



# SPECIAL PUBLICATION

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## Rafkróna?

*Central bank digital currency*

*Interim report*

September 2018

Central Bank of Iceland

*Rafkróna?*

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## Foreword by the Governor

This Special Publication focuses on the advantages and disadvantages of the issuance of digital currency by the Central Bank of Iceland – a *rafkróna*. Central banks around the world are currently evaluating whether to issue central bank digital currency (CBDC) in the future. CBDC is an electronic claim against a central bank that can play the role of a general payment instrument in the same way that banknotes and coin do today. Various central banks have issued reports on this topic in the recent term, as is discussed further in this publication. In this report, *rafkróna* is used as the working terminology for digital cash issued by the Central Bank of Iceland.

This widespread international discussion of the possible issuance of CBDC is apparently attributable to at least three factors. First of all, technological advancements have pushed this issue higher up on the agenda. These advancements include growing prevalence of digital solutions, development of distributed ledger technology such as that used in blockchain technology, and the advent of crypto-assets (such as Bitcoin), which are used to some extent in payment intermediation. Second, steadily diminishing use of banknotes and coin, particularly in advanced economies, has given rise to questions about central banks' role in payment intermediation and its task of providing the public with payment instruments without counterparty risk. Third, in many developing countries, digital cash is viewed as a potential tool for the provision of payment intermediation to people who, until now, have had very limited access to it.

The questions that arise in connection with possible supply of CBDC extend to all three of central banks' main tasks: formulating and implementing monetary policy, promoting financial stability, and ensuring sound, and effective payment intermediation. Central banks' central position in the monetary system plays a key role in their potential to carry out these tasks. That position is based on several factors, perhaps the most important being that all interbank payment intermediation is ultimately settled using central bank money, via transfers between commercial banks' accounts with central banks; that central banks attempt to preserve the value of money, which functions simultaneously as a unit of account, a medium of exchange, and a store of value; and that central banks provide banks with liquidity if the need arises.

In the past century or so, the generally held view has been that it is necessary for businesses and individuals to have access to central bank money and be able to use it as a payment instrument without incurring

counterparty risk. As the share of banknotes and coin in payment intermediation steadily declines, the possibility develops that physical cash could virtually disappear when network effects and economies of scale begin to undermine it due to ever-decreasing use. It is partly in this context that CBDC is considered as an option. The question here is whether individuals will use banknotes and coin less because they wish to avoid paper and use digital solutions, or whether they think they need any access to central bank money at all.

There are benefits to CBDC issuance, but as always, there are drawbacks and risks as well. This report explores these further, both from a general standpoint and in view of uniquely Icelandic conditions. One point of concern is that runs on banks might be more aggressive if retail depositors could transfer their account balances electronically from banks to digital central bank money. This is certainly among the topics that must be examined more thoroughly. In this context, it is important to emphasise that CBDC is not intended to lead to central bank involvement in credit intermediation. This is not the role of a central bank.

The design of a CBDC will have an impact on the assessment of its advantages and disadvantages, and there are various options that can be considered, as is outlined in the report: i.e., concerning use of central bank balances and/or issuance of an independent digital payment instrument, interest on individuals' central bank money, imposition of caps on digital account balances, and others. It would also enhance the benefits of a CBDC if it could function as an alternative in the event of a malfunction in other payment intermediation channels. Moreover, it would be an advantage if it could function for some time on battery power and without an internet connection. The possibilities offered by future technological advances have yet to emerge.

This report has been released in order to share with stakeholders and the public the discussion on CBDC that is taking place abroad and to launch a discussion of the numerous issues relating to the possible issuance of a *rafkróna*. The report does not recommend that the *rafkróna* be introduced, and no decisions have been taken on the matter. Discussions with stakeholders lie ahead, as do further analysis and assessments of the pros and cons of issuing a *rafkróna*. A decision on the *rafkróna* is in part a political one, and it can have various implications for the structure and evolution of the financial system. That decision will not be taken without extensive discussions so as to generate the broadest possible consensus on decisions that may be taken in the future. The process will involve numerous others in addition to the Central Bank, including Parliament.



## I Introduction

In the recent past, central banks around the world have given consideration to the possibility of digitising cash. The main reasons for this focus are technological advances, reduced use of conventional cash, and security considerations. Reasons differ from one country to another, and discussion of the topic is therefore affected by local factors. The advent of so-called distributed ledger technology and issuance of money based on that technology has also been a factor. Central banks in Canada and the Netherlands have experimented with using parts of distributed ledger technology in payment intermediation, and the Uruguayan central bank has begun issuing electronic central bank money to the public on an experimental basis. It is not unlikely that arrangements for issuance of cash will change over time, in view of rapid market and technological developments, innovations in service offerings (not least in the field of retail payment intermediation) and the entry of new players, including financial technology (fintech) companies into the market.

At present, financial institutions (commercial banks and acquirers) are the most active providers of payment services in Iceland. When the new Payment Services Directive (PSD2) is implemented in the European Economic Area (EEA), the market will open up to even more entities, in addition to the current participants, which will probably increase competition.<sup>1</sup> This will bring with it challenges and opportunities for current payment service providers and newcomers planning to enter that market.

The Central Bank of Iceland has the exclusive right to issue cash (banknotes and coin), which is classified by law as legal tender for all payments.<sup>2</sup> The vast majority of payment intermediation in Iceland takes place electronically, however. At the end of 2017, banknotes and coin in circulation totalled about 60 b.kr., whereas average daily turnover in the Central Bank's electronic payment systems was 76 b.kr. The ratio of cash to the money supply (M1, which comprises deposit institutions' current accounts plus banknotes and coin in circulation) was about 11% in April 2018. Payment cards are the most commonly used payment instrument in Iceland, together with electronic transfers between bank accounts. Mediums of payment based on market solutions are in competition both with one another and with cash. As a result, there is every reason to consider the future of cash issuance and the options available in payment intermediation.

The term electronic money is defined in the Act on the Issuance and Treatment of Electronic Money, no. 17/2013. Electronic money is well known in the form of prepaid payment cards. The Act places various restrictions on its use. Among other things, it is prohibited to calculate interest or grant a holder of electronic money any other benefits based on the length of time during which the holder holds the electronic money. The current legislation authorises the Central Bank of Iceland to issue electronic money, but it has not as yet used that authorisation.

In this report, the term *rafróna* is used to describe digitised cash issued by the Central Bank of Iceland. Unlike the statutory provisions on electronic money, it would conceivably be possible for *rafrónur* to bear interest. Foreign and international institutions are considering whether it would be feasible to issue digitised cash; what the potential advantages, disadvantages, and effects would be; and what design/regulatory framework would be best if it were issued.

According to the Act on the Central Bank of Iceland, the Bank shall promote "a sound and efficient financial system, including domestic and cross-border payment systems." The Bank's tasks in the field of payment intermediation are numerous and varied. The Bank operates electronic interbank systems, greatly reducing liquidity risk during the payment intermediation process. There is no counterparty risk, and settlement finality is ensured. The Central Bank is also an issuer of cash. Furthermore, the Bank oversees systemically important financial market infrastructure. The objective of this oversight is to promote security, efficacy, and efficiency in the Icelandic payment intermediation system's core infrastructure, thereby promoting financial stability. The social cost of payment intermediation is an important factor in an assessment of the efficiency of mediums of payment and methods of payment at any given time.

1. Payment service providers are subject to an operating permit and to official supervision. With the incorporation of the original Payment Services Directive (PSD) into Icelandic law — the Payment Services Act, no. 120/2011 — access to the payment services market opened up to more types of supervised entities than just financial institutions. Electronic money institutions and payment institutions are now classified as payment service providers, as are financial institutions. Financial institutions have retained their market dominance until now, however. With PSD2, the payment services sector will expand to include still more new types of providers. The objective of PSD2 is to increase competition while ensuring that appropriate minimum requirements are met as regards security measures and consumer protection.

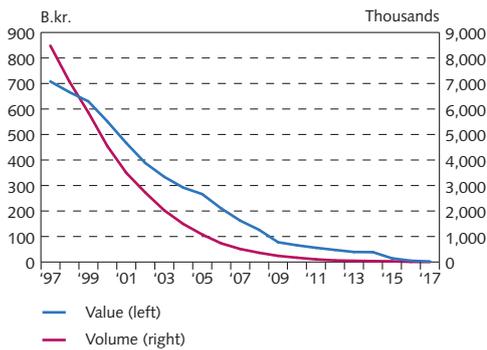
2. Cf. Article 5 of the Act on the Central Bank of Iceland, no. 36/2001, and Article 3 of the Act on Iceland's Currency, no. 22/1968.

Chart I-1  
Cash in circulation  
1961-2017



Sources: Statistics Iceland, Central Bank of Iceland.

Chart I-2  
Use of cheques



Source: Central Bank of Iceland.

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The history of central banks spans a period of about 350 years. Until now, issuance and maintenance of banknotes and coin have been a major part of their activities; however, the scope and importance of this task has been reduced in recent decades by advances in payment intermediation. Forms of cash have evolved significantly over time. At one point, cash took the form of objects such as lumps of metal. Later, these metals were shaped into standard units, with the weight or volume printed on them. Issuance of paper money was a major step forwards.

Since 1960, when cheques were introduced in Iceland, cash in circulation declined rapidly as a share of GDP. In 1960 it accounted for just under 5% of GDP but by 1984 it had fallen to 1%, where it remained virtually unchanged until the 2008 financial crisis. During the aftermath of the crisis, it rose to just over 2% and has increased slightly more in recent quarters. Payment cards gradually took over in payment intermediation, and cheques virtually disappeared from the market, while the share of cash in circulation remained largely unchanged.

The Central Bank is required by law to promote price stability and financial stability. It is also required to undertake such tasks as are consistent with its role as a central bank, such as promoting a sound and efficient financial system, including domestic and cross-border payment systems.<sup>3</sup> Therefore, the Bank must always be prepared to take action if necessary to carry out its legally mandated role. Employers and consumers rely on effective, secure, and economical electronic payment intermediation. Necessary actions or responses by central banks in the field of retail payment intermediation could entail, for instance, promoting the passage of legislation to ensure that the public always has access to cash (central bank money), although its form may be subject to change.

Governmental authorities and central banks around the world are now considering whether and how to respond to market developments in the field of retail payment intermediation. One topic under scrutiny is whether to digitise currency (i.e., to issue central bank digital currency). Central banks in a number of countries have considered this option alongside conventional cash, including Sweden, Finland, Denmark, Norway, the UK, Canada, and the Netherlands. They have already invested considerable effort in examining the pros and cons of such issuance. Scholars and international institutions have also discussed these issues.

