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Dear readers,

This issue of Sveriges Riksbank Economic Review contains articles on topics that span a broad field. The first three articles deal with payments, from different perspectives. This is followed by an article giving a historical perspective on monetary policy, inflation and war. The last two articles deal with the Riksbank's asset purchases and households' inflation expectations.

- **What is money and what is the role of the state in the payments market?**

  Governor *Stefan Ingves, Eva Julin*, *Stefan Lindskog*, *Gabriel Söderberg* and *David Vestin* describe the fundamental changes taking place in the payment system. This means, among other things, that we are moving rapidly towards a more or less cashless society. The authors argue that the state should take its responsibility to ensure that the payment system of the future works well in a global digital world. Part of this responsibility is to ensure that Sweden issues a central bank digital currency (CBDC) if money issued by the state is to remain widely available to the public.

- **Cross-border payments in the spotlight**

  Carl Andreas Claussen and *Anders Mølgaard Pedersen* provide an easy-to-read introduction to cross-border payments, what options are available, how they work, what they cost, and how they are regulated. They also report on what is happening in the field, including as a result of the G20 roadmap to improve cross-border payments.

- **Remittances – the overlooked payments**

  Nina Engström and *André Reslow* write about remittances, i.e. the cross-border payments we often associate with the funds migrants send to friends and relatives in their countries of origin. The authors describe how remittances can work and why they are important. They also describe Swedish statistics on remittances, and provide a first assessment of how well Sweden is meeting the G20 targets for remittances.

- **Monetary policy and inflation in times of war**

  Mikael Apel and *Henry Ohlsson* go back in history to study the relationship between war and inflation. Are there any common denominators between what is happening now after Russia's invasion of Ukraine and previous war episodes? They also look back at times when wars have been associated with rising inflation in Sweden, and discuss the lessons from this.

- **Understanding the Riksbank's asset purchases: who sold bonds to the Riksbank?**

  Meredith Beechey Österholm studies the Riksbank's bond purchases since 2015. By analysing data from the financial market accounts and the Riksbank's database of assets holdings, she studies which actors have reduced their holdings of the assets purchased by the Riksbank. The results of this analysis can be used to better understand the transmission of bond purchases.

- **Inflation illiteracy – a micro-data analysis**

  Fredrik N. G. Andersson, *Erik Hjalmarsson* and *Pär Österholm* study survey data from the National Institute of Economic Research's *Economic Tendency Survey* on Swedish households' perceptions of the current rate of inflation and their expectations of the future rate of inflation. They analyse what percentage of households can be considered to be poorly informed about inflation (as their responses deviate significantly from the historical pattern of inflation), and what characterises these households.

Read and enjoy!
Marianne Nessén and Ulf Söderström

Contents

What is money and what is the role of the state in the payments market?

Stefan Ingves, Eva Julin, Stefan Lindskog, Gabriel Söderberg, and David Vestin*

Stefan Ingves is Governor of the Riksbank, Eva Julin is Deputy Head of the General Secretariat and Chair of the Riksbank's e-krona project, Stefan Lindskog is former President of the Supreme Court, Gabriel Söderberg is Associate Professor of Economic History and Senior Economist on leave of absence from the Riksbank, and David Vestin is Senior Advisor in the Research Division of the Riksbank's Monetary Policy Department,

In this article, we argue that the state should take its responsibility to ensure that future payment systems work well in a global digital world. Part of this responsibility is to ensure that Sweden issues digital central bank money, if money issued by the state is still to be widely available to the public.

Our conclusion is that the Riksbank should issue e-kronas within the next few years and that these e-kronas need to be usable by the public in everyday life. This is necessary to ensure that fundamental objectives for society, such as confidence in the monetary system, resilience, accessibility and competition can be safeguarded in the payments market in the future.

A regulatory framework is needed to enable the introduction of a new digital payment instrument and to set the scope for it. From a legal perspective, our analysis suggests that electronic central bank money in the form of electronic cash as a complement to physical cash is preferable to electronic central bank money in the form of claims on the state. In other words, this implies a dematerialisation of cash in the same way that paper shares have already been dematerialised into book-entry shares. The central bank is thus modernising the product it has been offering for hundreds of years with the help of new technology.

