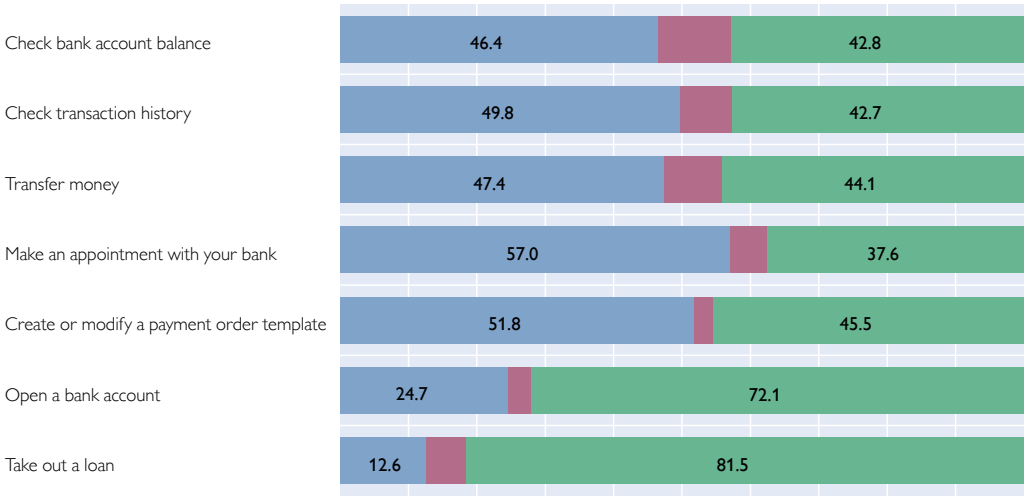
[13] *The results suggest that mobile banking reduces the number of visits to bank desks even further than online banking. While this seems plausible, one has to be cautious about making such a causal statement. One plausible alternative explanation for this result is that mobile banking is mainly used by younger and better educated people and that these persons would visit a bank desk very rarely even without mobile banking. A detailed analysis of the effect of mobile banking on visit frequencies is beyond the scope of this paper.*

Chart 3

Access modes for various banking services

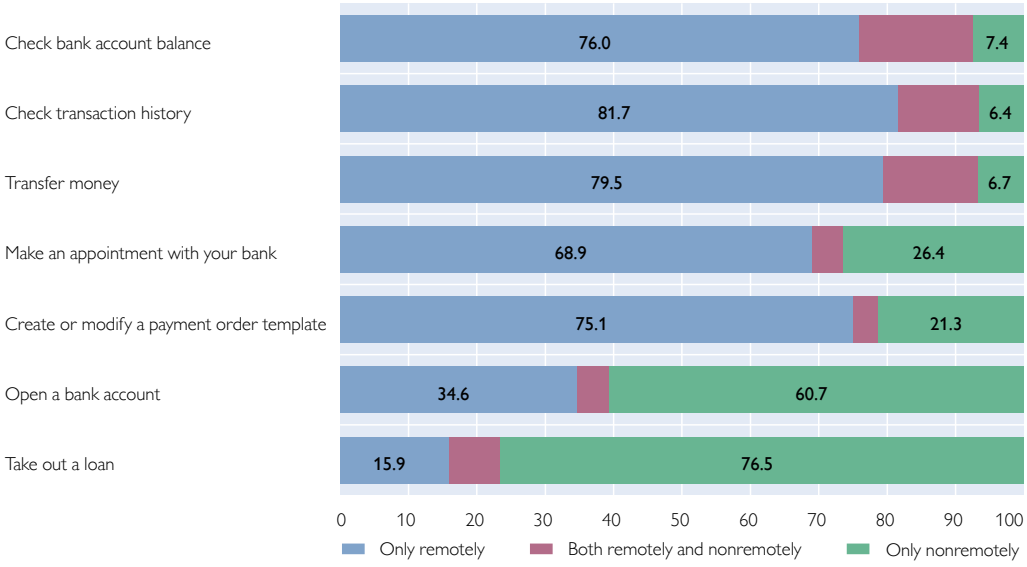
All respondents

% of respondents who have used the service within the past 12 months



Online banking users

% of online banking users who have used the service within the past 12 months



Source: OeNB-Barometer Q2/2018.

Note: The chart shows how each of the banking services was accessed (1) only remotely (via desktop computer/notebook, smartphone/tablet, e-mail or telephone), (2) only non-remotely (via bank desk, self-service or ATM) or (3) both remotely and non-remotely. The upper panel shows the results for all respondents, the lower panel shows results for online banking users. The underlying survey question referred to respondents' behavior over the past 12 months. For each activity, only respondents are included who have accessed the respective banking service over the past 12 months. The number of respondents who have taken out a loan over the past 12 months is rather low (n=270 for all respondents), implying that these results must be treated with caution.

their account balances and transaction histories, money transfers and creating or modifying a payment order template. In line with expectations, opening a bank account or taking out a loan is conducted predominantly nonremotely.

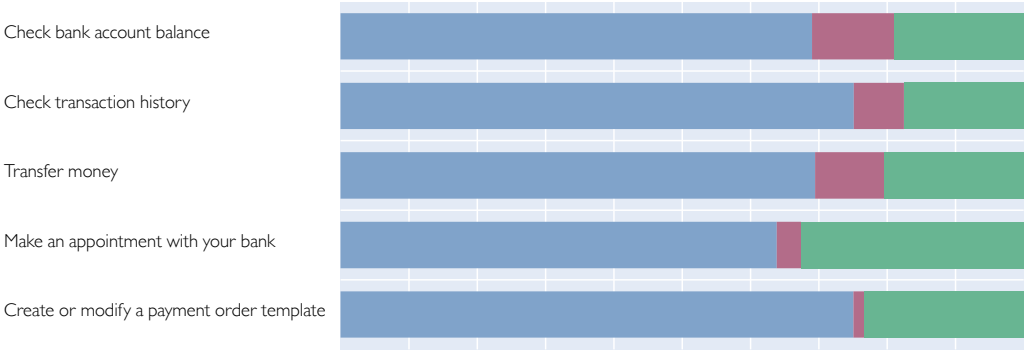
The share of Austrians that have used both a remote and a nonremote channel to contact their bank is rather low. This already indicates that online banking users

Chart 4

Access modes for various banking services by age groups

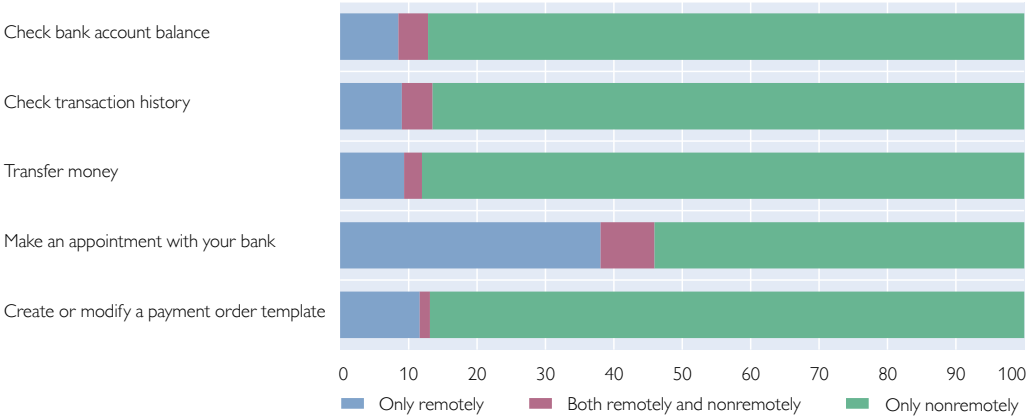
Age 14 to 35

% of respondents who have accessed this service over the past 12 months



Age 66 or older

% of respondents who have accessed this service over the past 12 months



Source: OeNB-Barometer Q2/2018.

Note: The chart shows for each service how it was accessed: (1) only remotely (via desktop computer/notebook, smartphone/tablet, e-mail or telephone), (2) only nonremotely (via bank desk, self-service or ATM) or (3) both remotely and nonremotely. The upper panel shows the results for respondents aged between 14 and 35, the lower panel shows the results for respondents aged 66 or over. The underlying survey question referred to respondents' behavior over the past 12 months. For each service, only respondents are included who have accessed the respective banking service over the past 12 months. The number of services for each age group is relatively small; hence, the results should be treated as indicative. The number of observations per service ranges from 180 to 335 for the top panel and from 141 to 303 for the bottom panel.

conduct their various banking activities mainly online. The lower panel of chart 3 confirms this by presenting a separate analysis only for online banking users. Depending on the activity (from checking the bank account balance to creating a payment order template), between 7 and 8 out of 10 online banking users contact their bank exclusively remotely, which implies that they actually do not need a bank branch. Only for opening a new bank account or for taking out a loan does a clear majority of online banking customers still visit bank branches. With regard to the starting question about which types of banking activities are conducted online, the results are unambiguous: Online banking users conduct, on average, all of their typical regular banking activities online and need their bank branch only for infrequent banking activities, which are service intensive and/or require their physical presence at the bank, like taking out a loan or opening an account.

Finally, chart 4 contrasts the behavior of older and younger respondents. The overwhelming majority of persons aged between 14 and 35 get in touch with their bank only via remote channels. The reverse picture emerges for persons aged 66 or over.[14]

2.4 Assessing the future trend

Austrians' use of online banking (58%) is above the EU-28 average but not as high as in some Nordic countries and the Netherlands. Already a substantial number of Austrians is using a mobile device for online banking (about 36% of the population or 62% of online banking users). The fact that the share of persons who possess a smartphone (73% of the population) and the share of persons who use the Internet (at least) once a week (80%) are above the share of online users suggests that online and mobile banking has potential for growth given consumers' current technical equipment. In addition with younger cohorts being more inclined toward online banking in general and mobile banking in particular, we can expect a growing share of bank customers who conduct their banking activities mainly remotely and visit a bank desk only occasionally or for specific purposes (e.g. a loan request).

3 Use of payment innovations at the point of sale

The proliferation of cashless payments requires that consumers have access to new payment methods and that they are also willing to use them. Adoption and use are economic decisions made by consumers that are influenced by a multitude of factors, like the relative costs of payment instruments (e.g. cash versus cards) and how consumers rate the attributes of payment instruments (e.g. safety, ease of use, expenditure overview). The choice of payment instruments also depends on the payment options offered by merchants, which, for a specific point in time, are given from an individual consumer's perspective, e.g. whether card payments are accepted for low-value purchases. The behavior of both consumers and of merchants each depends on each other and will change over time. The existence of network effects (e.g. if people want to pay in cash, there is no incentive for merchants to accept cards, and given the low level of card acceptance, people continue to use cash) implies that payment behavior tends to change only rather slowly (Huynh, Schmidt-Dengler and Stix, 2014). Aside from these factors, the literature (Bagnall et al., 2016; Esselink and Hernandez, 2017) has also documented large differences across countries which might be related to institutional differences (e.g. the costs of ATM withdrawals), cultural differences and social norms.