It is necessary to assess the potential effects and risks before taking a position on possible issuance, as such issuance could have wide-ranging and even unforeseeable impact on financial systems as we know them today. To a degree, decisions on such matters are political but they must be based on technological and economic factors, including those pertaining to monetary policy and financial stability. There are various technological options available if it is decided to digitise cash. Electronic cash can be designed to be very similar to the current arrangement. It is also possible to base it on a centralised

3. See Articles 3 and 4 of the Act on the Central Bank of Iceland, no. 36/2001.

system comparable to the one used currently in the banking system. It is possible to use current technology or a new solution such as distributed ledger technology, although it is not yet fully evolved. Another possibility would be to buy a balance that would be entered to a digital wallet. There is the possibility of preparing infrastructure for digital cash and keeping it as a contingency measure if the financial system should suffer a shock. Obviously, electronic cash will always depend on access to electricity and an internet connection, just like other electronic mediums of payment; therefore, it would not be useful during a prolonged power outage. However, rapid technological advances, powerful smart device batteries, and registration of digital wallet balances could facilitate payment intermediation, at least temporarily, particularly when smaller amounts of money are involved.

The central banks in Sweden, Denmark, Finland, and Norway have already published reports on the possibility of issuing digital cash in their own currencies. Sweden's central bank (Sveriges Riksbank) is of the opinion that there is good reason to conduct further analysis and assessment, in part because of underlying market developments and diminishing use of cash.<sup>4</sup> In March 2017, Riksbank established a steering committee tasked with studying in depth, in cooperation with stakeholders, the pros and cons of issuing an electronic krona (e-krona).<sup>5</sup> In December 2017, the bank published an action plan for the project, with the first findings expected later this year.<sup>6</sup> Denmark's central bank (Danmarks Nationalbank) has no plans to issue electronic cash.<sup>7</sup> Their view is that such issuance would entail fundamental changes in its own position in the financial market, and in risks relating to financial stability and monetary policy conduct. The Danmarks Nationalbank also considers it unclear what benefits electronic cash would have over and above the options already available in the Danish payment intermediation system. Norway's central bank (Norges Bank) is of the view that there is reason to look more closely at digital cash issuance but raises the same questions as the other banks do.<sup>8</sup> Finland, as a member of the eurozone, may be in a different position than the other Nordic countries.

The Bank for International Settlements (BIS) issued a report on digitisation of cash in March 2018.<sup>9</sup> That report covers the most salient issues relating to the subject and points out the potential advantages and disadvantages to central banks, financial systems, and financial markets in connection with issuance of digital central bank money. The authors of the report point out that the discussion revisits familiar questions on the role of central banks and central bank money. They do not take a position on whether issuance of digital central bank money would be beneficial; instead, they point out the importance of thoroughly examining the various potential effects on financial stability, monetary policy, the structure of financial services,

4. Sveriges Riksbank (September 2017).

5. Sveriges Riksbank (March 2017).

6. Sveriges Riksbank (December 2017).

7. Gürtler, K.; Nielsen, S.; Rasmussen, K.; Spange, M. (December 2017).

8. Norges Bank (2018).

9. BIS Committee on Payments and Market Infrastructures (2018).

and market developments more broadly. It would also be necessary to take a stance on whether such a system should be anonymous (as is the case with banknotes and coin) and whether deposits in digital accounts with central banks should bear interest.

This report presents the idea surrounding Central Bank issuance of an electronic króna (rafkróna) and discusses several key issues that have been raised in connection with it, with reference to Icelandic conditions and circumstances. The report is the Central Bank of Iceland's first step towards further study and analysis of the impact of rafkróna issuance. It is hoped that this report can be used to explain what rafkróna issuance entails and to stimulate discussion and exchange of ideas among stakeholders. Many questions remain unanswered, however. For instance, consumers, firms, merchants, and the authorities may hold differing views and opinions on the following topics:

- Do current retail payment solutions fulfil requirements for security, efficacy, and efficiency?
- Is conventional cash unnecessary or beneficial?
- The term “cashless Iceland” refers to the abandonment of physical currency. But what should take its place?
- The status of banknotes and coin (and rafkrónur?) as legal tender. Do statutory provision on legal tender need to be amended?
- What is entailed, or should be entailed, in the Central Bank's legally mandated obligation to promote “a sound and efficient financial system, including domestic and cross-border payment systems”?
- How do stakeholders view rafkróna issuance — the pros and cons?
- Does the rafkróna promote concentration or abnormal price formation in the payment intermediation market, or is the opposite true?
- Does the rafkróna jeopardise security if extraordinary or serious circumstances arise, or can they provide a solution?
- International tech companies and retail giants will probably become competitors in the domestic payment intermediation market. From the standpoint of stakeholders, what are the pros and cons of this as regards security, efficacy, and efficiency?

## II Rafkróna

Central bank money is a claim against the central bank and, in most economies, takes two forms: as current accounts held with the central bank by financial institutions and the national treasury (the account owner's electronic claim against the central bank), and as cash (banknotes and coin) that represents a claim against the central bank and is accessible to the general public as well as to institutions and companies.

To describe it simply, the difference between a rafkróna and a króna in conventional cash, the rafkróna is an electronically registered deposit or payment authorisation, whereas conventional cash is tangible, taking the form of banknotes and/or coin. Those who choose to use conventional cash today will doubtless continue to do so to some extent, even if a decision is made to issue a rafkróna. Therefore, the rafkróna would not substitute entirely for physical cash but would be a supplement to it, at least at first.

## II 1 Properties of the *rafkróna*

Technologically, there is little to prevent the Central Bank from issuing a *rafkróna* with the following properties:

- Available to the general public.
- Represents the holder's claim against the Central Bank.
- Accessible 24/7/365, and in real time.

This report discusses two different ways of issuing a *rafkróna*: a), as base money; b) as a registered, traceable deposit to a payment account with the Central Bank, hereinafter referred to as a *rafkróna* account. The *rafkróna* would be available to the public either year-round or only in case of emergency, as an element in financial system contingency measures in response to a major interruption in the electronic payment service or to a financial crisis. It is likely that using the *rafkróna* as a prudential tool would be consistent with the Central Bank's legal mandate.<sup>10</sup> But the law should be interpreted with caution in this respect, as the ultimate design or technological execution could be a determining factor.

### a) Electronic base money

A simple type of *rafkróna* that would have properties similar to those of conventional cash. Balances would be stored in a card or smartphone (some type of digital wallet). If the card or smartphone should be stolen or destroyed, the balance would be lost, just as it would be lost if an individual lost a wallet containing conventional cash. The *rafkróna* can be either anonymous or a traceable payment instrument. Giving it the status of legal tender would require a statutory amendment. *Rafkrónur* issued in this manner would be a claim against the Central Bank.

### b) *Rafkróna* accounts

*Rafkrónur* would be entered to *rafkróna* accounts with the Central Bank, in a manner similar to deposits with a commercial bank. Owners of *rafkróna* accounts with the Central Bank would have access to their funds through a payment instrument such as a card or smartphone. If the card or smartphone should be lost, stolen, or destroyed, the impact would be limited, as the account balance would be registered in the Central Bank database in the same manner as a deposit with a commercial bank. This would make *rafkrónur* traceable. The Central Bank itself could be a payment service provider in accordance with the Payment Services Act, or it could entrust other payment service providers with this task (banks, for example).

Issuing the *rafkróna* on this basis would probably require more extensive amendments to the Act on the Central Bank of Iceland, no. 36/2001, than issuing digital base money would.<sup>11</sup> It can be assumed

10. See, for example, Article 4, Paragraph 2 and Article 5 of the Act on the Central Bank of Iceland, no. 36/2001, and Article 5, Item 8(c) of the Act on Issuance and Treatment of Electronic Money, no. 17/2013. It should be noted, however, that only banknotes and coin have the status of legal tender by law; cf. Article 5, Paragraph 2 of Act no. 36/2001 and Article 3 of the Act on Iceland's Currency, no. 22/1968.

11. Various substantive provisions of the law would have to be assessed in connection with *rafkróna* issuance. An example is Article 17, Paragraph 2, which states that the Central Bank may not undertake transactions with individuals or companies that, according to law, custom, or the nature of the case, are considered the function of others.

that the cost would be similar to the cost associated with deposits, operations, and use of the commercial banks' internal payment intermediation systems. The Central Bank would then have to comply with the same requirements as financial institutions concerning investigation and knowing their customers and would have to take comparable measures to prevent money laundering and terrorist financing.

### III Central Bank money: purpose and form

A claim against a central bank is the most secure claim possible in the currency concerned, in that there is no counterparty risk. Precisely because of this, central banks play a key role in interbank payment intermediation, and digital central bank money forms the basis of final settlement of all capital transfers between banks/deposit institutions. Participants in interbank payment intermediation have a claim against the central bank at the time of final settlement.

Potential issuance of a rafkróna is, by its very nature, comparable to the current issuance of banknotes and coin. The difference is only that the general public would have the option of having a digital claim directly against the Central Bank, as well as a claim in the form of conventional cash. Digital claims held by the public would potentially be subject to other, more stringent requirements than those applying to the Bank's transactions with financial institutions, and they would probably be subject to other requirements than those applying to deposits with financial institutions as regards, for instance, interest, possible maximum balances, and deposit insurance.

Commercial bank money is a claim against a financial institution in the form of an account balance or other type of monetary claim. Transfers between deposit accounts with the same bank (internal payments) are settled in commercial bank money, as is settlement of payment card transactions in which the payer and the recipient of payment do business with the same bank; cf. Chart III-2 on page 13.

It would be possible to conclude that mandatory deposit insurance would make insured deposits with financial institutions as secure as central bank money. However, deposit insurance does not cover losses above a specified minimum amount, and it could take some time to trigger deposit insurance provisions, possibly to the detriment of depositors

#### III 1 Central Bank money in electronic deposit accounts

The Central Bank of Iceland owns and operates interbank payment systems (real-time gross settlement (RTGS) and netting systems) as provided for in the Act on the Security of Transfer Orders in Payment Systems and Securities Settlement Systems, no. 90/1999, and rules adopted by the Bank.<sup>12</sup> The Central Bank handles all of the country's interbank payment intermediation; i.e., intermediation of payments between individual banks. The banks themselves, however, can

12. Rules on the Central Bank of Iceland Real-Time Gross Settlement System, no. 703/2009, with subsequent amendments. Rules on Activities of Netting Systems, no. 704/2009, with subsequent amendments.

handle payments between their own customers, without the involvement of interbank payment systems. The Central Bank's RTGS system also provides an avenue for the Bank to implement monetary policy. Transfers between account owners who do business with different banks are settled in Central Bank systems (using central bank money). The same applies to payments made with payment cards, when the cardholder and the merchant do business with different banks.