1 The payments market is changing faster and faster

The modern economy is based on our ability to make payments. It is therefore crucial to our society that payment systems function smoothly. In prehistoric times, we

* The views expressed in this paper are those of the authors and are not necessarily shared by the Executive Board of Sveriges Riksbank.

exchanged goods with one another; today, we exchange means of payment in the form of cash or carry out digital transactions through accounts. Recently, digitalisation has also brought a growing flurry of potential new means of payment – e-money, stablecoins, crypto assets and digital central bank currencies.[1]

Not so long ago, banknotes were usually equivalent to a value in gold or other metal. This direct link has long since disappeared in most countries. Today, we use what is commonly referred to as "fiat money", where the public's trust in the state creates confidence in the value of the means of payment.[2] The state guarantees, through the central bank, that the means of payment issued by the nation has what is usually referred to as the basic characteristics of money, namely being a store of value, a unit of account and a means of payment.

In Sweden, the state, through the Riksbank, has issued banknotes and coins that have been used by the public for hundreds of years. But in the past decade, digitalisation and globalisation have had a revolutionary impact on payment patterns and methods. Fewer and fewer consumers use cash. We appear to be on a very fast-moving path towards the cashless society. Money (in the broad sense of that term) is being privatised, and this directly affects the role of the state in the payments market.[3]

Analysing the consequences and considering possible measures when the national state payment instrument no longer works in practice is a responsibility that the state should reasonably assume.

In this descriptive analysis, we discuss and argue why a Swedish digital central bank currency, a so-called e-krona, is needed in the future payments market.[4] We begin with a historical review in section 2, after which we move on in section 3 to analyse what money is and then, in section 4, we focus on the legal framework for money and a future e-krona. In section 5, we discuss the marginalised role of the state in the payments market and why an e-krona is needed for the future. Finally, we provide a summary and some recommendations regarding the role of the state in the payments market.

The positions and arguments in this article are based on a subjective analysis of the work produced within the Riksbank's e-krona project and the authors' many years of work in the area of payments for the Riksbank and other authorities in Sweden.[5] The

[1] Electronic money refers to electronically stored monetary value, which represents a claim on the issuer, usually issued by private operators, the remaining concepts are explained later in the article.

[2] Fiat, translation from Latin "let it happen". According to Bossu et al. (2020), this is the mechanism by which states sanction a means of payment. The meaning of this concept is that the value of a banknote is the amount in the official monetary unit that is printed on it by the issuer. The banknotes are to be accepted as payment for that value, without having to be convertible into, for example, gold coins. This is the function that leads economists to call banknotes "fiat money".

[3] See, for instance, Julin (2022).

[4] The arguments in favour of an e-krona have been described in various ways in the Riksbank's many reports and speeches (e.g. Sveriges Riksbank 2017, 2018, Skingsley 2016, Armelius et al. 2020).

[5] In 2016, the e-krona project was launched at the Riksbank and several speeches, articles and reports are published at www.Riksbanken.se. In 2020, the Riksbank also launched a pilot project, the e-krona pilot, to gain knowledge about how an e-krona could look and work in technical terms. Together with the company Accenture, the project has developed an e-krona platform.

messages and conclusions in the article are solely those of the authors. Questions about digital central bank currencies fall within a sphere where we touch on everything from politics, philosophy, economics and not least values, so there may be other stances and conclusions that are at least as reasonable.

2 History repeats itself!

The rapid digitalisation of the world has brought with it a rapidly growing flurry of potential means of payment. This is similar to the situation before central banks in most parts of the world were given the exclusive right to issue cash.[6] Several of the world's current central banks, such as the US Federal Reserve, did not exist until the early 20th century, and money in the United States was therefore issued by private banks. The United Kingdom had the Bank of England, but it was not a central bank in the modern sense - instead it was privately owned and competed with a large number of smaller banks that issued banknotes. In Sweden, where the Riksbank was established as early as the 17th century, private banks were created in the 1830s and given the right to issue banknotes to finance loans to businesses and individuals. Commercial bank money thus existed in physical form and circulated as a means of payment in society.