Table 5

Ownership of payment devices

	% of the population
Debit card	90.6
Credit card	41.3
Prepaid card	4.2
Other card	2.4
Debit card contactless	64.3
Credit card contactless	15.0

Source: OeNB-Barometer Q2/2018.

Austria is still a cash intensive country: in 2016, about 80% of consumer transactions (at the point of sale) were settled in cash (Rusu and Stix, 2017). Against this backdrop, it is of particular interest how payment innovations are used by Austrians and how usage rates compare internationally.

[14] *For this comparison, we omit taking out a loan and opening an account as the number of observations is very low.*

Table 5 summarizes Austrians' ownership of payment cards according to the survey data. 91% of Austrians possess a debit card and 41% possess a credit card. Prepaid cards are owned by 4% of Austrians and 2.4% state that they own other payment cards, like cards used in soccer stadiums or in workplace canteens or cafeterias. Almost two-thirds of respondents are aware that their debit card is equipped with an NFC chip for contactless payments and 15% know that they own a contactless credit card.[15,16]

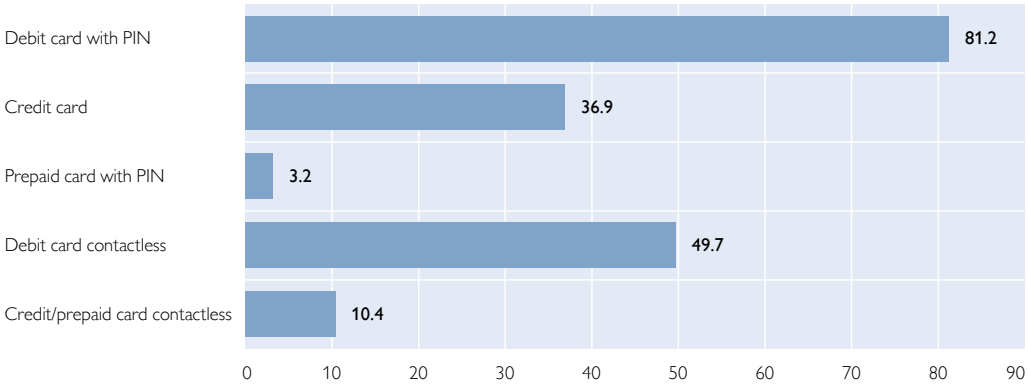
Although ownership and use of payment instruments are typically very closely related for many payment cards (e.g. someone who pays a fee for a credit card will also use it), this does not necessarily apply for other cards. For example, debit cards may be used for ATM withdrawals but not for payments. Moreover, some people may use debit cards only for larger (and seldom) purchases but prefer to pay in cash for all other purchases, etc. Therefore, chart 5 displays the share of respondents who use their card for payments at least once a year. 81% of the population uses their debit card with entering their PIN at least once a year, already 50% of the population uses their debit card contactless without entering a PIN (payments up to EUR 25) and 10% of Austrians use a contactless credit or prepaid card.[17]

The dissemination of contactless payment only a few years after its market introduction in 2013 is remarkable given that in the past new payment instruments used to gain market share only rather slowly. Most likely the fast uptake can be explained by the fact that the contactless technology has been implemented on

Chart 5

Use of payment cards (at least once a year)

% of the population



Source: OeNB-Barometer Q2/2018.

Note: The chart shows the share of the population who use the respective payment cards at least once a year. "Contactless" refers to the use of the respective card without PIN. "Credit card" refers to credit card use with signature, PIN or TAN.

[15] *According to unpublished data, about 84% of all Austrian debit and credit cards were equipped with an NFC chip in the second quarter of 2018. This compares with about 66% of respondents, according to the survey, who are aware that their debit or credit card is equipped with an NFC chip.*

[16] *95% confidence intervals: debit card: 88.3% to 92.9%, credit card: 37.7% to 44.8%, prepaid card: 3.0% to 5.4%, other card: 1.4% to 3.4%, debit card contactless: 60.5% to 68.1%, credit card contactless: 12.2% to 17.8%.*

[17] *We use the term "contactless" for cards with an NFC chip and the term "contactless payments" for payments up to EUR 25 for which no PIN is necessary. The survey questionnaire distinguishes between PIN-based payments and payments without a PIN. We cannot exclude that some respondents have misunderstood the separation of payments into payments with and without PIN. If this is the case, the true value for "contactless payments" might be somewhat lower.*

cards which were already well known and frequently used by Austrians and on an existing dense network of point-of-sale terminals.[18] Available evidence suggests that in the second quarter of 2018, about 3 out of 4 payment terminals in Austria already allowed for contactless payments.[19] Mooslechner, Stix and Wagner (2012) have shown the close co-movement between the number of payment terminals and the number of debit card transactions. However, the fast adoption could also indicate that the adoption speed itself has accelerated.

Aside from information on the incidence of use of contactless payments, we are also interested in the intensity of use. As survey respondents also indicated the broad frequency with which they use their debit and credit cards, we can compute a rough estimate of the share of debit and credit card transactions that are conducted contactless. However, we note that this computation relies on respondents' recollection and is based on a series of assumptions that are difficult to verify and hence the results should only be seen as indicative. According to this estimate, roughly 40% of all card transactions are conducted contactless without a PIN. This result is roughly in line with actual transaction data from the second quarter of 2018, which show that 50% of all Austrian debit and credit card transactions and about one-third of transactions in terms of value were initiated contactless.[20] However, the actual transaction data are not directly comparable with the survey information as the former counts as contactless all card payments that were initiated contactless, regardless of whether a PIN is required or not. In contrast, the survey differentiates between PIN and non-PIN transactions. Given that the number of contactless transactions without a PIN must be lower than the figure arising from the transaction data, the estimated share seems at least plausible.

How does the use of contactless payments in Austria compare with that in other countries? According to a study by the European Central Bank conducted in 2016 and early 2017, Austria ranked third among 17 euro area countries in the use of contactless payments (Esselink and Hernandez, 2017). Nevertheless, the share of contactless payments (<EUR 25) then was still low at 2.5% of all transactions. The rapid growth of contactless payments suggests that this share has increased in the meantime. In other countries, contactless payments already make up a considerable share of transactions. As a case in point, they accounted for one-third of all point-of-sale transactions in 2016 in Australia, having tripled from 2013 to 2016 (Doyle et al., 2017). In 2016, nearly 60% of Australians made at least one contactless card payment per week, compared with about one-third in 2013. While contactless payments replaced both cash and card payments, in general, they replaced mainly cash for low transaction values. From 2013 to 2016, the share of cash declined from 47% to 37%. An increasing trend for contactless payments can be observed also in many other countries.

One segment of point of sale payments which is likely to grow in the coming years is mobile payments, e.g. via mobile phones, tablets, smartwatches, bracelets, etc. As of now, the payment methods for mobile point-of-sale payments available to Austrian consumers range from contactless NFC payments to payments via text

[18] *The electronic purse "Quick" was launched under similar conditions (implementation mainly on debit cards and use of an existing terminal network) but did not gain a comparable market share.*

[19] *According to unpublished OeNB payment statistics Q2/2018.*

[20] *According to unpublished OeNB payment statistics Q2/2018.*

message or a confirmation call (e.g. Paybox) or via a bar code (e.g. Blue Code). The survey questionnaire did elicit information on payments with mobile devices, however, we doubt that the questionnaire was clear enough for respondents to provide consistent answers. About 7.4% of respondents stated that they use a mobile phone for payments in a shop or at a vending machine. The Deutsche Bundesbank reports that 2% of respondents (18 years or older) used a mobile phone for payments at the point of sale in 2017 and 6% used a mobile phone for a payment outside a shop (Deutsche Bundesbank, 2017). At the end of 2015, about 8% of U.S. citizens had used their mobile phone "to pay for something in a store in the last 12 months" (Federal Reserve Board, 2016). Given this comparison, we suspect that the share found for Austria is too high and that respondents might have also included the purchase of pay-and-display parking tickets, public transport tickets or of other non-point-of-sale transactions.[21] At least, this finding suggests that mobile payments at the point of sale deserve further attention in future surveys.

Apps with which money can be transferred to other persons or to merchants have reached a considerable diffusion in some countries. In Austria, several solutions allow consumers to send money to other people or abroad (e.g., most Austrian banks operate "Zoin," which allows for transfers of bank deposits between persons within seconds). We find that 3.9% state that they use one of these apps "on a mobile phone or tablet to send money to other persons" at least once a year (95% confidence interval from 2.6% to 5.2%). This compares with 5% in Germany (Deutsche Bundesbank, 2017).

3.1 Payment preferences: contactless payments already important

As the actual use of payment instruments by consumers might be constrained by the payment options available, the survey included a question on payment preferences. Specifically, respondents were asked how they would prefer to pay for a purchase worth EUR 10, EUR 20 and EUR 50, e.g. in a supermarket, assuming that cash, cards (with PIN) and contactless payments (without PIN) are accepted and that they have enough cash at hand to make the payment.[22] Chart 6 summarizes the responses: for a hypothetical EUR 10 payment, almost 3 out of 4 Austrians state that they would prefer to pay in cash. For a EUR 50 purchase, still 45% prefer to use cash. In turn, already almost one-quarter of respondents would prefer to make the EUR 10 payment contactless. For a EUR 20 payment, this share is one-third.

We think that there are two messages that can be deduced from chart 6. First, a sizeable share of Austrians still prefer to pay in cash, regardless of the availability of other payment options. Second, given that the contactless payment option is relatively young, it has already reached a remarkable share of the population. In the next section, we therefore take a closer look at the users and nonusers of contactless payments.

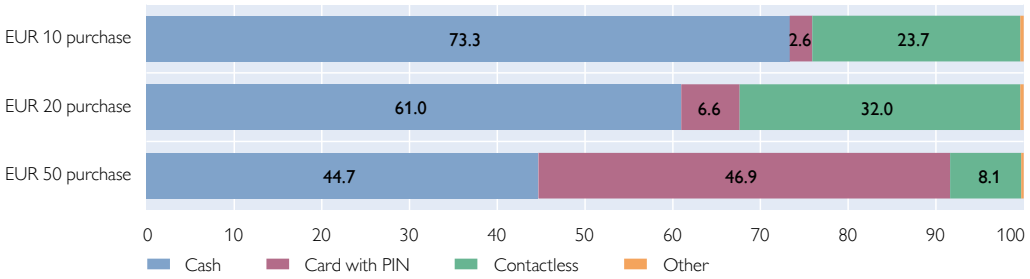
[21] *The Deutsche Bundesbank reports that in 2017, 2% of German respondents used a mobile phone for a payment in a shop and 6% used a mobile phone for a payment outside a shop (Deutsche Bundesbank, 2017).*

[22] *The question asked respondents to assume that they have enough cash at hand. This assumption might, on the one hand, bias results in favor of cash as some respondents who prefer not to use cash might want to get rid of it in this hypothetical scenario. On the other hand, some people who would like to use cash might typically carry too little cash with them. Regardless of these subtleties, we think that the question is useful for revealing preferences given the specific scenario.*

Chart 6

Preferred payment instruments

% of the population



Source: OeNB-Barometer Q2/2018.