Participation in interbank payment systems is governed by the aforementioned laws and rules, and the Central Bank sets rules on who may hold electronic netting and settlement accounts (current accounts) with the Bank.<sup>13</sup> According to the current rules, financial institutions<sup>14</sup> and the Treasury are the only parties that may have current accounts with the Central Bank. Balances on current accounts are in Icelandic krónur and most often bear interest determined by the Bank. Businesses and individuals may hold deposits with commercial banks, however, and these are insured up to a specified amount by the Depositors' and Investors' Guarantee Fund, in accordance with legislation on deposit insurance.<sup>15</sup>

### III 2 Central Bank cash

According to Act no. 36/2001, the Central Bank has the exclusive right to issue banknotes and coin, or another currency that could circulate in place of banknotes or lawful currency.<sup>16</sup> Banknotes and coin issued by the Central Bank are legal tender in Iceland. Provisions on legal tender have the sole purpose of resolving disputes on the execution of payment.<sup>17</sup> Cash is a liquid asset and is anonymous in transactions. When payment is made in cash, the payer's claim against the Central Bank is transferred to the recipient of the payment. Settlement takes place in real time. In the case of electronic payments using payment cards, for instance, or carried out via online banking, payment and settlement systems become involved; i.e., the settlement process takes place in stages and is usually longer, as it includes clearing and settlement.<sup>18</sup> The Central Bank's issuance of cash is a part of its role of promoting effective and secure payment intermediation.<sup>19</sup>

13. See the Rules on Current Accounts in the Central Bank of Iceland, no. 540/2007, and the Rules on Trading in the Interbank Market for Domestic Currency, no. 805/2009. In addition to its role as centralised settlement agent for interbank payment systems, the Central Bank is, by law, the banks' bank (accepts deposits). Therefore, an electronic netting and settlement account is also the current account of the party eligible to hold an account with the Central Bank.

14. In 2017, there were eight financial institutions participating in the interbank payment system.

15. See also Act No. 98/1999, on Deposit Guarantees and an Investor-Compensation Scheme.

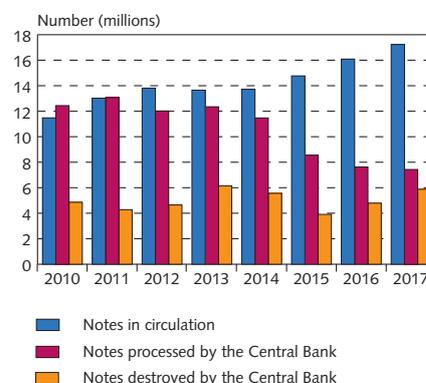
16. See also Articles 3-5 of the Act on the Central Bank of Iceland, no. 36/2001, and Articles 2-3 of Act no. 22/1968.

17. Segendorf, B and Wilbe A (2014).

18. In Iceland, payment intermediation has long been very efficient and counterparty risk at a minimum, as settlement of all interbank payments takes place using central bank money, irrespective of the amount involved. The Central Bank of Iceland owns and operates both the RTGS system and the retail netting system (the latter through the company Greiðsluveitan ehf.). Advances in payment intermediation abroad have taken place not least because of increasing demands for quick execution of payment and settlement, often referred to as instant or real-time payments. In many countries, increased emphasis has been placed on involving the central bank in retail payment intermediation.

19. I.e., intermediation, pairing and, in some instances, confirmation of payment orders before settlement takes place. Sometimes, this involves netting of payment orders and creation of a final balance for settlement.

Chart III-1  
Processed banknotes, destroyed notes,  
and notes in circulation at year-end  
2010-2017



Source: Central Bank of Iceland.

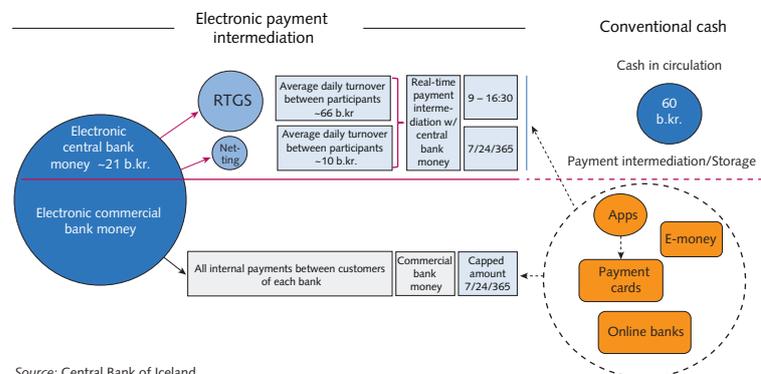
At the end of 2017, cash in circulation totalled 60.3 b.kr., or 2.4% of GDP. It totalled nearly 5% of GDP in 1960 but declined rapidly in the two decades that followed. From 1984 until the financial crisis struck in autumn 2008, the cash-to-GDP ratio held relatively stable at around 1%. The rapid decline in demand for cash after 1960 stemmed from increasing use of cheques. As is mentioned above, the introduction of payment cards in the 1980s eventually came close to eliminating cheques as a means of payment.

### III 3 Scope of Central Bank money in electronic payment intermediation

The Central Bank of Iceland carries out a large proportion of all domestic electronic payment intermediation. All payments between banks and their customers take place through the Bank's RTGS and netting systems.<sup>20</sup> Average daily turnover in the Bank's systems totalled some 76 b.kr. in 2017, and annual turnover is about 21 trillion kr. All of these payments are based on central bank money; i.e., they represent electronic claims against the Central Bank of Iceland. In addition is conventionally issued cash.

Each bank then takes care of its own internal payment intermediation; i.e., payments routed between customers of that bank.

Chart III-2  
Icelandic payment intermediation and Central Bank involvement



Source: Central Bank of Iceland.

### III 4 Efficiency in payment intermediation

There are no transaction fees associated with the use of cash. In that sense, it is a more economical option for the general user than electronic payments are.<sup>21</sup> This does not mean that use of cash costs society nothing, however. Various costs are incurred; for instances, users must obtain cash from an automatic teller machine (ATM) or bank branch, which takes time and requires travel. By holding cash, users

20. Transfers in the amount of 10 m.kr. or more are routed through the RTGS system, as are all settlement transactions from the netting and securities settlement systems, irrespective of amount.

21. See Chapter VII in the Central Bank's publication *Financial Market Infrastructure 2016*. According to that report, it was not possible to take account of the cost borne by merchants and service providers in connection with use of cash and payment cards, due to low survey participation rate. Their share weighs heavily in the social cost of using mediums of payment.

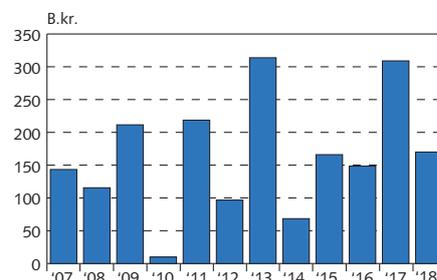
also relinquish any interest that they could have earned by investing their money differently. For banks and sellers of goods and services, there are various administrative costs, including transporting cash to and from the bank, plus the loss of interest earned by investing the funds differently. There are four types of costs incurred by central banks in connection with issuance and administration of physical currency. First of them is the cost of designing banknotes and coin and having masters printed. Second is the cost of producing the currency. Third, the Bank must hold cash inventories and safeguard them effectively. Fourth are the administrative expense and cost of capital associated with cash being circulated at any given time.

Cost analyses that have been carried out abroad, including in Norway and Denmark, indicate that the cost of issuing and administering domestic debit cards is lower than the cost of cash and of international debit and credit cards.<sup>22</sup> Credit card use is by nature a form of credit financing, and it is therefore understandable that the cost is higher than the cost of cash or debit cards. The magnitude of the cost difference between national and international debit cards is noteworthy, however. In Iceland, all payment cards (debit and credit) are issued on the basis of licences from international card conglomerates, which makes it possible to withdraw cash and pay for goods and services overseas but may give rise to higher costs for domestic payment intermediation. Moreover, credit card use has been much more widespread in Iceland than in other European countries, even though credit cards are less economical to use than debit cards and other means of payment. This could be due to the interest-free loan that credit card users enjoy from the time they make a purchase until they pay their credit card bill, not to mention the perquisites that often accompany credit cards.<sup>23</sup> In Norway and Denmark, a very large majority of consumers use domestic debit cards almost exclusively in their home market.

The more people use and accept a given type of payment medium, the greater the benefit will be for each consumer and merchant to use or accept it. Card usage fees affect which payment instruments are used. In Denmark, it has been customary in many cases that consumers pay differing fees for goods and services, depending on which means of payment they use. For example, it is not uncommon for merchants to announce that they charge a premium for payment by credit card.

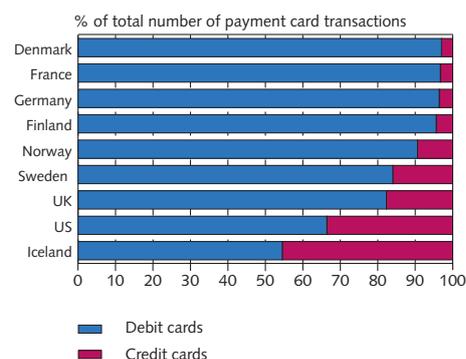
Recently, Denmark, Norway, Sweden, the UK, and other countries have adopted smartphone solutions (apps) based directly on the banking system's core infrastructure (deposit and payment systems) instead of on payment card infrastructure, as is the case with the apps in use in Iceland. It can be expected that solutions of this type will be marketed in Iceland in the near future. It is uncertain whether such solutions will lower consumers' and merchants' payment intermedia-

Chart III-3  
Expenses due to banknotes and coin<sup>1</sup>  
2007-2018



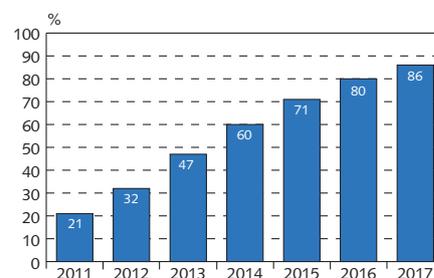
1. Estimated values.  
Source: Central Bank of Iceland.

Chart III-4  
Household payment card use<sup>1</sup>



1 Comparison year 2016.  
Sources: The Authors' calculation based on European Central Bank, Norges Bank and Central Bank of Iceland data.

Chart III-5  
Smartphone owners in Iceland<sup>1</sup>



1. A smartphone with the properties of both a mobile phone and a computer.  
Source: Gallup consumption and lifestyle survey.

22. Further information on studies of the social cost of payment intermediation can be found in the Central Bank's publication *Financial Market Infrastructure 2016* (Chapter VII).

23. In 2017, domestic credit cards accounted for 51% of total domestic payment card turnover and 45% of all card transactions. Further information on the cost of payment cards can be found in the Central Bank's publication *Financial Market Infrastructure 2016* and *Financial Market Infrastructure 2018*.