Although private banknote issuance was regulated in various ways, the exclusive right of the central bank to issue banknotes was introduced in almost all countries. The specific reasons in each country differed, however, depending on the context. In Sweden, private banknote issuance was particularly tightly regulated and private banknotes were legally redeemable for Riksbank banknotes.[7] Nevertheless, after a long political process, the Riksdag decided in 1897 to grant the Riksbank the exclusive right to issue banknotes. The overall motive was to ensure the stability and security of the monetary system for the future by making banknotes completely risk-free and ensuring that their issuance would not be driven by profit interests. International developments, with a virtually complete transition to a banknote monopoly in country after country, probably also influenced the decision.

In the United States, for example, the situation was much more chaotic. In the mid-19th century, more than 1,500 private banks issued private banknotes that could circulate far from the issuing bank. These notes were therefore not as valuable, and there were even special books published that note recipients could consult to ascertain the exact value of a particular note. Dissatisfaction with this situation contributed to the eventual creation of the Federal Reserve in 1913, which was given a monopoly on the issuance of banknotes.

From at least the beginning of the 20th century, the state has therefore been almost exclusively, through the central bank, the sole issuer of physical means of payment to the public. Alongside these means of payment, there have also been account-based commercial bank money which holders could use for payments, for example by writing cheques. With the development of technology, physical means of payment in several countries, and especially in Sweden, have been outcompeted by digital

[6] This section is based on Söderberg (2018).

[7] Instead, from 1874 onwards, banknotes were formally redeemable for gold.

payments. This has also meant that government money has been used less and less for payments in favour of privately issued money.

To fully begin to analyse the consequences of this transformation, we first need to discuss what money actually is.

3 What is money?

3.1 Money in the economic sense

Economists traditionally say that "money", for example Swedish kronor, is something that fulfils three functions: to be a unit of account, a means of transaction and a store of value. The first function means that prices in the economy are quoted in kronor (F1). The second means that payments can be made in kronor (F2) and the third that the value of kronor is stable over time (F3).[8]

None of the functions are black or white, they are grey scales where the function can be filled more or less well. For example, as we have already discussed, there were banknotes issued by private banks in the United States in the 19th century, with the possibility of paying with these decreasing with distance from the bank.

Money as a phenomenon is older than written history, so we don't know exactly how it came into being. There are two alternative accounts of how it came into being. The first, which tends to be the focus of economists, assumes that money was invented to facilitate trade. Barter became impractical as the number of goods in the economy increased, and money conveniently solves a number of related problems (easier to find trading partners, divisibility, unnecessary transport, etc.).

The second narrative, more common among historians and sociologists, is that money originates in the exercise of power. We can imagine a king who finances an army by paying it with newly printed coins and at the same time demands that citizens pay taxes with such coins. This creates a demand for them and enables the soldiers to buy equipment, etcetera and pay with the coins.

Both of these stories are relevant to understanding how money came to be, and in practice they are easily confused in real economies. For example, if we assume that the origin of money is in the king's story, it is easy to believe that once this money circulates, it would also be used as a broader means of transaction (F2) and as a store of value (F3).

Historically, (F3) has periodically been handled by linking the means of payment to precious metals, either directly in the form of silver and gold coins, or indirectly by mandating a central bank to redeem banknotes for a certain amount of precious metal. The best-known example of the latter is the so-called gold standard, which was the dominant system from about the 1870s until the First World War. None of these systems has operated smoothly. Medieval rulers could dilute the metal content of

[8] See Hull and Sattath (2021) for a discussion of how digital aspects affect this classic definition.

coins, and central banks, despite the gold standard, could end up holding far less gold than would be needed if all banknotes were to be redeemed at the same time. Both of these weaknesses have led to periods when the value of money has been called into question and to a bank run, a rush of withdrawals from central banks.