Note: The chart summarizes the answers to the question: "Suppose you make a EUR 50 (20) (10) purchase in a supermarket. You have enough cash at hand and the shop accepts both card payments and contactless payments. How would you prefer to pay for this purchase?"

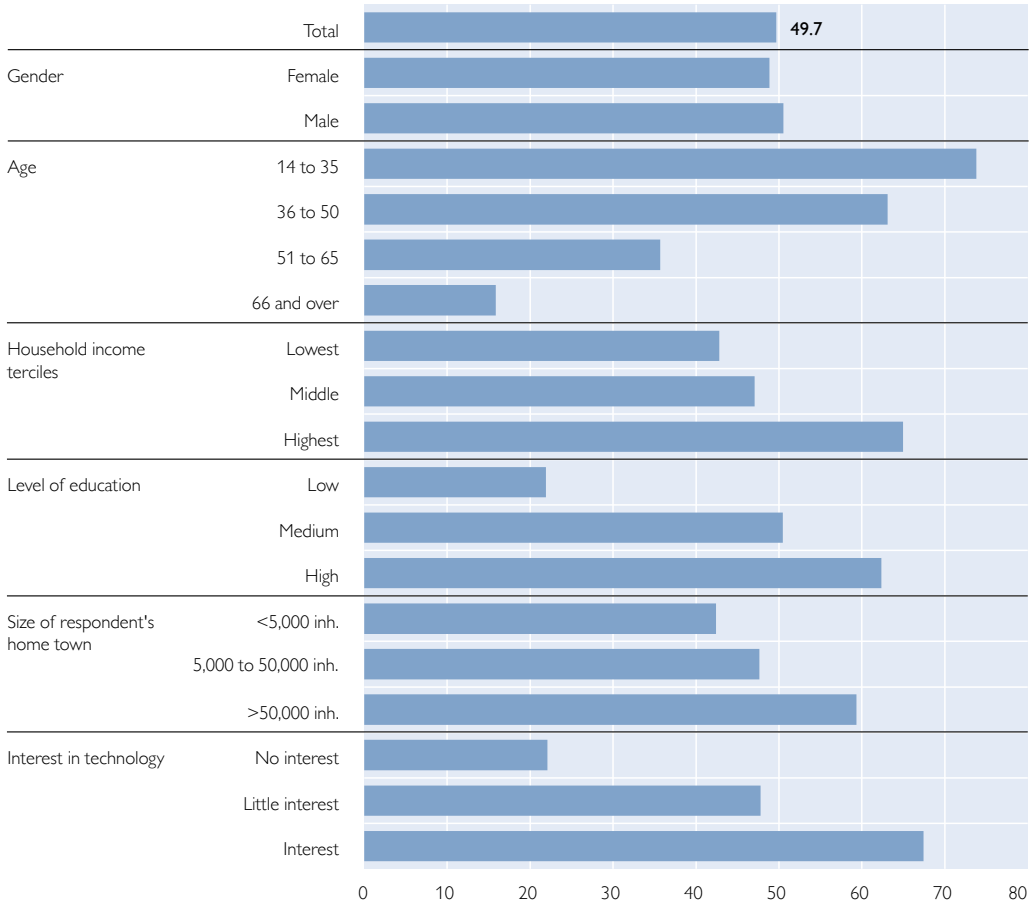
3.2 A closer look at the use of contactless payments

Chart 7 summarizes the use of contactless debit cards without PIN (at least once a year) by sociodemographic groups.

Chart 7

Use of contactless debit cards for payments (at least once a year)

% of the population

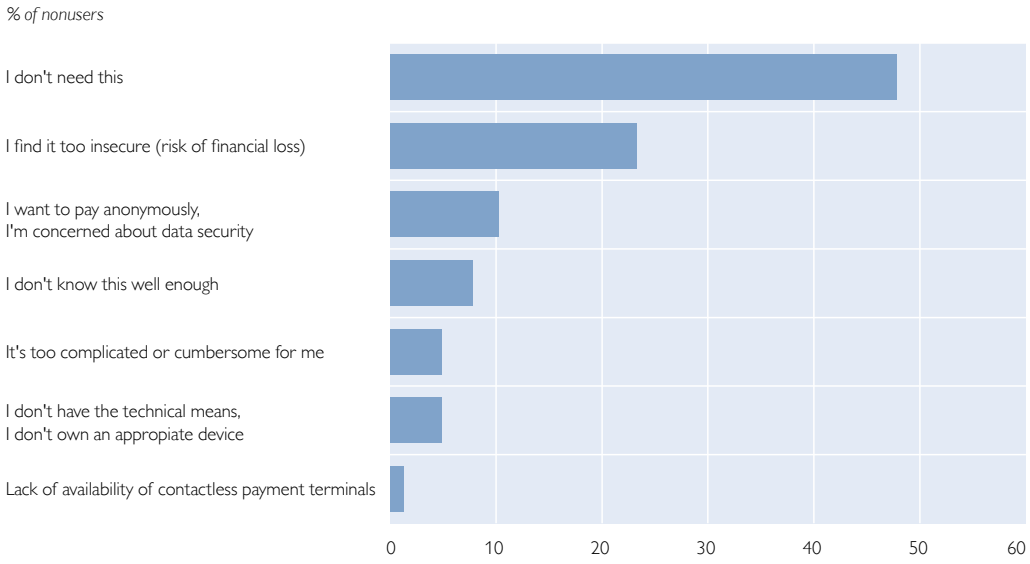


Source: OeNB-Barometer Q2/2018.

Note: The chart shows the share of the population by socio-demographic groups that uses a contactless debit card.

Chart 8

Reasons for not making contactless payments



Source: OeNB-Barometer Q2/2018.

Note: The chart summarizes a list of reasons provided as responses to the question why respondents do not make contactless payments. Multiple answers were possible. Base: Nonusers of contactless payments (and who know about contactless payments). Respondents who did not provide an answer were omitted.

The pattern of results mirrors the patterns found for online banking, despite the obvious differences in levels: The use of contactless payment cards decreases with age, increases with income, level of education and interest in technology. For some of these sociodemographic groups, usage rates are already quite high, for others they are still rather low. For example, 74% of persons aged 14 to 35 use contactless cards without PIN; for persons aged 51 to 65, this share is 36% and for persons aged 66 or over, it is 16%. 84% of users of contactless card payments see the fast transaction speed as one advantage of this technology.

So what are the reasons why people do not use contactless debit cards? Chart 8 shows that there are two dominant reasons: "I don't need this payment instrument," followed by concerns about security.

4 Awareness and use of fintech at an early stage of diffusion

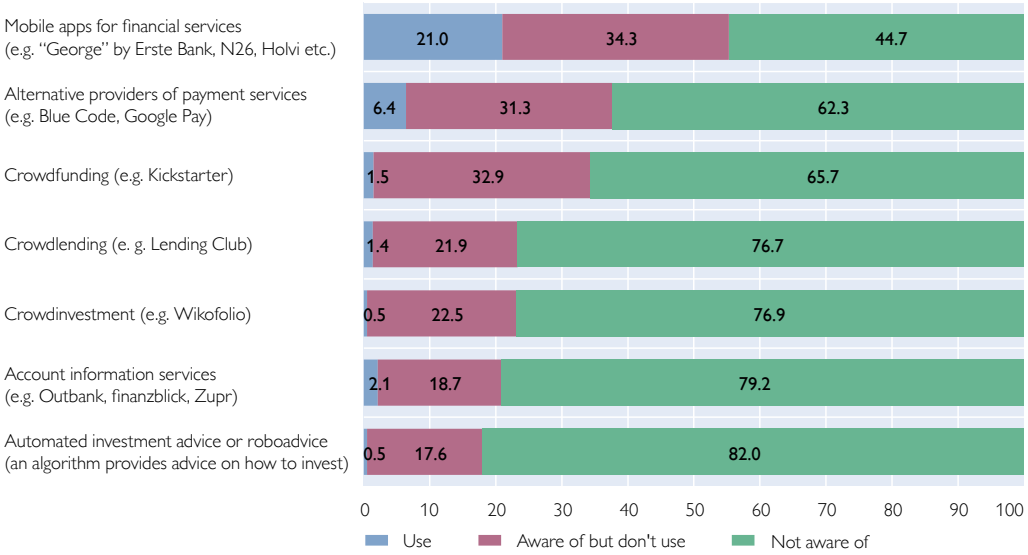
Fintech, short for financial technology, a concept that denotes both new companies that offer innovative financial services and products as well as the technology underlying these services and products, has been attracting much attention. Fintech offers new financial products/services and/or easier access to existing products (often through mobile access) and, as a result, has been identified as potentially disruptive to traditional banking.

Chart 9 summarizes awareness and use of various fintech services/products in descending order, from respondents' highest to lowest awareness. The products/services were clustered into broad categories, with some services being provided (also) by banks (e.g. online apps for financial services). To make it easier for respondents to understand the question, the questionnaire provided examples for each category. As a validation of survey responses with external information is not

Chart 9

Awareness and use of fintechs

in % of respondents



Source: OeNB-Barometer Q2/2018.

Note: The chart summarizes the responses to the question about whether respondents use, are aware of (but don't use) or aren't aware of various fintech services.

possible, we cannot assess whether the respective survey responses are accurate. Therefore, these results should be seen as indicative only.