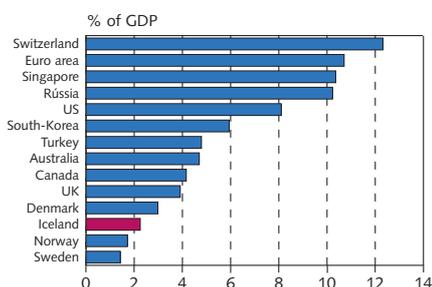
tion costs, however. This will depend in part on how widespread they become, as well as on mark-ups and competition.<sup>24</sup> By highlighting the costs associated with different means of payment at any given time — and thereby enhancing consumers’ and merchants’ awareness of the costs and conveniences in the payment intermediation chain — it is possible to promote healthier competition in retail payment intermediation.<sup>25</sup> Payers must be able to select the means of payment that suits them as regards cost and convenience. Innovative payment solutions of this type, such as payment via smartphone using core infrastructure directly, can also be useful as a meaningful foundation for ensuring the security and efficacy of domestic retail payment intermediation if other methods fail.<sup>26</sup> The structure and operational arrangements for domestic payment intermediation are among the factors that must be explored before a decision is taken on the issuance of a rafrkróna. If the payment intermediation market is oligopolistic, the Government may need to intervene — for instance, by issuing a rafrkróna — in order to satisfy criteria for security, efficacy and efficiency.

## IV Cash

Ever since cheques — and subsequently, electronic payment cards — came into being, use of cash has been declining in Western countries, not least in the Nordic region. With the advent of online shopping, payment card use has increased even more. In 2017, for instance, nearly one-fourth (24%) of Icelanders aged 18-44 bought goods online on at least a monthly basis, up from 11% in 2014.<sup>27</sup> The number of packages sent from abroad rose 55% year-on-year in 2017, and the number of domestic packages was up 12%.<sup>28</sup> This trend will doubtless continue in coming years, not least because prices are often better and people increasingly take advantage of improved access to foreign goods.

The share of conventional currency, at least in so-called cash transactions, is likely to diminish in the future.<sup>29</sup> Both in Iceland and

Chart IV-1  
Cash in circulation in selected countries  
2016



Sources: Bank for International Settlements, Danmarks Nationalbank, Norges Bank, StatBank Denmark, Central Bank of Iceland.

24. The Danish payment solution MobilePay has become very widespread in recent years, and its use has affected the market share of online banking, payment cards, and probably cash as well. A recent report from Danmarks Nationalbank cites information from MobilePay’s website ([www.mobilepay.dk](http://www.mobilepay.dk)), which estimate the number of MobilePay users in Denmark at 3.7 million at year-end 2017 (see Danmarks Nationalbank, Rapport (April 2018 - No. 4). *Oversight of the financial infrastructure* (April 2018). According to the website, over 75,000 merchants, including online merchants, used MobilePay at the end of 2017 (an increase of about 40,000 during the year). The number of transactions in 2017 was roughly 230 million. According to the company website, MobilePay is planning to enter the Finnish retail payment market in 2018. In addition, a new real-time cross-border settlement system for retail payments in euros, the Target Instant Payment Settlement (TIPS) system, will be launched this November. It will be interesting to keep abreast of market developments on the Continent, including in Finland. Further information on TIPS can be found in Central Bank’s publication *Financial Market Infrastructure 2018*.

25. The Central Bank of Iceland plans to conduct regular cost analyses modelled on those carried out by the European Central Bank.

26. From the standpoint of the public interest (in a modern society where consumers and employers rely on effective electronic payment intermediation), it is inevitable, in the Central Bank’s opinion, to identify one or more realistic alternate solutions for use in case of a major interruption in operation of important electronic mediums of payment.

27. Gallup (2017).

28. Íslandspóstur (2018).

29. A study done by Bech, M.; Ougaard, F.; Faruqui, U.; and Picillo, C. (March 2018) indicates that cash in circulation is not contracting worldwide, except in Sweden and Russia. The reason for this may be that, according to their findings, there is more demand for cash as a store of value than as a payment instrument.

abroad, there are examples of merchants and service providers that do not accept cash because of the cost and inconvenience involved. Issuance of digital central bank currency to financial institutions would continue unchanged, with reference to the central bank's role in payment system settlement and facilities relating to monetary policy, liquidity management, and financial stability. Central banks, as government institutions, have both the power and the credibility to ensure secure payment intermediation in their own currency during tailwinds and headwinds. Issuing cash or its equivalent could prove necessary for society as a contingency measure, not least in times of emergency, even if its use were very limited otherwise.

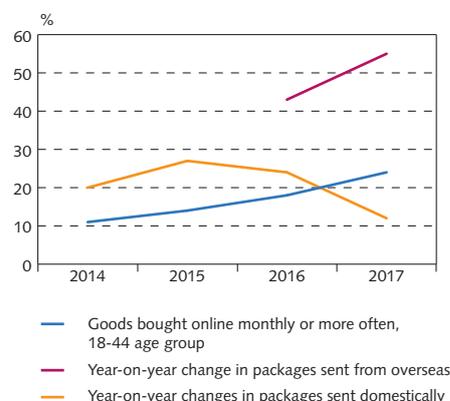
Cash issued by central banks is actually a government-guaranteed claim accessible to the public. Physical cash is not the only form, however, because in most economies, individuals can acquire government-guaranteed claims in the form of securities issued by the government. Furthermore, deposits with commercial banks are insured through deposit guarantee schemes up to specified limits, although this is not the equivalent of a government guarantee. One of the differences between government securities and cash is that the price of government securities is determined by supply and demand, while the price of cash is equal to its nominal value. It can take a longer time for a government to issue securities than for a central bank to increase the amount of cash in circulation, which is important if it proves necessary to step up the supply of "riskless" money quickly; for instance, during an emergency. If conventional cash disappeared from payment intermediation without being replaced by another form of central bank money, this would limit public access to "riskless" government-guaranteed claims.

All mediums of payment are on competition with one another to some extent, including competition with cash. It is not the role of the Central Bank of Iceland to engage in direct competition with the private market — not for deposits, and not for loans — so that this would have to be considered if it were decided that the Central Bank should in some way guarantee public access to central bank money. The Bank must always assess the impact of innovations in payment solutions on the effectiveness of payment intermediation, however. Other Governmental authorities must also keep abreast of the impact of innovation on substitute products and competitive products. Furthermore, an assessment is needed of whether action is required if indicators suggest that payment solutions are not conducive to efficient and secure payment intermediation.

### IV 1 Cash in the turbulent waters of market and technological developments

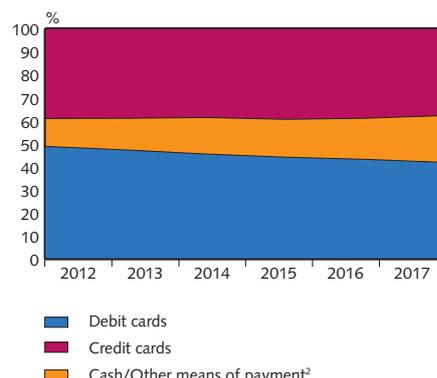
According to the European regulatory framework, supervised entities are authorised to provide financial services throughout the European Economic Area (EEA). From a technological standpoint, it will be increasingly easy to provide cross-border payment services. For example, foreign acquirers have become more active in Iceland in the recent past. Technological advances bring with them both benefits

Chart IV-2  
Online shopping in Iceland



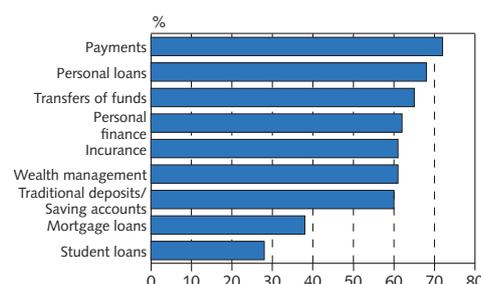
Sources: Gallup, Íslandsþóstur hf.

Chart IV-3  
Use of cash and payment cards at point of sale<sup>1</sup>



Cash transactions include all household consumption items except for the following: actual rentals for housing, imputed rental for housing, educational service, financial services, heat and electricity, telephone services, insurance, and purchase of vehicles. It is not possible to distinguish among other means of payment than those referred to here; i.e., payment for goods and services via online bank, gift card, and remittance slip.

Chart IV-4  
FinTech involvement in specified services; In which financial services will FinTech companies be most active in the next five years<sup>1</sup>



1. PwC international survey among financial company executives. Source: PwC, SFF.

and risks. They make it possible to increase the efficiency of the payment intermediation system (for example, longer opening hours and real-time settlement) and cut costs. The risks lie, among other things, in the fact that more complex technological solutions increase the probability that something could go wrong. Another risk is that problems at one service provider could affect the entire system.

Payment service providers are already subject to an operating permit and to official supervision. With the planned implementation of PSD2<sup>30</sup> in Iceland, the concept of payment services will be expanded. Upon fulfilment of specified conditions, payment service providers will be authorised to provide services entailing collecting data and publishing, in one place, information on one or more payment accounts held by a specified user with other payment service providers. They will also be authorised to give payment orders, on behalf of users, pertaining to their payment accounts with other payment service providers (including banks). Payment service providers that limit their activities to the aforementioned services do not hold customers' funds in custody and are subject to less stringent requirements than others are.<sup>31</sup> All of this is subject to the consent of the account owner, and financial institutions will be required to comply with customers' requests to give payment service providers access to their payment and deposit accounts, and to establish secure communications so that the latter can provide their services.<sup>32</sup> It can be considered certain that the innovations provided for in PSD2 will affect the Icelandic financial market. It is too early, however, to say how strong that effect will be.

Chapter IV of the Central bank's publication *Financial Market Infrastructure 2016* mentions the report by the Danish Payment Council (Betalingsrådet) on the role of cash in society.<sup>33</sup> According to that report, cash is used in particular by children and the elderly, as a survey in Iceland also indicated.<sup>34</sup> In addition, in Iceland as well as in Denmark, use of cash seems to decline with rising income. Digital payment options will doubtless continue to increase in number, and it can be expected that coming generations will be even more receptive to a variety of payment solutions and innovative financial services than their elders.

30. Directive of the European Parliament and of the Council on payment services in the internal market (Payment Services Directive, PSD2), no. 2015/2366. PSD2 is discussed more fully in the Central bank's publication *Financial Market Infrastructure 2017* (Chapter VII).

31. Under current Icelandic law (cf. the original payment services directive, PDF), there are primarily three types of payment service providers. All of them subject to operating permit requirements and official supervision: *financial institutions*, *electronic money institutions*, and *payment institutions*. When the substantive provisions of PSD2 are incorporated into Icelandic law, which is expected in the near future, there will be even more types of payment service providers. New providers include payment initiation service providers (PISP) and account information service providers (AISP). These two types of service providers will be subject to registration or operating permit. They will be required to ensure that appropriate minimum requirements are satisfied, including authentication and other security measures.

32. PSD2 is discussed in greater detail in the Central bank's publication *Financial Market Infrastructure 2018*.

33. Betalingsrådet (June 2016). The report can be found on the Council's page on the Danmarks Nationalbank website ([www.nationalbanken.dk](http://www.nationalbanken.dk)).