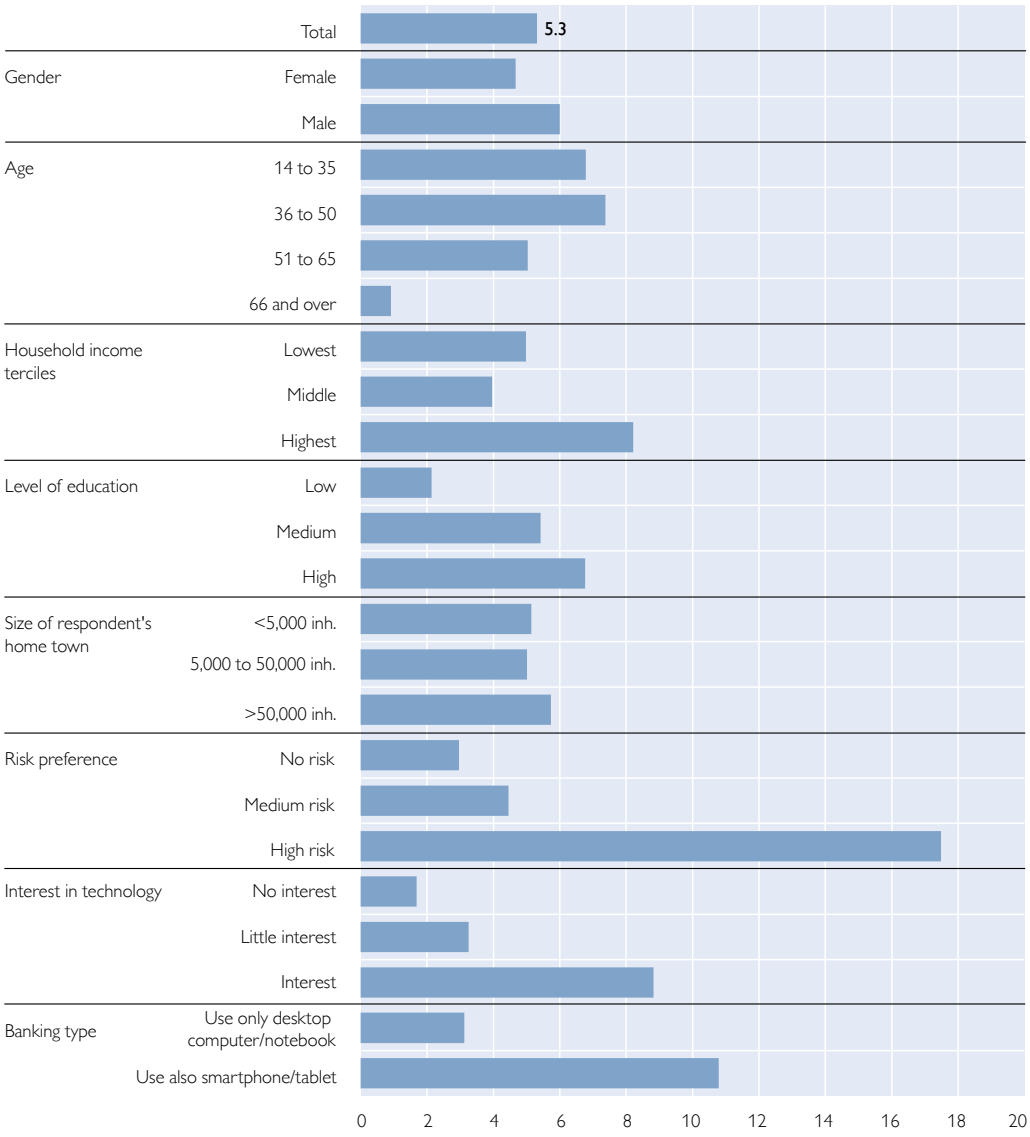
When we look at individual fintech products/services, use is low among the Austrian population, with two exceptions: mobile apps for financial services are used by 21% of Austrians, and alternative payment providers are used by 6.4% (95% confidence intervals: 17.3% to 25.3% and 4.7 to 8.8%, respectively). For the remaining items, a broad majority of Austrians is unaware of their existence. However, given that the factual diffusion of several fintech products/services is very modest (e.g. Pointner and Raunig on lending platforms in this volume; or Stern, 2017) one can also interpret this result differently, namely that it is remarkable that between 18% and 34% (depending on the product) have already heard about these services.

We also looked into how many respondents use any of these products. Overall, we find that 25% of Austrians use at least one of the products/services listed in chart 9. If we leave banking apps aside, there are still 10% of Austrians that use at least one of the remaining products (confidence interval: 7.5% to 12.5%). If we also disregard payment service providers, we find that 5.3% (95% confidence interval: 3.7% to 7.0%) state that they use fintech. These results demonstrate that the adoption of these services is not negligible, with the important qualification that we have no information on the amounts involved. In contrast to previous results, for which the highest usage rates were among persons aged between 14 and 35, we find the highest use of fintech among persons in the age group of 36 to 50 years. In our view, this reflects that users need financial resources to be able to use fintech (chart 10). Chart 10 also shows fintech use by respondents' financial risk attitude. In the small group of respondents who are willing to accept financial

Chart 10

Use of fintech (disregarding mobile apps for financial services and alternative providers of payment services)

% of respondents



Source: OeNB-Barometer Q2/2018.

Note: The chart shows the share of respondents that use any of the following fintech services/products in the overall population (total) and by sociodemographic groups: crowdfunding (e.g. Kickstarter), crowdlending (e. g. Lending Club), crowdinvestment (e.g. Wikofolio), account information services (e.g. Outbank, finanzblick, Zupr)", automated investment advice or roboadvice (an algorithm provides advice on how to invest) and "other" (open question).

risks (e.g. losses), the use of fintech is largest by far. Finally, chart 10 depicts the results for online banking users who only use their desktop/notebook and online banking users who also use a mobile device. Adoption rates are much higher in the latter group than in the former group (the difference is statistically significant). We can only presume that this difference reflects the degree to which people are willing to handle financial matters on a technical device.

Table 6

Expected importance of fintech in five years' time

	Respondents who know at least one fintech service/product	Respondents aged 14 to 35	Respondents who use online banking via smartphone/ tablet	Respondents with financial risk tolerance
	% of respondents who are aware of fintech			
I don't think I'll ever use fintech for my banking transactions	59.6	52.2	49.7	33.6
I'll try some fintech sometime	20.9	25.9	23.9	32.6
I'll use fintech regularly	5.3	8.7	9.3	12.9
I'll conduct most of my banking transactions via fintech	2.0	3.3	3.8	4.0
I'll conduct all my banking transactions via fintech and won't have a traditional bank account	0.1	0.1	0.1	0.3
Don't know	12.1	9.8	13.3	16.7

Source: OeNB-Barometer Q2/2018.

Note: The table shows the responses to the following question: "Do you think that in five years' time fintech will be important for your personal finances?" Answer categories are in rows. The columns refer to different subsamples of the population.

At this early stage of adoption, it is impossible to assess the extent to which banks will be challenged by fintech; all we can do is look at respondents' views. Currently, only a small share of 2.1% respondents (who are aware of at least one fintech product/service and who provided an answer) can imagine that they will conduct most or all of their banking activities via fintech. A share of 26% states some willingness to try out fintech services or to use them regularly. Finally, about 60% of respondents state that they will never use fintech for their banking transactions. For the sake of comparison, table 6 shows responses for three subgroups that are keener on adopting newer technologies than other groups. The results indicate that younger persons aged 14 to 35 and those who conduct online banking are also more open to trying out fintech services.[23] The last column shows respondents who are risk tolerant, i.e. who are willing to accept high financial risks if high profits can be expected. This subgroup has the lowest loyalty to traditional banks: 50% of this (rather small) group can imagine trying out a fintech product at least some time.

5 Crypto assets – just a hype?

Over the past few years, so-called "cryptocurrencies" (in the following referred to as crypto assets) have received considerable attention.[24] These assets (or tokens) are privately issued without the involvement of a central institution; trust is established via the mechanism design, mainly cryptography and economic incentives for miners. Miners provide the computing power to conduct cryptographic computations and are rewarded with newly issued tokens. The current systems, most prominently Bitcoin, have implemented a system of economic incentives which makes it costly for miners to be dishonest. Double spending of digital tokens is

[23] *As this analysis is mostly explorative, we have not tested whether these differences are significant.*

[24] *Up to now, crypto assets lack the characteristics of currencies, i.e. mainly with regard to their instability in value and their usability for day-to-day transactions.*

prevented as the whole history of transactions is stored in a public register (blockchain), which can only be manipulated ex post at exorbitant costs (unless miners own more than 50% of the computing power). In this way, any transaction between two parties can be conducted without the need of a trusted third party (Weber, 2018).

Again and again, crypto assets have attracted enormous media attention – partly due to stories that crypto assets have the potential of replacing central bank-issued money, partly due to stories about people getting very rich, and partly due to stories about fraud and theft. As a consequence several questions which are important to policymakers and regulators have emerged, for instance: How widespread is the ownership of crypto assets? Should the market be regulated? To what extent are crypto assets used for legal and for illegal transactions?

Table 7

Ownership and awareness of crypto assets

	% of the population
1. I currently own crypto assets (Bitcoin or other)	2.0
2. I owned crypto assets in the past	1.1
3. I've never owned crypto assets but I'm interested in crypto assets	7.9
Interest in crypto assets (1+2+3)	*11.0*
4. I know crypto assets only by name	24.6
5. I know crypto assets by name but have absolutely no interest in such assets	41.5
6. I've never heard of crypto assets	22.9

Source: OeNB-Barometer Q2/2018.

Note: The table summarizes the responses to two questions about respondents' ownership of crypto assets. The first question asks whether respondents have heard of „Bitcoin or of other so-called cryptocurrencies". For those respondents that have heard of crypto assets, another question asks whether respondents (1) currently own Bitcoin, (2) currently own other so-called cryptocurrencies, (3) owned them in the past, (4) have never owned such assets but are interested in them, (5) know of and (6) know of but have abosolutely no interest in such assets. Answers (1) and (2) are summarized in one category („owns crypto assets").

To enrich this debate, the OeNB-Barometer Q2/2018 contained questions about the ownership of crypto assets (table 7). Accordingly, 2% of Austrians owned crypto assets at the time of the survey (with a 95% probability the mean is in a range from 1% to 2.9%). About 1.5% owned Bitcoin and 0.09% owned other crypto assets. 1.1% had owned crypto assets in the past but sold them before the interview.

The survey also asked respondents about their motives to hold crypto assets. As an ownership rate of 2% implies that only 25 persons in the sample owned crypto assets, we stress that the results can be seen only as indicative. The most commonly cited reasons are "I see [crypto assets] as an investment with prospects of capital gains" (70% of owners stated this reason, multiple answers were possible) and "interest in technology" (59%). This motivation conform with findings for Canada (Henry, Huynh and Nicholls, 2018b). Almost half of crypto asset owners use these assets to pay for goods or services at least once a year. The relative majority has acquired their digital tokens via a domestic (35%, multiple answers possible) or international platform (35%), followed by systems that invest on behalf of their customers (25%) – only a small proportion has acquired their crypto assets via a vending machine or retail outlet (again, these findings are very unreliable due to the low number of observations).

How do our findings regarding ownership compare to other studies? For Austria there are two other recent surveys that report ownership rates of crypto assets. According to a survey by ING-DiBa (ING International Survey), about 8% of Austrians owned crypto assets in March/April 2018.[25] According to the survey company Market, 4% "have already used [crypto assets] for a payment or for

[25] *ING International Surveys Mobile Banking 2018: https://think.ing.com/reports/cracking-the-code-on-crypto-currency/.*

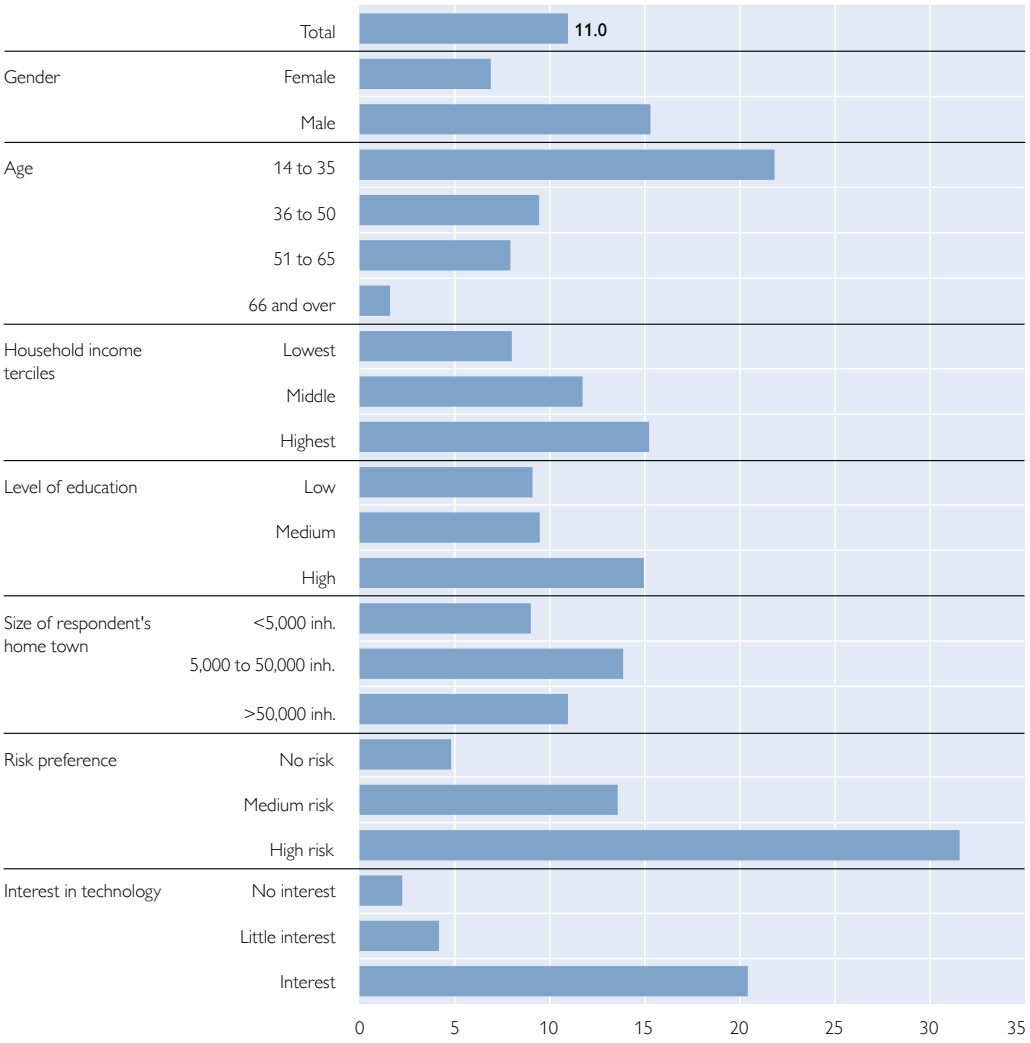
speculation" (interviews were conducted in December 2017).[26] As this survey refers to current and past ownership, the OeNB-Barometer's result (2% current and 1.1% past ownership) is in the confidence interval of Market's result, and the difference might be attributable to a different sampling and/or differences in the interview dates.[27]

Austrians' ownership rate of crypto assets of 2% according to the OeNB-Barometer compares with an ownership rate of 4% for Germany, based on a survey

Chart 11

Interest in crypto assets

% of respondents



Source: OeNB-Barometer Q2/2018.

Note: The chart shows the share of respondents with an interest in crypto assets, i.e., persons who either owned such assets at the time of the interview, had owned them before or said that they have an interest in crypto assets.

[26] *"Große Skepsis gegenüber Bitcoin & Co. Aber für die junge Generation geht der Hype weiter" (www.market.at). (Both results are based on samples that are drawn from online users (n=1009 for ING and 608 for Market) while the OeNB-Barometer is based on personal interviews.*

[27] *In our survey, the 95% confidence interval for current or past ownership ranges from 2.0% to 4.1%.*

conducted by the industry association Bitkom in 2018.[28] In Canada, the Bank of Canada has conducted specialized surveys, reporting Bitcoin ownership of 3% for 2016 and 5% for 2017 (Henry, Huynh and Nicholls, 2018a and 2018b). For the U.S.A., the Federal Reserve Bank has conducted surveys on payment behavior, reporting that 0.7% of the U.S. population held "virtual currencies" in 2017 (Greene and Stavins, 2018).

For policymakers, a key question is the "market potential" of crypto assets, e.g. the number of persons that have already invested or could potentially invest in these assets. Table 7 shows that 7.9% of the population does not own crypto assets but is interested. Thus, a total of about 11% can be viewed as being very interested, either due to current or past ownership or because they expressed interest (confidence interval: 8.9% to 13%). A further 25% of respondents know of crypto assets, and 42% know them but have absolutely no interest. Finally, 23% have never heard of crypto assets.

Chart 11 summarizes respondents' interest in crypto assets by socioeconomic groups. The pattern is very similar to previous findings with respect to age and interest in technology. Interestingly, the differences are not as strong as for the other financial innovations discussed earlier with respect to income and education but stronger for gender, with men being on average considerably more interested than women. To assess the impact of risk attitudes of interested people, we also show interest in crypto assets according to different levels of risk aversion. Our findings suggest that interest is much higher when persons state that they are willing to accept financial risks if they can expect an above-average profit from an investment.[29] This also holds for current owners of crypto assets (among the 25 owners, 14 are risk tolerant and just 2 are risk averse, the remaining 9 cases have a medium risk tolerance – if the risk attitudes of the overall population were applied to current owners, then we should observe that 14 out of the 25 persons are risk averse).

To find out more about people's attitudes about crypto assets, survey respondents who are aware of crypto assets and who are not completely uninterested were asked whether they agreed or disagreed with a number of statements.[30] Chart 12 summarizes the results as balance statistics, expressing a voting result, i.e. whether and how strongly respondents agreed with a statement or an associated opposing statement. For example, a value of 40 means that the group that agrees with a statement is 40 percentage points larger than the group that agrees with the opposing statement. It should be kept in mind that the results pertain to a subsample of the population and that item nonresponse was considerable for some statements.

We find that a substantial majority considers crypto assets to be volatile (in terms of their value in euro), and a (smaller) majority considers crypto assets as an unattractive investment. Accordingly, a majority does not consider purchasing

[28] *Sample of about 1,000 persons aged 14 or older (https://www.bitkom.org/Presse/Presseinformation/Inzwischen-kennen-zwei-Drittel-der-Bundesbuerger-Bitcoin.html). Further details on the sampling are not available.*

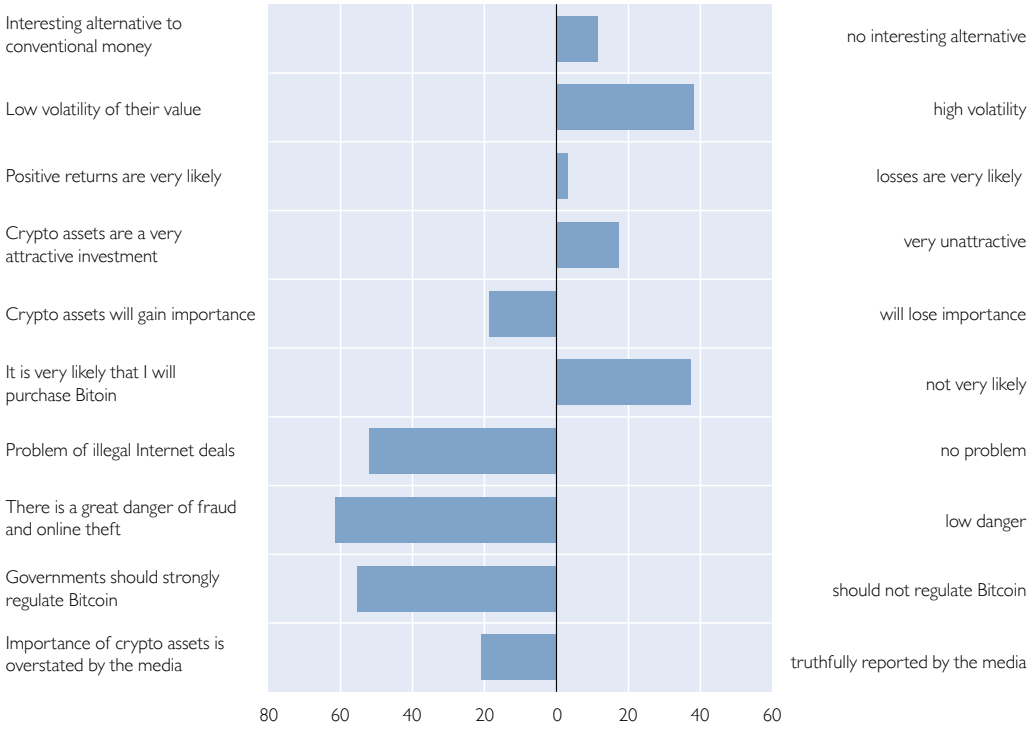
[29] *The differences according to gender and risk attitudes are statistically significant. To assess whether the other differences are statistically significant, the reader is referred to the estimation results in section 6.*

[30] *The question was asked for respondents who belong to line 1, 2, 3 and 4 of table 7.*

Chart 12

Attitudes toward crypto assets

Balance statistics (percentage share of respondents who agree minus percentage share of respondents who disagree)



Source: OeNB-Barometer Q2/2018.

Note: The chart shows respondents' agreement with various statements about crypto assets. Values left of the vertical line indicate agreement with the statement, values on the right-hand side indicate disagreement. In the survey each statement was presented with an opposing statement and respondents could indicate whether they agree with the first statement or with the opposing statement or whether they agree with neither. The bars represent the share of respondents who disagree minus the share who agree. Basis: respondents who are aware of crypto assets and who have a little interest in such assets (and who provided an answer to the respective statement).

crypto assets. However, a majority also thinks that crypto assets will increase in importance in the future.

A vast majority agrees with the statement that crypto assets facilitate illegal activities and that they involve a great danger of fraud and online theft. The statement that the government should regulate Bitcoin receives strong support.