34. The results of a public opinion survey in Iceland were discussed in the Central bank's publication *Financial Market Infrastructure 2014* (Chapter VI). In addition, the societal costs of payment intermediation are discussed in the Central bank's publication *Financial Market Infrastructure 2016* (Chapter VII).

## IV 2 The importance of cash in extraordinary circumstances

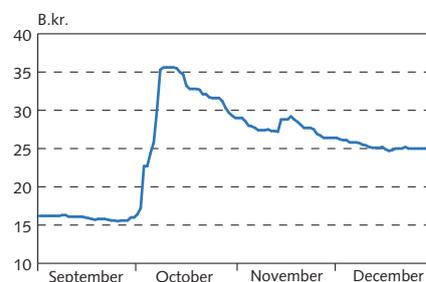
During the 2008 financial crisis, demand for cash soared — so much, in fact, that the Central Bank of Iceland’s inventory of banknotes was nearly exhausted. Prior to the crisis, cash in circulation totalled nearly 13 b.kr. Inventories had long been based on the assumption that the vast majority of Icelandic retail payment intermediation would take place electronically, and cash in circulation totalled only 0.91% of GDP, the lowest ratio in the world. In response to the surge in demand in autumn 2008, the Central Bank decided to access all of its cash inventories, including old banknotes scheduled for destruction and notes that had been withdrawn from circulation because of obsolete security features and poor overall condition. In nine business days, the amount of currency in circulation grew by a factor of 2.5. If outflows had continued unchanged, it would have taken only one day more to exhaust the Central Bank’s supply of currency.

Uncertainty led to a surge in demand for central bank money in the form of cash. With guaranteed unrestricted access to all electronic retail payment intermediation in the commercial banking system, the authorities’ declaration that deposits held in deposit institutions in Iceland were guaranteed in full, and the passage of legislation to address imminent problems,<sup>35</sup> the uncertainty receded markedly and demand for cash more or less normalised.<sup>36</sup>

There was considerable discussion within the Central Bank concerning how the Bank would respond if its cash inventories should be depleted. One of the options discussed was to transfer banking system deposits to rafkróna accounts in the Central Bank of Iceland. Such a measure would have represented issuance of rafkrónur. It would have been relatively simple and quick to execute such a transfer in the then-current technological environment. However, the problem was not technological but financial. With such a measure, the Central Bank would have acquired unsecured claims against the failed banks. Another option that was discussed was to offer individuals who had withdrawn cash in large amounts to deposit their funds to rafkróna accounts with the Central Bank, thereby acquiring a direct claim against the Bank. The cash that would have been returned to the Bank as a result could have been put back into circulation in order to meet demand. Under both options, owners of cash would acquire a direct claim against the Central Bank, similar to the claim represented by issued banknotes and coin.

Chart IV-5

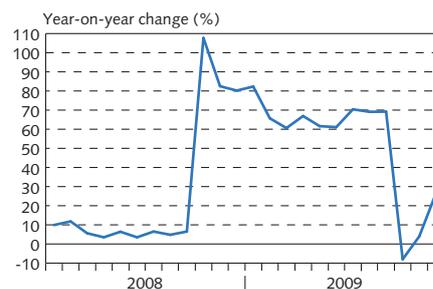
Cash issued by the Central Bank of Iceland  
1 September - 31 December 2008



Source: Central Bank of Iceland.

Chart IV-6

Cash in circulation



Source: Central Bank of Iceland.

35. A paper by A. Berentsen and F. Schar (2018) discusses, among other things, the increase in cash in circulation in Switzerland since 2008. The reasons they cite involve dwindling confidence — in the financial system during the aftermath of the crisis and in central banks’ power as lenders of last resort — and concerns about the financial implications for businesses and households of measures taken by governments to prevent further shocks (such as taxes and asset confiscation).

36. One consequence of the conditions in autumn 2008 was that the Icelandic króna was no longer included among settlement currencies in global payment card conglomerates’ systems. The Central Bank, with reference to its legally mandated task of promoting sound and efficient domestic and cross-border payment systems, responded to the situation by adopting rules on settlement of payment card transactions. The Bank then took on the role of centralised settlement for card transactions, as is described further in the summary of retail payment intermediation from the standpoint of contingency and financial stability, issued concurrent with this report.

Under the conditions facing the Icelandic financial system in autumn 2008, the support and guarantee of the Government were of pivotal importance in ensuring the efficacy of payment intermediation. It was clear that conventional cash would never have been an adequate alternative in the event of a major disturbance in electronic payment intermediation. The fact is that Icelandic society is highly dependent on effective electronic payment intermediation. Stepping up inventories of domestic banknotes in preparation for possible runs on the banks is a costly venture. Other options/other contingency measures, such as issuance of a rafkróna or an increase in deposit insurance, could also be feasible.

### IV 3 Demand for rafkrónur

The rafkróna can be viewed as a modern version of cash. Use of rafkrónur, whether in the form of base money in a digital wallet or registered and traceable holdings in rafkróna accounts with the Central Bank, should be comparable to the convenience we experience today in electronic retail payment intermediation. For the Central Bank, the cost of issuing rafkrónur could potentially be lower than the cost of issuing conventional cash.

Cash offers the option of anonymous (untraceable) payment. Some view this as negative, partly because of black market activities, fraud, and tax evasion, and have encouraged restrictions on use of cash, or even argued that use of cash should be discontinued.<sup>37</sup> On the other hand, it has been pointed out that measures to restrict use of cash would merely channel clandestine payments to other options, such as virtual currency. Measures to reduce the use of cash could also cause unnecessary inconvenience to members of the public who use cash for legitimate purpose.

Commercial banks and retail merchants offer anonymous payments with limited traceability in the form of prepaid payment cards. If the issuer should become insolvent, the claim would become a general public claim, not an anonymous one. Virtual currency is also an option if payments are to be anonymous and untraceable, but its price has been highly volatile, and there is considerable uncertainty about security in the wake of issues that have arisen in recent years, including theft and fraud. With other solutions from private entities, there is always someone who has access to information on the identity of the payer and the payee. These parties must fulfil stringent requirements on the sanctity of personal privacy and protection of identifiable personal data. The public must be able to trust that such information will not be shared with external parties unless such disclosure is required by law or court order.<sup>38</sup>

37. See, for instance, the proposals from a work group established by the former Minister of Finance and Economic Affairs (20 June 2017). Ruminations on a future without cash have repeatedly been published in articles and shared at conferences, including in Iceland.

38. New legislation on protection and processing of personal data, Act no. 90/2018, supplanted the previous legislation on 15 July 2018 (implementing the EU Regulation on personal data protection, GDPR) and reiterated that the rights in question are protected by the Constitution. There are also confidentiality provisions in various pieces of special legislation, including the current Act on the Central Bank of Iceland (cf. Article 35), no. 36/2001, and the Act on Financial Undertakings, no. 161/2002 (cf. Articles 58-60 and Article 19(b)).

Why should the general public be interested in rafkrónur? In what way would Central Bank issuance of rafkrónur differ from payment services provided by private entities, either in the form of electronic base money or as a registered holding in a rafkróna account with the Central Bank of Iceland? Today the commercial banks are by far the most active providers of payment services in Iceland. They offer individual customers current accounts whose balances are insured up to a specified amount on the basis of regulatory instruments on deposit insurance.<sup>39</sup> Current accounts can be linked to key mediums of payment, such as payment cards, online bank accounts, and mobile phones.<sup>40</sup> Does electronic issuance of conventional currency by the Central Bank have any particular advantages? The answer depends on several factors: First of all, whether the cost of issuing rafkrónur is lower than the cost incurred by payment service providers issuing their own payment solutions, plus the required return on the latter. Second, whether rafkróna accounts with the Central Bank would be subject to amount restrictions higher than the commercial banks' minimum deposit insurance amount. Because of the risk that deposits would be transferred virtually en masse from financial institutions to the Central Bank in response to negative news, it would presumably be necessary to impose a maximum on deposits so as to ensure that this option would not create a crisis in and of itself or would not amplify risks in the financial system. Such restrictions are not without problems of their own, however, as is discussed later in this report.

Demand for rafkrónur issued by the Central Bank depends on more than whether the currency is anonymous/untraceable or not, and what costs are associated with its use. If rafkrónur are registered to a rafkróna account in a manner similar to that applying to deposit accounts, it matters whether the Central Bank and financial institutions offer interest on such accounts, and if so, how much. Although the rafkróna would not bear interest like other cash, rafkróna accounts would be in competition with banks' deposit accounts. Consumers compare interest rates and security. The lower banks' deposit rates are, the less sacrifice there is in holding funds in secure but non-remunerated accounts with the Central Bank. For the Central Bank's liquidity management, it matters not only how much demand there is at a given interest rate differential and under other conditions, but also how volatile demand is with respect to people's experience of uncertainty about their holdings in deposit institutions and in rafkrónur issued by the Central Bank.<sup>41</sup> Further discussion of liquidity management in connection with transfers of funds between commercial bank deposit accounts and Central Bank rafkróna accounts, and the possible implications for financial stability, can be found in Chapter V 2 of this report.

39. Amended pan-European rules now stipulate that deposits must be insured up to EUR 100,000, or about 12.5 m.kr. Icelandic law has not yet been adapted to reflect this (Directive 2014/49/EU has not yet been incorporated into Icelandic law).

40. All smartphone apps currently in use in Iceland are based on the debit and credit card system infrastructure and are subject to the properties and terms and conditions applying there.

41. This topic and others are discussed in a paper by J. Barrdear and M. Kumhof, published by the Bank of England in July 2016, as well as in the previously cited report by two BIS committees, Central Bank Digital Currencies (March 2018).

## V The impact of the rafkróna on monetary policy and financial stability

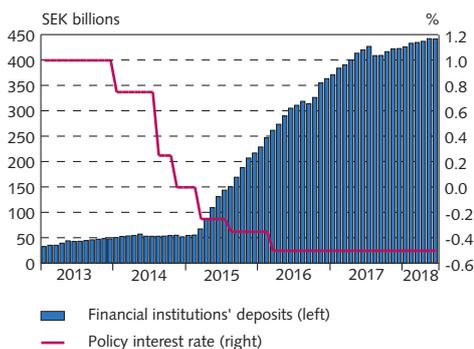
Under normal circumstances, the main monetary policy instrument is central bank interest rates; i.e., the rate paid by central banks on deposits held by financial institutions eligible to do business with the central bank, and the rate charged by central banks on loans to those same parties. Today these transactions are entirely electronic; therefore, it can be said that to this extent the Central Bank already issues rafkrónur in the form of deposits. If interest is paid on balances held in financial institutions' deposit accounts, it could prove controversial if the Bank did not pay interest on individuals' accounts. Nevertheless, there could be solid arguments for this.

Deposit institutions are important institutions for payment intermediation, saving, and allocation of savings to commercial enterprises' financing. These institutions are vulnerable to shocks because they obtain their funding from demand deposits but grant long-term loans, which can cause liquidity problems. It is the role of central banks and financial supervisors to monitor these institutions and set rules on their activities, including minimum capital ratios and liquidity ratios, so as to prevent them from taking excessive risk. Furthermore, central banks can contribute funds to these institutions to ensure their continued operation when funding from other sources is tight. Central banks are in the unique position of being able to create money that they can then lend to others.

Today it is considered normal that central banks should use their position as lenders (and also through financial institutions' deposit accounts with them) to affect interest rates in the domestic economy, thereby affecting demand and, in turn, GDP growth and inflation. This is why it is appropriate to task central banks with affecting inflation through their policy instruments.

Although the decision to issue a rafkróna is in some respects a political one, the methodology and technology must satisfy requirements for access, reliability and security, operating compatibility, and flexibility. As a result, it can be said that rafkróna issuance does not actually entail a change in the nature of the Central Bank's payment intermediation role.

Chart V-1  
Policy interest rate and financial institutions' deposits with the Swedish central bank



Source: Sveriges Riksbank.

### V 1 Rafkróna accounts and monetary policy

At first perusal, it may seem as though rafkróna issuance would have little impact on the part of monetary policy that centres on interest rates. This can depend on how issuance is designed, however. In the recent past, there has been widespread discussion abroad of ways to resist the risk of deflation, a problem of which Icelanders have little first-hand experience. The problems of monetary policy in the fight against deflation lie in the fact that nominal interest rates cannot be negative — or at least, not as negative as they might need to be. The reason for this is that if bank deposits bear negative interest rates, financial institutions' deposits with central banks, owners will withdraw their money and keep it as cash. In recent years, many central banks have set their policy rates just below zero; indeed, Sweden's

policy rate was -0.5% at the beginning of 2018. In spite of these negative rates, financial institutions have not withdrawn massive amounts from their accounts with Sveriges Riksbank, presumably because of the cost associated with holding cash. Commercial banks in these countries have not lowered rates on individuals' deposits into negative territory, however; therefore, deposit rates have been higher than the policy rate in the recent term, which is the opposite of the usual practice.

Electronic money has gotten mixed up in the discussion of responses to the risk of deflation; for instance, in connection with an idea proposed by Kenneth Rogoff, former Chief Economist with the IMF and currently a professor at Harvard University in the US. Rogoff's idea is to stop issuing banknotes and coin, thereby closing off the possibility for depositors to respond to negative rates by withdrawing cash. This would give central banks the option of setting (nominal) interest rates as negative as necessary to stimulate economic activity and prevent deflation. This idea of Rogoff's is unrelated to ideas about issuing central bank digital currency to the public (rafkrónur/e-currencies). Although it has drawn considerable attention, there are few who explicitly recommend that it be implemented. The most common counterargument is that it can prove difficult to cease issuance of cash entirely.<sup>42</sup>

Others point out that issuing non-remunerated e-currency in the form of deposits to a digital account with a central bank (like conventional cash) could make it more difficult for central banks to maintain negative interest rates.<sup>43</sup> The reason is that it would be less expensive to withdraw money from central bank accounts bearing negative interest and re-deposit it to payment accounts bearing zero interest than it would be to withdraw that same money as cash. One solution to this problem would be to set negative interest rates on e-currency accounts, making cash still the only option for depositors seeking to avoid negative interest. It would also be possible to prohibit financial institutions from owning e-currencies or to impose a limit on the balance of such accounts — a limit that would be very low in comparison with the institution's activities.

The possibility of offering interest on rafkróna/e-currency account balances complicates the analysis of the impact on monetary policy. Another complicating factor is that interest on financial institutions' deposits with central banks is generally somewhat higher than the deposit rate offered by commercial banks.

Potentially, the change in form as such — i.e., the issuance of rafkrónur instead of conventional cash — could increase significantly the amount of central bank money (cash) in circulation, at the expense of other mediums of payment, thereby expanding the Central Bank's balance sheet. An expanded balance sheet could entail increased risk, even though the expansion is based on the same premises as the Bank's current balance sheet.

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42. See, for example, Rogoff, K (May 2014).

43. See, for example, Sveriges Riksbank (September 2017) and Danmarks Nationalbank (December 2017).

The part of monetary policy that centres on liquidity management could be profoundly affected by the issuance of rafkrónur, particularly during periods when uncertainty about financial institutions' position led to capital outflows from them and to the Central Bank, as is discussed in Chapter V 3.

### V 2 Impact of interest on rafkróna accounts

If the Central Bank paid interest on individuals' rafkróna account balances, it would be necessary to examine the impact on the commercial banks' deposit and lending rates. The commercial banks could need to offer higher deposit rates so as to avoid losing deposit business to the Central Bank. The smaller the differential between interest rates on financial institutions' deposit accounts with the Central Bank and the rates on rafkróna accounts, the greater than impact would be. On the other hand, it would be possible to impose a cap on individuals' rafkróna account balances (a maximum balance). Such a provision could reduce the risk of a run on the banks, thereby mitigating the risk to financial stability, but it would also mean deviating from the custom of always satisfying demand for banknotes and coin.<sup>44</sup> Higher commercial bank deposit rates could also prompt the banks to raise their lending rates in a bid to recoup the lost income from interest rate spreads. This, in turn, could have a dampening effect on demand for credit. Provisions on maximum balances and positive or negative financial shocks can also affect both demand for rafkrónur and the public's willingness to keep money on deposit with the central bank rather than with commercial banks.

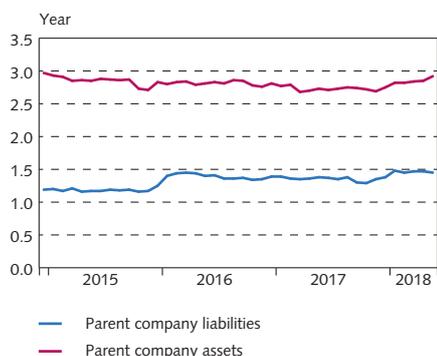
Interest on rafkróna/e-currency accounts with the central bank could also function as a supplemental monetary policy instrument. It might be possible to achieve the same objectives with other conventional central bank tools.

### V 3 The rafkróna and financial stability

Deposit institutions are vulnerable to shocks because they issue long-term loans that they often fund to a large extent with short-term deposits. In other words, the duration of their liabilities is often shorter than the duration of their assets. In addition, the assets (i.e., the loans they grant) can often be illiquid during times of financial uncertainty. This can cause a deposit institution to suffer liquidity problems even if it is well run and financially strong.<sup>45</sup>

Large financial institutions' insolvency can trigger a chain reaction affecting assets and liability in the economy as a whole. In addition, it can disturb payment intermediation and cause chaos if members of the public have difficulty paying for goods and services. These two factors are the core of what is meant by the term "systemically important" financial institutions. This can give rise to a general consensus or widely held belief that, if push comes to shove, the authorities will protect large deposit institutions from failing — in

Chart V-2  
Weighted average duration of systemically important banks' assets and liabilities<sup>1</sup>



1. Weighted average duration of the systemically important banks' assets and liabilities. Parent company figures are taken from monthly balance sheet summaries.  
Source: Central Bank of Iceland.

44. Sveriges Riksbank's September 2017 report on e-currencies recommends against such restrictions on the grounds that they would complicate matters, particularly during times of financial uncertainty.

45. See, for example, Diamond, D.W. and Dybvig, P.H. (June 1983), pp. 401-409.

other words, an implied government guarantee is created. In addition to this, for decades the authorities in most advanced economies have created a special framework for deposit institutions. This has been done primarily with deposit insurance legislation and collateralised liquidity facilities from the central bank. When an implied government guarantee is considered to be in effect, it opens up the possibility that financial institutions will operate under the assumption that they will be rescued no matter what happens. This moral hazard can lead to excessive growth and risk-taking. In addition, some financial institutions come to dominate the economy so much that the repercussion of their potential collapse are deemed too severe to allow it to happen. This is the “too big to fail” phenomenon.<sup>46</sup>

The potential effects of the rafkróna on financial stability are not straightforward. It is possible to argue in both directions: that the introduction of the rafkróna could support financial stability in important ways, and that it could undermine financial stability in other ways. Whether rafkrónur are issued as deposits on rafkróna accounts in the Central Bank or as a digital wallet is less important to financial stability than how it is done; i.e., whether a cap is imposed on balances, and whether deposits earn interest.

The rafkróna can contribute to financial stability by diminishing financial institutions’ systemic importance in the payment intermediation process. Rafkrónur held in a rafkróna account in the Central Bank, either for continuous use or as a safety valve, represents a new option. Such an arrangement would be independent of privately run payment service providers (including banks) and could facilitate the transfer of payments between all parties in the economy. New payment flows such as wages, benefits, and pension income could be routed to such accounts if a deposit institution became insolvent. Customers of the insolvent institutions could therefore (at least to some extent) continue to service their debts and purchase consumer goods, using their rafkróna accounts with the Central Bank. This could mitigate the impact of financial crises when they occur. It could also reduce the moral hazard facing systemically important financial institutions — a moral hazard that over time contributes to the accumulation of systemic risk and can lead to shocks.

If the Central Bank offered uncapped rafkróna accounts to the public, possible responses on the assets side of the Bank’s balance sheet would have to be explored. In the BIS report on digitisation of cash, it is pointed out that if use of physical currency does not contract in line with the issuance of central bank digital currency, increased central bank demand for Treasury bonds and even corporate bonds could result. The implications of this could be numerous and varied. Increased central bank demand for such securities could reduce the depth of the bond market and erode the informational value of pricing in such markets, including the interbank market. At the same time, central banks could be forced to address significant maturity, liquidity, and credit transformations, plus the risk attached to them.<sup>47</sup>

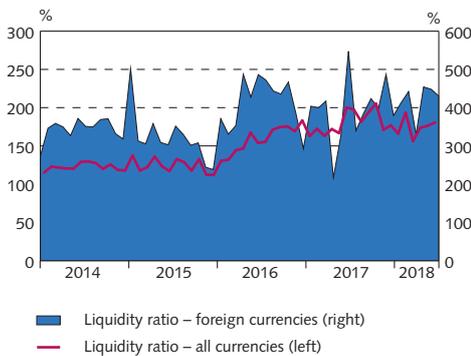
46. See, for example, Stern G. H. and Feldman R. J. (2004) and Seeling, S.A. (2004).