These answers are informative as they reveal the overall assessment of crypto assets by informed parts of the population. As the majority of informed people do not hold crypto assets, some of the results might not come as a surprise. To look into attitudes in more detail, we analyze the balance statistics separately for three groups: (1) owners (n=25), (2) nonowners with a high interest (either because they owned crypto assets in the past or because they say that they are interested) (n=105) and (3) nonowners who are aware of crypto assets but who are neither interested nor disinterested ("know by name") (n=326).

Again, the group of owners is very small, which requires caution when interpreting findings. With this in mind, the analysis reveals marked differences between the three groups:

- Owners see crypto assets as an attractive investment, they have a relatively better assessment of their volatility than the other groups, they think that crypto assets will increase in importance and they are likely to further invest in these assets.

- The group who knows crypto assets only by name does not view crypto assets as an attractive investment; on average these respondents do not expect profits, they think that crypto assets are volatile and they do not intend to buy them.
- The group of current nonowners with a stated interest is particularly interesting as this group is closest to investing. The majority among this group regards crypto assets as volatile but nevertheless considers crypto assets an attractive investment. Moreover, the majority in this group believes that crypto assets will rise in importance.

As regards the other statements, we find that a majority in all three groups (1) considers crypto assets a problem because of illegal activities, (2) sees a great danger of fraud and online theft and (3) thinks that their importance has been overstated by the media. Nonowners are in favor of regulation while among owners there is an equal number of those in favor of and those against regulation.

6 Digital natives und technology skeptics – socioeconomic aspects of the use of banking and payment innovations

The previous results suggest that the use of newer banking and payment technologies follows a similar pattern across socioeconomic groups, e.g. that risk tolerant persons are more likely to adopt digital financial products than risk averse persons. While being indicative, such findings can also be misleading as many of these apparently important characteristics are correlated; therefore, we would like to identify those socioeconomic factors that matter most. The effect of age is of particular interest. If age still exerted an effect once other potentially important variables are controlled for (e.g. education, income, risk tolerance), this would have implications for predictions about the future course of adoption and use of financial innovations.

In this context, we conduct regressions which control for a broad range of potentially important variables. Again, we take a broader perspective and juxtapose the results for various technologies, from banking to payments, with each other. Specifically, we define various types and assign survey participants to whether they belong to a specific consumer type (if so, the respective variable is coded as 1, and as 0 if they do not belong to this type). The types themselves follow the discussion in this paper, i.e. whether (1) consumers bank more frequently online than at a bank branch, (2) use their debit card at least monthly, (3) pay contactless at least monthly and (4) have an interest in crypto assets (see table 8 for the definition of consumer types). To assess nonuse of financial innovations we define a (5) cash type, i.e. persons who have a strong cash preference.

For each consumer type, we estimate a separate probit regression. As explanatory variables, four groups of variables are considered. The first group consists of sociodemographic variables (gender, income, age, education, size of home town). The second group consists of background variables that measure interest in technology as well as risk preferences regarding financial decisions (see the annex for definitions of variables). The third group consists of variables that measure respondents' assessment of the safety of a given innovative product or service with respect to financial losses or the unwanted disclosure of personal information. Finally, the fourth group consists of additional variables that could have an impact on the use of payment/banking instruments (see the annex for variable definitions). In particular, we include the dummy variable "financially literate," which measures respondents' self-assessed knowledge of financial matters (Lusardi and Mitchell, 2014).

Table 8

Definition of consumer types used in regressions

	Definition	Mean	Confidence interval
		(% of the population)	*(95%)*
Types			
Type: online banking	= 1 if a person banks more frequently online than going to a bank branch (at a bank desk or self-service area), 0 otherwise.	46.7	42.8–50.6
Type: debit card PIN (monthly)	= 1 if a person pays at least once a month with a debit card by entering a PIN code, 0 otherwise.	75.1	71.3–78.8
Type: contactless card payment w/o PIN (monthly)	= 1 if a person pays at least once a month with a contactless debit or credit card (without a PIN code), 0 otherwise.	48.5	44.8–52.3
Type: uses at least one fintech service or product	= 1 if a person uses at least one of the following fintech services or products: alternative provider of payment services, crowdfunding, crowdlending, crowdinvestment, account information services, automated investment advice, "other", 0 otherwise. Mobile apps for financial services were excluded.	10.0	7.5–12.5
Type: interest in crypto assets	= 1 if a person owns or owned crypto assets or expresses interest in crypto assets, 0 otherwise.	11.0	8.9–13.0
Type: cash preference	= 1 if a person states that he or she prefers to make a EUR 50 payment in a supermarket in cash although cards are accepted and the person has enough cash at hand, 0 otherwise.	44.7	41.2–48.2

Source: OeNB-Barometer Q2/2018.

"Think before buying" measures whether respondents need to or want to keep track of their expenses (i.e. whether they agree to the statement "before I buy something, I consider very carefully whether I can afford it"). Finally, the regressions contain a variable which measures whether respondents have no trust in domestic banks as well as variables for the perceived safety of a given innovation (if such variables are available).

The regression results are summarized in table 9. For ease of exposition, only the direction of the effect is symbolized by a plus or a minus symbol (only for point estimates that are significant at the 5% level), which indicates whether the odds of a person belonging to a specific type are higher or lower than the odds of a person belonging to the base category.[31] In the following we do not discuss the results in detail but focus on the bigger picture:

- The perceived safety of an innovation is, not surprisingly, an influential driver of adoption. If a person considers online banking or a payment instrument as being not safe, the likelihood that this person uses this financial product or service will be very small. In contrast, a person who considers cash to be safer than other payment instruments, is more likely to have a preference for cash.
- Age is an influential determinant of use of financial innovations even if other variables are being controlled for. For all but one innovative product or service, the youngest age group has the highest adoption rates. In contrast, the likelihood that someone has a preference for cash increases with age. Differences between age groups fade for the most mature payment innovation (i.e. debit card payments with PIN), where only the oldest age group is significantly less likely to use it than all other age groups.

[31] *Odds represent the chances of belonging to a specific type.*

Table 9

Regression results: determinants of different consumer types

		Type: online banking	Type: debit card PIN (monthly)	Type: contactless card payment w/o PIN (monthly)	Type: uses at least one fintech service or product	Type: interest in crypto assets	Type: cash preference
		(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable							
Gender	(relative to Female)						
	Male					+	+
Age	(relative to age 16 to 35)						
	Age 36 to 50	–		–	–	–	
	Age 51 to 65	–		––	–	–	
	Age 66 and over	––	–	––	––	––	
Household income	(relative to Household income lowest)						
	Household income middle						
	Household income highest						
Level of education	(relative to Low)						
	Medium			+			–
	High		+	+			–
Size of respondent's home town	(relative to >50,000 inh.)						
	<5,000 inh.			–			+
	5,000 to 50,000 inh.					+	
Risk preference	(relative to Low financial risk)						
	High financial risk	++	++	+	++	++	
	Medium financial risk	+		+			–
Interest in technology	(relative to Very low)						
	High	+	+	+	+	++	–
	Low		+				–
Financial literacy	Quality news		+			+	
	Financially literate			+	+		
	Think before buying		–	–			
Trust/safety	Rel. trust safety online banking	++	.	.	.	.	.
	Rel. trust safety cards with PIN	.	++	.	.	.	.
	Rel. trust safety contactless cards	.	.	++	.	.	.
	Rel. trust safety cash	.	.	.	.	.	++
	No trust domestic banks	.	.	.	+	.	.
	Observations	945	1,008	1,002	1085	1109	1,013
	Sample mean of dependent variable	0.52	0.79	0.53	0.10	0.10	0.40
	Log likelihood	–461.11	–412.94	–478.81	–277.52	–286.2	–544.92

Source: OeNB-Barometer Q2/2018.

Note: The table represents regression results from probit estimations. The sample comprises only respondents with a transaction account and who provide a safety ranking for at least 4 out of 6 payment instruments. Results are not weighted. For each dependent variable in columns, the indicated model is estimated. The symbols denote whether a particular variable is found to be statistically significant at the 5% level. A plus or minus symbol denotes the direction of the effect relative to the base category. A double „++" (or „––") denotes that the odds ratio of a variable is higher than 2 (lower than 0.5). A „+" (or „–") denotes that the odds ratio is between 1 and 2 (0.5 and 1) relative to the base category. „." indicates that a variable has not been included in a specific regression. The model in column 4 omits persons aged 66 or over as the sample does not contain persons in this age group who use a mobile phone for payments at the point of sale. The symbols are based on robust standard errors. Variable definitions and descriptive statistics are presented in the annex.

- The willingness to accept risks of losses in financial decisions is a strong predictor for the use of digital financial products. The small group of risk tolerant respondents (13% of the sample) has a much higher likelihood of using financial innovations. The reverse holds for cash preferences: The large group of people who do not want to take any risk when making a financial decision (57% of the population) is more likely to prefer cash than the group who is willing to take medium risk.

- Interest in technological innovations exerts a significant impact on the adoption of innovations and has a particularly strong effect on interest in crypto assets. Those who are interested in technology are also less likely to use cash.
- Respondents who have a desire to keep track of their expenses (either because they want to or because they have to for financial reasons) are less likely to use payment cards.
- Lastly, the regressions control for whether respondents have trust in domestic banks. It has been conjectured that the use of fintech or crypto assets is related to a lack of trust in banks. Likewise, the increase in cash demand that has been observed since the outbreak of the global economic and financial crisis in 2008 has been associated with these factors. Our results partly confirm this conjecture as a lack of trust in domestic banks is correlated with a higher likelihood of using fintech. For crypto assets or cash preferences, however, we find no effect.

To check for the robustness of results, we repeat the regressions only for those respondents that own the devices/cards for making use of banking and payment innovations (e.g. persons who hold a contactless card). This modification has little qualitative implications for the discussed findings.

While these results are informative, we also stress that they should be treated with some caution. The literature has shown that perceptions of ease of use, costs and other factors are important drivers of adoption (Bagnall et al., 2016), and due to missing information we cannot control for all relevant drivers. Moreover, some of the explanatory variables, i.e. trust in the safety of an innovation, are likely to be endogenous. A more detailed study of adoption decisions should acknowledge these considerations but is beyond the scope of this paper. We conjecture that the results for age, risk attitudes and interest in technology are unaffected by controlling also for these missing variables.

While the regressions inform us about relative effects, table 10 presents descriptive statistics about key variables and thus informs us about the characteristics of

Table 10

Socioeconomic characteristics of users

	Total	Type: debit card PIN (monthly)	Type: online banking	Type: contact-less card payment w/o PIN (monthly)	Type: use of at least one fintech service or product	Type: interest in crypto assets	Type: cash prefer-ence
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	% of respondents						
Age (median)	48	44	39	39	36	33	56
Share of persons born before 1980	67	63	52	50	42	36	77
Share of persons aged 66 or over	20	12	5	7	3	3	33
Share of persons willing to take high financial risks	13	16	21	19	36	37	10
Share of people with high interest in technology	45	51	64	62	71	84	32
Share of persons who own risky assets	19	21	24	19	31	27	18

Source: OeNB-Barometer Q2/2018.