47. BIS (March 2018), pp. 14-15.

The use of rafkrónur in the form of balances on rafkróna accounts with the Central Bank during normal times would depend largely on account caps and on the price of the service (i.e., interest or transaction fees). Even if the Central Bank chose, all else being equal, not to encourage the use of rafkrónur directly — such as with low interest rates or transaction fees — such accounts would be a new alternative to bank accounts.<sup>48</sup> Without the rafkróna, depositors who do not wish to purchase other monetary assets or withdraw cash can only transfer their funds between commercial and savings banks. The rafkróna would give individuals the option of transferring funds electronically from the privately run banking system to the shelter of the Central Bank, either whenever and wherever they were or upon satisfying specified conditions. As a result, the rafkróna could result in increased volatility in banking system balances. Until now, deposits owned by individuals and SMEs have served as a constant and economical source of funding for the banks, not least because of deposit insurance legislation.<sup>49</sup> In this context, the possibility of interest-bearing rafkróna accounts is very important. The higher interest rates were in comparison with deposit institutions' rates, the more volatile deposits with those institutions would be. Their liquidity management could become correspondingly more complicated and costly.

The Central Bank imposes requirements on deposit institutions in Iceland as regards liquidity ratios and funding ratios. The current rules on liquidity ratios require a liquidity buffer amounting to 100% of expected outflows over a thirty-day stress period. Expected outflows depend, among other things, on the stability of banking system deposits. At present, the liquidity and funding ratios of all of Iceland's systemically important banks are well above the regulatory minimum. Based on their current position, outflows would have to be substantial in order for the banks to have difficulty satisfying the requirements. Nevertheless, the banks could be subject to some expense from the rafkróna in this respect. It could therefore be necessary to revisit the deposit run-off rates used to calculate liquidity ratios. Other things being equal, they might need larger liquidity buffers in order to fulfil the requirement of a 100% liquidity ratio. If these funds are tied up in liquidity reserves, they will not be used for other, more profitable, investments. As a result, it is clear that liquidity management could prove more costly. Furthermore, the BIS points out that banks could try to respond to cost increases by undertaking riskier lending.<sup>50</sup> It can be considered unlikely that the rafkróna would have a major impact on the banks under normal circumstances, but the impact in the event of financial market disequilibrium is unclear. When uncertainty is high and risk in the banking system is deemed significant, a run on the banks could ensue. Under such conditions, it is probable that individuals would transfer substantial funds to rafkróna accounts with

Chart V-3  
Domestic systemically important banks:  
liquidity ratios<sup>1</sup>



1. Domestic systemically important banks. Consolidated figures. New Central Bank liquidity rules took effect in March 2017. Source: Central Bank of Iceland.

48. The current legislation restricts the Central Bank of Iceland's authorisation to impose service charges in excess of the cost of providing the service in question.

49. See also the Act on Deposit Guarantees and an Investor-Compensation Scheme, no. 98/1999.

50. BIS (March 2018), p. 16.

the Central Bank. Various issues could then come to the fore, including whether the Central Bank would try to contain such a run by, for instance, putting through large interest rate cuts or imposing caps on rafkróna accounts, or whether it would choose instead to provide the banks with liquidity support against secure collateral. As long as the run is in domestic currency, the latter response would be more in line with central banks' usual response to a run on a bank.

Capping rafkróna accounts is not merely a technical design element. It is related to the purpose of the rafkróna system — i.e., whether it is an emergency system that can be accessed when financial market infrastructure is under imminent threat, or whether it is intended as an alternative to deposit institutions and a means of exerting restraint on them. Should caps be very low except under extraordinary circumstances, so as to limit the use of the system? Or should households in general be able to use rafkrónur for all of their payments year-round, irrespective of the broader environment?

Circumstances could arise where the Central Bank grants liquidity facilities to credit institutions in the interest of preserving financial stability at a time when public demand for central bank money is increasing by leaps and bounds. Sveriges Riksbank has drawn attention to the tradition in Sweden of always responding to public demand for banknotes and coin. The same practice has been observed in Iceland. With the advent of the e-krona, as the Sveriges Riksbank authors call it, it could be contradictory to provide extensive liquidity support to financial institutions while restricting individuals' access to central bank money. In addition, Sveriges Riksbank has warned that if Swedish e-krona supplies were limited, an undesirable secondary market for it could develop under certain conditions, generating profits for holders of excess e-krona reserves.<sup>51</sup>

The introduction of the rafkróna would not be without its challenges for the banking system. Even so, there is no reason to assume that use of rafkrónur would immediately be widespread and substantial unless there were economic incentives involved.

#### V 4 Technological aspects of the rafkróna

The methodology and technology involved in issuing a rafkróna must fulfil requirements for access, reliability, security, operating compatibility, and flexibility. From a technological standpoint, the rafkróna must be based on a sound foundation that can be adapted and developed over time in response to scope and changed circumstances in the future. For example, it must be possible to update software solutions for the rafkróna on a regular basis to keep abreast of market developments and technological advances. Actually, it is possible to issue rafkrónur using the technology already available in Iceland, which is built on the same foundation as the banks' conventional deposit and internal payment intermediation systems. Such a solution is presumably the least expensive way to issue rafkrónur, as well as being known and tested. Another option would be to develop a new

51. Sveriges Riksbank (September 2017).

payment system from the ground up. In this context, there has been widespread discussion of distributed ledger technology, which is the methodology underlying virtual currency systems. In general, though, central bank experts agree that the technology on which distributed ledger technology is based is not yet well enough developed to enable a thorough analysis of it. Furthermore, it is still considered inadequate in terms of capacity, security, and economic efficiency as regards the scope (i.e., number of transactions) of retail payment intermediation.

The Bank of Canada (BoC) is among the central banks that have done extensive research and development work on this new technology, in cooperation with a Canadian financial technology (fintech) company. In September 2017, the BoC issued a detailed report on an experimental project called Jesper,<sup>52</sup> including an assessment of the advantages and disadvantages of implementing distributed ledger technology for the real-time gross settlement system. In addition, the BoC conducted an experiment on whether Jesper could handle the liquidity management that is built into its current RTGS system.<sup>53</sup> The principal conclusion drawn from the experiment was that distributed ledger technology offers various possibilities from consumer and business points of view. It is thought that the technology could offer improved user properties, mainly in terms of increased simplicity, reduced operating expense, and enhanced transparency. From the standpoint of payment and settlement, the conclusion is that distributed ledger technology could lower operating expenses and perhaps increase operational flexibility. In addition, the BoC conducted an appraisal of whether distributed ledger technology was in compliance with the CPMI/IOSCO Principles for Financial Market Infrastructures (PFMI). According to the appraisal, the Jesper project was in compliance with the PFMI regarding collateral, credit risk, settlement risk, and liquidity risk. But this came as no surprise to the project's sponsors, as Jesper was designed in accordance with Canada's current RTGS system. On the other hand, Jesper did not perform as well with respect to rules on monetary settlement, operational risk, and conditions concerning access and participation. Distributed ledger technology is advancing rapidly, however, and many institutions and other parties are examining it. As a result, it is likely that distributed ledger technology, or a portion of it, will be used in the future, including by central banks. As yet, however, no central bank has taken a decision on using it.

## VI The regulatory framework

The adoption of a rafkróna in addition to conventional banknotes and coin could give rise to legal issues. The Central Bank of Iceland operates pursuant to Act no. 36/2001. Article 5 of the Act states that the Central Bank has the sole right to issue banknotes and to mint and

52. Payments Canada, Bank of Canada, and R3, (September 2017).

53. This is a liquidity saving mechanism already adopted by many central banks, which makes it possible to put payments on hold before final settlement. This mechanism is not built into Iceland's RTGS system.

issue coin or other currency that could circulate in place of banknotes or lawful coin. Furthermore, provisions in the Act on Issuance and Treatment of Electronic Money, no. 17/2013, authorise the Bank to issue electronic money. If there were plans to issue a rafkróna, statutory amendments would probably be needed.

## VI 1 The role of the Central bank of Iceland

According to Article 3, Paragraph 1 of Act no. 36/2001, the Central Bank's principal objective is to promote price stability. Subject to ministerial approval, the Bank is authorised to set a numerical inflation target. In addition to this principal objective, the Bank is required under Article 4, Paragraph 1 of the Act to promote financial stability and to carry out tasks consistent with its role as a central bank, including maintaining Iceland's international reserves and promoting a sound and efficient financial system, including domestic and cross-border payment systems; cf. Paragraph 2 of the same Article. If the Central Bank of Iceland issues rafkrónur, it is important to ensure that such issuance does not undermine the Bank's other objectives as described above. On the contrary: rafkróna issuance would have to be handled with reference to these objectives.

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## VI 2 Exclusive right to issue banknotes and coin

Article 5, Paragraph 1 of Act no. 36/2001 states that the Central Bank has the sole right to issue banknotes and to mint and issue coin or other currency that could circulate in place of banknotes or lawful coin. The same appears in Article 2 of Act no. 22/1968, which states that the Bank has exclusive right to have printed and issue bank notes and to have metal coins minted and issued. Article 5, Paragraph 1 of the Act on the Central Bank of Iceland has been unchanged since Act no. 63/1957, but it can be assumed that the Parliament of that time did not envision digitisation of cash when drafting the law. With this in mind, it is clear that even though the provision states that the Bank has the exclusive right to issue other currency, this does not necessarily include a rafkróna as described in the present report. Statutory amendments may prove necessary before work on issuing such a currency could begin.

In order to remove all doubt, and with reference to the Bank's task of promoting a sound and efficient financial system, including domestic and cross-border payment systems, it is clear that the Bank will continue to issue banknotes and have coin minted and issued in response to demand for physical cash, no matter whether rafkróna issuance happens or not. The rafkróna would be a supplement to physical cash. If a rafkróna is issued, however, the value of banknotes and coin in circulation can be expected to decline.

The Act on Issuance and Treatment of Electronic Money,<sup>54</sup> no. 17/2013, contains provisions authorising the Central Bank to issue

54. This provision incorporated the substantive provision of the second E-Money Directive (Directive 2009/110/EC of the European Parliament and of the Council of 16 September 2009 on the taking up, pursuit and prudential supervision of the business of electronic money institutions) into Icelandic law.

electronic money, provided that it is not acting in its capacity as a monetary authority. This means that electronic money issuance by a central bank is not considered part of monetary policy implementation. As is stated in Chapter I, the law sets various conditions on the treatment of electronic money. Among other things, it is prohibited to calculate interest or grant a holder of electronic money any other benefits based on the length of time during which the holder holds the electronic money.

### VI 3 Legal tender

According to Article 5, Paragraph 2 of Act no. 36/2001, banknotes and coin issued by the Central Bank shall be legal tender for all payments at full nominal value. Article 3 of Act no. 22/1968 states that the bank notes the Central Bank of Iceland has printed and issues, and the coins it has minted and issues, shall be legal tender for all payments in Iceland at full nominal value. In spite of this, there is nothing that actually prohibits sellers of goods and services from requiring that payment be remitted in a particular way, whether this means a demand for cash payment or for electronic payment. If the Central Bank of Iceland should issue a rafkróna, a decision must have been made on whether it shall have the status of legal tender, as banknotes and coin do, whether it is considered a supplement to banknotes and coin, or whether the status of legal tender should change in view of market developments and the advent of the rafkróna.