Note: The table shows mean values of socioeconomic characteristics (in rows) for different user types (in columns). For age, the median is reported. Total refers to the sample of all individuals. Risky assets refer to mutual fund investments and stocks.

the adopters of new technologies. Specifically, table 10 presents descriptive statistics on their age, the share of persons willing to take high financial risks and the share with a strong interest in technological innovations for the overall population and for different types. The median age of users, e.g. of online banking, is considerably lower than the median age of the overall Austrian population. Across different types, the median adopters are in their 30s, and hence a considerable share of adopters cannot be considered to be "digital natives" (who are usually understood to be born in 1980 or later). At the same time, we observe rather low adoption rates for persons older than 65 years. Persons that prefer cash, in turn, are considerably older than the overall population. Table 10 also shows that risk preferences of adopters deviate substantially from the population average as does interest in technology. Finally, table 10 summarizes the share that possesses risky assets (i.e. stocks and mutual funds shares). In contrast to risk preferences, the actual ownership of risky assets also reflects financial resources. Among those who use at least one fintech product or service and those interested in crypto assets, ownership of risky assets is more prevalent than among the overall population.

The regressions reveal that adopters of fintech and persons who are interested in crypto assets share common characteristics. So are they the very same persons? Among all the persons who are either interested in crypto assets or who use fintech, about one-fifth belongs to both consumer types. The remaining 80% belong to one of the two types but not to both.

7 What role for cash?

Given that Austrians have access to a multitude of payment options and increasingly use these options, how do they see the role of cash? How does this assessment differ between users and nonusers of financial innovations? And what does this imply for the future of cash?

Over the past decades, many have expected that the importance of cash will sharply decline or that cash will disappear altogether. However, cash has proven to be remarkably resilient. In fact, cash demand has even increased over the past decade in the euro area, the U.S.A., Switzerland and Japan as well as in many other economies (Jobst and Stix, 2017; Bagnall et al. 2016). The proliferation of electronic payments and the parallel increase in cash demand indicate the difficulties in predicting the future of cash. Part of this seeming paradox arises because the largest part of cash demand is unrelated to its use for domestic payments (e.g. cash as a store of value or cash circulating outside the euro area): the use of cash for payments is estimated to account for only 10% to 15% of overall cash in circulation (Politronacci et al. 2018; Stix 2004).

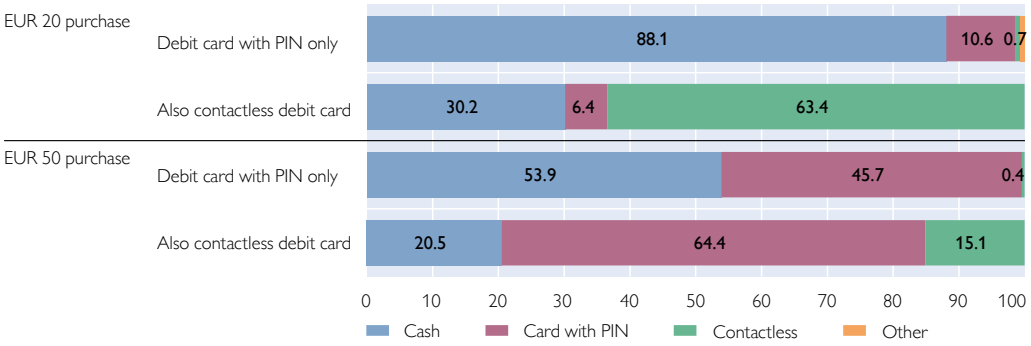
To grasp how the use of cash for transactions is likely to evolve, chart 13 compares the payment preferences of two types of consumers: those who use the contactless function of their debit card and those who pay with their debit card only in a traditional way, that is by entering their PIN. The chart shows the share of respondents stating a preference for card and cash payments for a purchase worth EUR 20 and EUR 50, respectively. To grasp the relevance of this example, we note that the group paying only with PIN comprises 33% of the population and the group who already uses contactless payments accounts for a share of 50%.

The preference for cash is considerably lower among contactless payers than among "traditional" card payers. For a EUR 20 purchase, almost 90% of traditional

Chart 13

Preferred payment instrument: persons making PIN card payments only compared with persons using both PIN and contactless card payments

% of respondents



Source: OeNB-Barometer Q2/2018.

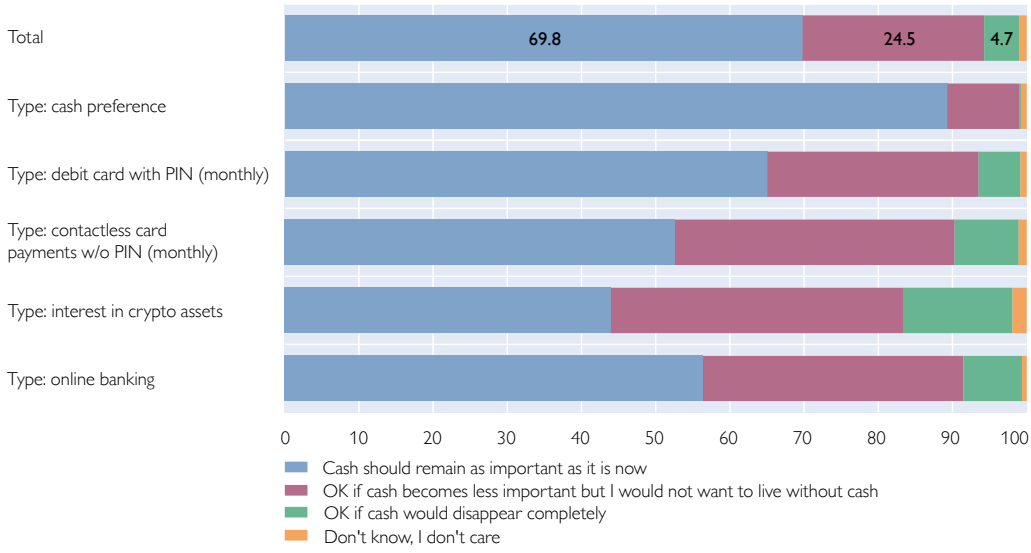
Note: The chart summarizes answers to hypothetical questions about the use of payment instruments for EUR 20 and EUR 50 purchases for two groups: 1) for respondents who pay with their debit cards but do not use contactless payments and 2) for respondents who also use contactless debit card payments.

card payers prefer to use cash, while this share is only 30% for those paying contactless (the difference is statistically significant). The share of those preferring cash for a EUR 50 payment is only 54% among card payers and 21% among contactless payers (the difference is statistically significant). As the number of contactless payments will increase in the coming years, these results suggest that cash use for transactions will decline overall and decrease relatively more strongly for smaller payment amounts.

Chart 14

Preferences regarding the future of cash

% of the population



Source: OeNB-Barometer Q2/2018.

Note: The chart summarizes the responses to the following question: "In some countries, e.g. Sweden, cash has almost disappeared from daily life. Almost all people pay by card or by mobile phone. There has been a debate about the future of cash also in Austria. Which of the following statements reflects your preference?".

Over the past years, there have been discussions about the future of cash and whether cash is still needed in a digital world. The survey looked into the preferences of respondents in this regard. Overall, about 70% of Austrians state that cash should remain as important as it is now, 25% state that it would be ok for them if cash became less important but that they would not want to live without cash, and only 5% state that it would be ok for them if cash disappeared completely. Chart 14 also depicts the responses for the different types of consumers. Evidently, the support for cash is strongest among respondents with a preference for cash (who still account for 45% of the population) and weakest among those using payment innovations. However, even within the group who uses contactless card payments, there are still 53% that would like cash to remain as important as it is now and a further 38% would not want to live without cash (even though they would not mind if it declined in importance). Overall, the results show that only a small minority of Austrians is in favor of a complete abolition of cash.

The reasons why people use cash are manifold – speed of transaction, ease of use, convenience, costs, keeping track of expenses, anonymity (Rusu and Stix, 2017). In a previous OeNB survey (fall 2017), respondents were asked to which extent various payment instruments come close to their notion of an optimal payment instrument. Cash ranked first by a considerable margin, with 96% of Austrians saying that cash comes close to an optimal payment instrument (74% of the population completely agreeing and 22% rather agreeing).

The Deutsche Bundesbank asked a similar question in their payment survey of 2017 (Deutsche Bundesbank, 2017), although the phrasing of the question and answer categories differed somewhat. In Germany, about 12% are in favor of either an abolition of cash (2%) or of cash being replaced with electronic means of payments to the largest extent possible (10%). 88% would like to keep the option of paying in cash. Despite the limited comparability of the questions, both the results for Austria and for Germany show that a vast majority does not want cash to disappear.

As Germany and Austria are rather similar in terms of the use of cash (Esselink and Hernandez, 2017), it is interesting to look at a country that has a much lower cash use, e.g. Denmark, where only 23% of transactions are carried out in cash compared to about 80% in the euro area or in Austria. A survey of Danmark's Nationalbank (Smestad, 2017) asked whether it would "be problematic for [respondents] if there was no cash in society as we know it today." 50% answered yes and 40% answered no (the remaining 10% answered "don't know"). This shows that support for cash is much lower in general, but at the same time this support can be observed also among respondents that are not heavy cash users.

Clearly, answers to questions on respondents' preferences regarding the future of cash only reflect a snapshot and will vary over time, i.e. as people increasingly pay cashless. Nevertheless, the results from both the OeNB-Barometer and from the Danish study suggest that people's answers do not only reflect personal views but also societal considerations. For example, 92% of Austrians hold the view that some social groups would have difficulties in a world without cash.

8 Conclusions

The digitalization of banking and payment services has provided Austrian consumers with different access modes to banks (self-service counters, online and mobile

banking), "banking products" provided by nonbanks (e.g. crowdlending) and a multitude of payment options (e.g. traditional card payments, contactless payments, payments by mobile phone). The present study employs survey data for a stocktaking of how Austrians use digital innovations in the field of banking and payments. Overall, the results reveal considerable changes in the way Austrians bank and pay.

A substantial share of Austrians are already using digital services. Most prevalent are online banking and card payments, which are also the most mature technologies. Contactless card payments, an option which has been available only for a few years, are already used by 50% of the population. Other innovative payment solutions (e.g. via mobile phones) are at a much earlier stage of diffusion but can be expected to increase in importance in the coming years. The use of newer financial services and products (fintech), which have the potential of challenging banks and existent payment service providers, is very modest if looked at individually. However, overall, the proportion of the population that already uses a fintech service/product is not negligible. Abstracting from traditional debit card payments, overall, about two-thirds of the population have come in touch with digital payment or banking products: they either bank more frequently online than visit a bank branch, pay contactless by card (at least monthly) or use a fintech service (other than just mobile banking apps).