### VI 4 Transactions between individuals

Chapter III of Act no. 36/2001 discusses domestic transactions conducted by the Central Bank. Article 6, Paragraph 1 states that the Central Bank of Iceland shall accept deposits from deposit institutions, including commercial banks, savings banks, branches of foreign deposit institutions, and other institutions and companies authorised by law to accept deposits from the public for safekeeping and earning of interest. Paragraph 1 states as well that the Bank is also authorised to accept deposits from other credit institutions and securities companies. According to Article 7, Paragraph 1, the Bank may grant credit to credit institutions authorised to conduct deposit transactions with the Bank, cf. Article 6, through the purchase of securities or in another manner against collateral deemed valid by the Bank.

If rafkróna issuance involved rafkróna accounts, the Central Bank Act would have to be amended, as it currently does not authorise individuals and parties other than financial institutions to conduct transactions with the Bank. Nowhere in Act no. 36/2001 are any provisions on transactions between individuals and the Bank, whether they be deposits, loans, or other types of transactions. On the contrary: Article 17, Paragraph 2 of the Act states that the Central Bank shall not engage in business transactions with the public or firms which on the basis of law, custom or the nature of the case are the appropriate function of others.<sup>55</sup> According to Article 1(a), Paragraph 1, Item 2 of

55. An exception to this can be found in Temporary Provision III of Act no. 36/2001. Paragraph 1 of that provision says that notwithstanding the provisions of Article 17, Paragraph 2, the Central Bank shall be authorised to conduct transactions with individuals and firms,

the Act on Financial Undertakings, no. 161/2002, a credit institution is an undertaking whose business is to receive deposits or other repayable funds from the public and to grant credits for its own account. Such activity is subject to an operating licence from the Financial Supervisory Authority; cf. also Chapter II of the same Act. It is specifically noted in Article 3, Paragraph 3, Item 1 of the Act that the central banks of member states of the European Economic Area, including the Central Bank of Iceland, do not fall within the scope of the Act. Before the Bank can be authorised to engage in deposit- or lending-based transactions with individuals, the law must be amended.

## VI 5 Increased legal obligations

If a rafkróna is issued, and if the Central Bank of Iceland is its issuer, it is likely that the Bank's legal obligations will increase or, at any rate, will change. For example, legislation on personal data protection changed radically in 2018, with the implementation of the new EU Regulation no. 2016/679 (the GDPR) via the Act on Protection and Processing of Personal Data, no. 90/2018. Furthermore, the Central Bank could itself assume the role of payment service provider in the sense of the Payment Services Act, no. 120/2011, with the associated rights and responsibilities, or could entrust other service providers with this task. It is also clear that legislation on consumer protection, money laundering, taxation, competition, etc., would require review. These increased legal obligations can first be mapped out when it has been decided whether a rafkróna will be issued, and if so, how.

## VII Conclusion

Many central banks are currently considering whether there is reason to issue electronic claims (in Iceland, rafkrónur) alongside conventional currency. The arguments for and against digitisation of currency are to some extent the same, no matter which countries are involved, but they can also vary because of differences in frameworks and conditions from one country to another.

The time is right to open discussions of this topic and to assess the need to digitise cash by issuing a rafkróna in Iceland. Rapid market developments and technological advances are revolutionising conventional retail payment intermediation. The new Payment Services Directive, PSD2, opens the door to new participants and methods, and competition will foreseeably increase, including from abroad.

Issuing a rafkróna would call for a re-evaluation of the Central Bank's tasks and a review of various provisions of current legislation. No matter whether the rafkróna were issued as base money or via rafkróna accounts, the system could be in full operation and available to the public year-round, or it could function as a contingency measure.

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provided that the Bank considers the transactions necessary for the removal of the restrictions that have been imposed on capital movements and foreign exchange transactions. The cited Paragraph 1 also states that the Bank is authorised, for the purpose of mitigating or preventing negative effects on monetary and exchange rate stability, or facilitating responses to such negative effects, to take receipt of any type of financial assets, including claims rights, financial instruments, and ownership shares in companies, and other rights over them, in connection with strategies for liberalisation of capital controls.

Apart from the impact on the structure of payment intermediation system, it is clear that rafkróna issuance could have a variety of effects, some perhaps unforeseeable, on the financial system as we know it today. Such potentially momentous changes must be based on sound reasoning, and it is important to research the various sides of the issue insofar as is possible before decisions are made and a position taken.

The impact of a rafkróna on monetary policy depends to a large degree on its design. If the rafkróna were more or less comparable to banknotes and coin, the impact on the application of the Central Bank's interest rates would be negligible under normal circumstances. There are exceptions, however, if negative interest rates should prove necessary to achieve the price stability objective. Furthermore, liquidity management could become more complicated. Rafkrónur held in deposit accounts with the Central Bank open the possibility that the accounts could earn interest, however. It would be possible to use the rafkróna in monetary policy implementation, but that would have a broader impact, including on competition in the deposit market, and it would also affect financial institutions' lending capacity and funding. In addition, the impact of caps on rafkróna account balances would have to be studied more thoroughly. If there were plans to use the rafkróna as a monetary policy instrument, more extensive statutory amendments would be required.

The rafkróna could have a significant impact on financial stability, but that impact would probably not be straightforward. On the one hand, rafkrónur could contribute to financial stability by offering a new alternative that, depending on circumstances, would be independent of the privately run banking system. Its existence could reduce the banks' systemic importance in the payment intermediation process and possibly reduce moral hazard. On the other hand, the rafkróna could compromise the stability of banking system deposits and could even pave the way for a new type of bank run.

Many issues have yet to be clarified, and they must be dealt with appropriately before a position can be taken. The Central Bank hopes that this report will provide useful input into further discussion and analysis in Iceland of a topic that central banks, international institutions, and academic communities around the world are exploring at the present time.

## Definitions

Acquirer:	A provider of payment services that offers acquiring.
Acquiring:	One type of payment service described in the Payment services Act, no. 120/2011.
App:	A software application designed for use on mobile devices such as smartphones and/or tablet computers.
BIS:	Bank for International Settlements.
Blockchain technology:	Technology that administers electronic bookkeeping via distributed ledger.
Cash:	Banknotes, coin, and digital payment instruments issued by a central bank.
CBDC:	Digital issuance of conventional cash by a central bank; i.e., central bank digital currency. In this report, CBDC issued by the Central Bank of Iceland is referred to as the rafkróna.
Central bank money:	A claim against a central bank, in the form of either physical cash or a balance on an account with a central bank.
Clearing:	Intermediation, pairing and, in some instances, confirmation of payment orders before settlement takes place. This may also include netting of payment orders and creation of a final balance for settlement. In electronic payment intermediation, a distinction is made between clearing and settlement. When payment is made using conventional cash, these two elements (clearing and settlement) take place simultaneously.
Commercial bank money:	A claim against a financial institution in the form of a deposit held on an account with that institution.
Core infrastructure:	Systemically important financial market infrastructure and other key infrastructure elements/information systems on which payment intermediation is based.
CPMI:	Committee on Payments and Market Infrastructures, located at the Bank for International Settlements (BIS).
Digital cash:	A digital claim against a central bank which functions in the same way as regular currency.
Digital wallet:	Software, a system, another medium or custodial service for the purpose of holding/administering money — in a mobile phone, for instance.
Distributed ledger technology:	Abbreviated as DLT. See blockchain technology.
Electronic base money:	A simple type of rafkróna that would have properties similar to those of conventional cash.
Electronic money (e-money):	Electronic money as defined in the Act on Issuance and Treatment of Electronic Money, no. 17/2013.
EMD/EMD2:	EU Electronic Money Directive (original/amended). EMD2 was implemented in Iceland with the passage of the Act on Issuance and Treatment of Electronic Money, no. 17/2013.
Financial institution:	A licenced and supervised entity as described in the Act on Financial Undertakings, no. 161/2002.
Financial market infrastructure:	A multilateral system among participating institutions, including the operator of the system, used for the purposes of clearing, settling, or recording payments, securities, derivatives, or other financial transactions (for further information, see the Central Bank's publication <i>Financial Market Infrastructure 2015</i> , p. 27).

Financial technology (FinTech):	A term covering technological innovation in the financial services sector.
Interbank payment intermediation:	Payments routed between participants (financial institutions) in the real-time gross settlement (RTGS) and netting systems; i.e., payment intermediation involving two or more legal entities.
Internal or in-house payment intermediation:	Payments between customers of the same payment service provider (financial institution).
IOSCO:	International Organization of Securities Commissions.
Legal tender:	Banknotes and coin issued by the Central Bank, cf. the Act on the Central Bank of Iceland, no. 36/2001, and the Act on Iceland's Currency, no. 22/1968.
Medium of payment:	A payment instrument as defined in Act no. 120/2011.
Netting system:	A payment system that receives requests from participants for the execution of transfer orders from one participant to another within the system. The payment system performs netting; i.e., converts multiple claims or liabilities into a single (net) claim or (net) liability for payment or the obligation to make payment on the part of participants. The netting system is subject to Central Bank Rules no. 704/2009, with subsequent amendments.
Payment account:	A payment account as defined in Act no. 120/2011.
Payment institution:	A licenced and supervised entity as described in Act no. 120/2011.
Payment service provider:	A payment service provider as defined in Act no. 120/2011.
Payment service:	A payment service as defined in Act no. 120/2011.
Payment solution:	In this report, the term payment solution(s) is used as an umbrella term to describe the various methods or ways to intermediate or execute electronic payment.
PFMI:	The Principles for Financial Market Infrastructures, issued by CPMI/BIS and IOSCO.
PSD/PSD2:	EU Payment Services Directive (original/amended).
Rafkróna:	Digital cash issued by the Central Bank of Iceland.
Rafkróna account:	A deposit account with the Central Bank of Iceland where rafkrónur are held.
Real-time gross settlement (RTGS) system:	A Central Bank of Iceland payment system that processes instructions for payments between participating members. Payment is transferred from the paying participant's settlement account to the receiving participant's settlement account when the balance on the payer's account is sufficient or when authorisation has been negotiated versus provision of sufficient collateral. Settlement is made as soon as the payment is transferred from the payer's settlement account and into the payee's settlement account (i.e., via real-time gross settlement). The RTGS system is subject to Central Bank Rules no. 703/2009.
Supervised entity:	An entity that carries out supervised financial activities and is subject to monitoring by an official financial supervisor.
Systemically important infrastructure:	Systemically important payment and settlement systems (infrastructure) and supervisory institutions such as the Central Bank of Iceland and the Financial Supervisory Authority; cf. the Act on a Financial Stability Council, no. 66/2014 (see the Central bank's publication <i>Financial Market Infrastructure 2015</i> , p. 27).
Virtual currency:	Virtual currency is an electronic issue that has value but is issued by an entity that is neither a central bank nor a supervised entity in the legal sense, and is valued according to the issuer's own unit of measure or unit of account. Virtual currency does not fall under the provisions of current regulatory instruments on payment services.

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