All these innovations provide different ways of accessing bank or nonbank assets denominated in legal tender. Crypto assets, which have been the subject of extensive media coverage, have a special position as their value is expressed in the respective "crypto currency" and transactions can be carried out without a trusted third party. The representative survey used in this paper shows that only about 2% of the population owns Bitcoin or other crypto assets. However, the share of those interested in these technologies is significantly larger, amounting to 11% of the population. Our results suggest that speculation is the major motive for an investment in crypto assets. The group who owns or considers buying crypto assets is much more willing to take financial risks than the overall population.

Besides this overall perspective, our data provide insights into user characteristics. Our results reveal a very similar pattern across various banking and payment innovations. Perceived safety, age, risk tolerance and interest in technology are key variables for the adoption of innovations. These results are useful for assessing the likely future evolution, e.g. as cash use among digital adopters is much lower than cash use across the overall population. For example, if today's young people continue to use less cash as they grow older, the use of cash will drop automatically in the future.

While a significant number of Austrians have already entered the market of digital financial services, we also stress that a sizeable share of Austrians do not yet use newer technologies – and very likely will continue to do so in the coming years: For instance, 45% of the population prefers to pay for a EUR 50 purchase in cash, and 42% of the population does not conduct online banking. On average, the group of nonadopters and the group of persons with a strong affinity for cash overlaps considerably (but not perfectly). These persons are on average older, more averse to financial risks, have a lower level of education and lower income and want to keep track of their expenses (which, for this group, is easier with cash).

Several policy conclusions emerge from our analysis. First, in many areas of financial digitalization Austria ranks close to or above the EU-28 average – but not at the top. If increasing the use of financial digitalization is a policy goal, our results suggest that Austrians are already sufficiently equipped (given, e.g., their ownership of payment cards, their use of the Internet or their ownership of smartphones) for such a goal to be achieved. Obviously, some consumers have the necessary equipment and knowledge but do not use financial innovations. Second, we identify safety and trust as key factors for the adoption of financial innovations by consumers. While this finding does not come as a surprise, it underlines the importance of measures to enhance trust, e.g. regulation of providers and initiatives aimed at informing consumers about how they can assess the safety of financial innovations. Moreover, trust is even more important for saving products than for payments, and incumbent banks enjoy the trust of a large share of the population. New (non-)bank competitors who enter the market have yet to establish such a trust level among the wider population. Third, as many as one-third of respondents state that they visit a bank desk only once a year or less frequently. The trend toward visiting bank desks only very rarely will accelerate. There are two reasons for this: On the one hand, younger people visit bank desks very rarely already now (52% for persons aged 14 to 35 years, 43% for higher educated), and they will continue to do so as they grow older. On the other hand, online banking will grow further even among current nonusers as a consequence of the diffusion of new technologies. This development will further affect banks, which will be challenged to adapt their branch network, the way they communicate with customers (e.g. regarding financial advice or loans) and their investments in newer technologies. Fourth, the results also highlight the role of cash as a payment instrument that does not require skills or ownership of a technical device. It must be acknowledged that a considerable share of Austrians prefer to pay in cash and have good reasons to do so (as found in many previous studies, e.g. Bagnall et al., 2016). Fifth, the results of this paper enrich recent discussions of whether and how to regulate crypto assets. The majority (of people informed about crypto assets) sees problems with fraud, theft and illegal activities and hence is in favor of regulating crypto assets. Those interested in investing are, on average, aware of the associated risk of losses and are also more willing to accept such risks.

The ongoing changes in the way Austrians bank and pay, the possibility that the diffusion of new technologies could occur faster than in the past and the finding that the group of nonadopters is still large calls for further analyses. First, the survey should be repeated to observe developments over time and to shape the understanding about how Austrians deal with financial innovations and with cash. Second, further analyses should be conducted to delve deeper into the drivers of adoption and use – which was beyond the scope of this paper. Third, we have only considered the viewpoint of consumers, neglecting the viewpoint of banks, payment service providers and merchants as well as their strategic considerations (this concerns also the costs associated with payments, e.g. Kosse et al. 2017). A view beyond consumers will help to better assess the likely consequences of digitalization for the financial industry, for consumers and for society at large.

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Annex

Table A.1

Definition of explanatory variables

Household income	Household income is equivalzed by dividing household income by the square root of the number of persons living in the household. Then terciles are computed. Household income T1 = 1 if the equivalized household income is among the 33% that represent the lowest household incomes in the sample, 0 otherwise. Household income T3 = 1 if the equivalized household income is among the 33% that represent the highest household incomes in the sample, 0 otherwise. Nonresponse rates can be high for household income.
Level of education	Edu low = 1 if the highest level of education of the respondent is the completion of mandatory schooling ("Pflichschule mit/ohne Abschluss"), 0 otherwise. Edu medium = 1 if the respondent has completed some form of medium secondary education, e.g. an apprenticeship ("Pflichschule mit Lehre") or a three-year technical school ("Fachschule, Handelschule"), 0 otherwise. Edu high = 1 if the respondent has completed higher secondary or tertiary education ("Matura", university degree), 0 otherwise.
Risk attitude	Based on the question: "If there are financial decisions in your household: which of the following statement best describes your attitude toward risk: a) if I can expect a substantial profit, I am willing to take substantial financial risks; b) if I can expect an above-average profit, I am willing to take above-average risks; c) if I can expect average profits, I am willing to take average financial risks; d) I do not want to take any risk. High financial risk = 1 if respondents choose a) or b), 0 otherwise. Medium financial risk = 1 if respondents choose c), 0 otherwise. Low financial risk = 1 if respondents choose d), 0 otherwise.
Interest in technology	Based on the following question: "How would you assess yourself in relation to technological developments, e.g. new devices or applications? Which of the following statement best applies to you?" Answers comprise "A) Highly interested, I would like to try new devices or applications immediately", "B) I am interested, but would not want to buy or try new devices or applications immediately", "C) I buy new devices or applications only if I see a benefit", "D) I am not interested in technological developments and only buy new devices when I need them". Tech interest thigh = 1 if respondents choose A) or B), 0 otherwise. Tech interest low = 1 if respondents choose C), 0 otherwise.Tech interest very low = 1 if respondents choose D), 0 otherwise.
Financially literate	Based on the following statement: "In general, I am well informed about financial matters." Financially literate = 1 if respondents answer "very much agree," 0 if respondents answer "rather agree," "rather disagree," "very much disagree."
Think before buying	Based on the following statement: "Before I buy something, I consider very carefully whether I can afford it." Think before buying = 1 if respondents answer "very much agree," 0 if respondents answer "rather agree," "rather disagree," "very much disagree."
Quality news	= 1 if respondents regularly read an Austrian quality newspaper ("Der Standard," "Die Presse," "Salzburger Nachrichten") or magazine (e.g. "Profil," "Format," "Trend"), 0 otherwise (if answer was provided).
No trust in domestic banks	Based on the following question: "How high is your trust in domestic banks?" = 1 if respondents answer "rather low" or "low," 0 otherwise (if answer was provided).
Trust in safety of payment instrument	Based on the following question: "If you think about various digital payment methods – how safe do you consider the following methods? Think about the possibility of a financial loss or the unwanted disclosure of personal information". Trust in safety of online banking = 1 if respondents answer "very safe" or "rather safe," 0 if "rather unsafe," "very unsafe" or "don't know." Likewise for Trust in safety of cards with PIN, Trust in safety of contactless cards, Trust in safety of contactless mobile phone payments and Trust in safety of cash.
Relative trust in safety of payment instrument	Used in the regressions. Answers on trust in the safety of payment instruments (very safe, safe, unsafe, vey unsafe) are normalized by respondents' average perception on the safety of these six payment instruments. As regards missing observations on the "Trust in safety of payment insruments" question, we only consider respondents who provide an answer for at least four payment instruments.

Source: OeNB-Barometer Q2/2018.

Table A2

Descriptive statistics

	Mean	Sd	Min	Max	Obs
Panel A. Sociodemographic variables					
Male	0.48	0.50	0.00	1.00	1,381
Age 14-35	0.28	0.45	0.00	1.00	1,381
Age 36-50	0.27	0.44	0.00	1.00	1,381
Age 51-65	0.25	0.43	0.00	1.00	1,381
Age 66+	0.20	0.40	0.00	1.00	1,381
Household income lowest	0.34	0.47	0.00	1.00	1,153
Household income middle	0.34	0.47	0.00	1.00	1,153
Household income highest	0.32	0.47	0.00	1.00	1,153
Level of education low	0.14	0.35	0.00	1.00	1,381
Level of education medium	0.57	0.49	0.00	1.00	1,381
Level of education high	0.28	0.45	0.00	1.00	1,381
<5,000 inh.	0.39	0.49	0.00	1.00	1,381
5,000 to 50,000 inh.	0.26	0.44	0.00	1.00	1,381
>50,000 inh.	0.35	0.48	0.00	1.00	1,381
Panel B. Risk preferences and interest in technology					
No financial risk	0.57	0.50	0.00	1.00	1,381
Medium financial risk	0.30	0.46	0.00	1.00	1,381
High financial risk	0.13	0.34	0.00	1.00	1,381
Interest in technology very low	0.27	0.44	0.00	1.00	1,381
Interest in technology low	0.28	0.45	0.00	1.00	1,381
Interest in technology high	0.45	0.50	0.00	1.00	1,381
Panel C. Financial literacy and trust					
Quality news	0.22	0.42	0.00	1.00	1,370
Financially literate	0.21	0.40	0.00	1.00	1,375
Think before buying	0.47	0.50	0.00	1.00	1,376
No trust domestic banks	0.26	0.44	0.00	1.00	1,372
Trust safety cards with PIN	0.85	0.36	0.00	1.00	1,381
Trust safety online banking	0.57	0.50	0.00	1.00	1,381
Trust safety cards contactless	0.46	0.50	0.00	1.00	1,381
Trust safety cash	0.96	0.20	0.00	1.00	1,381
Rel. trust safety cards with PIN	1.16	0.24	0.43	2.29	1,245
Rel. trust safety cards contactless	0.85	0.23	0.33	1.80	1,226
Rel. trust safety online banking	0.97	0.24	0.33	1.71	1,164
Rel. trust safety cash	1.41	0.43	0.38	2.67	1,247
Panel D. Ownership financial assets					
Savings deposits	0.66	0.47	0.00	1.00	1,354
Ownership risky assets	0.19	0.39	0.00	1.00	1,354

Source: OeNB-Barometer Q2/2018.