One problem with linking the value of money to gold, for example, is that when the supply of gold unexpectedly increases (new gold deposits are discovered) or the economy grows faster than the gold deposits, the relative price of gold changes. For this and other reasons, modern central banks have opted instead to use so-called "fiat" money, i.e. money that has no direct link to anything real, as we have already mentioned.

3.2 Money in the legal sense

Payments can be made using other means than banknotes and coins. In practice, this is done to a large extent, through bank money which is a claim on the bank. However, bank money is linked to banknotes and coins in that bank money is in legal terms a claim to receive banknotes and coins. That claim is not legally different from a claim to receive, for example, a certain quantity of wheat of a particular quality, other than that wheat is a tangible product, whereas banknotes and coins represent a generic value, that is to say a value without its own utility function.

So what is money in the sense of notes and coins in legal terms? The simple but not entirely enlightening answer is that under Swedish law, banknotes and coins are a class of property in themselves (sui generis), defined in terms of a value determined in the Swedish currency, the krona. A better understanding can be gained from a brief historical review.

As described earlier, previously a utility was exchanged for a utility, with certain types of utility becoming an intermediate step. In time, it came to be mainly a question of precious metals. When coins were created, it was both a small and a large step in the development of money. The small step was the quality assurance of the metal piece that the minting implies (or at least was intended to imply). The large step was that the denomination on the coin became the basis for currency as a unit of value.

When the banknote printing press came about, the foundation was laid for several subsequent steps in the development. To begin with, a representation system was introduced. A piece of paper represented a piece of metal that was kept in safe storage. The paper was a form of representation, and the piece of metal was the object represented. Initially, the banknote was probably a proof of storage which, for practical reasons, was used to make exchanges instead of the actual metal in storage. Gradually, merchants and bankers began to create banknotes for use in trade. Furthermore, the representational object changed from a specific piece of metal to a certain amount of metal. The banknote had changed from being a certificate of deposit to a certificate of debt, which represented a certain value in the form of metal, usually gold of a certain grade and in a certain quantity. After the nationalisation of the right of issue, the last major step in the development of the representative object was the abolition of the gold standard. With this, the

representational object had become a general social concept of value measured in the national currency.

Coins thus once *represented* a tangible value (the metal minted), while banknotes *represented a right to* a tangible value (the metal deposited, but gradually a claim to metal of a certain quantity and type). Today, both coins and banknotes are merely representations of a generic value measured in the currency of the issuing central bank. The medium of representation is, for historical reasons, paper and metal, but it can now just as easily be plastic or something else that functions in practice. The division into denominations (the different values in kronor represented by the banknotes and coins) has historical explanations. For practical reasons, large and valuable pieces of metal were not suitable for circulation and had to be represented by a paper banknote. Today, the order may just as well be the reverse, so that coins may represent larger denominations than paper.

But what exactly is a generic value measured in the currency of the issuing central bank? Functionally, it is what can be called purchasing power. Banknotes and coins are thus forms of representation of purchasing power rather than, as in the past, metals. Value as such (purchasing power) is based on social trust in the authenticity of the currency and in the currency itself, a trust which the central bank is responsible for maintaining.

3.3 Who creates the money in today's economy?

To understand the role of money in today's society, we also need to understand how money is created today. Therefore, we need to briefly explain how the banking system works.

Banks issue loans to borrowers and receive matching liability items on their balance sheet. When a bank issues a new loan, the amount of bank deposits increases at the same time. The bank records the loan as an asset of the bank, while depositing the corresponding amount in the borrower's bank account (the bank's debt to the customer). This increases the total amount of bank deposits in the economy.[9] Most Swedes pay their bills by instructing the bank to transfer bank deposits (i.e. deposits on a payroll account) from their own account to the recipient's account. Thus, (F2) is satisfied for bank deposits. At the same time, the value of the money is backed by both the borrower's future ability to pay and the Riksbank's responsibility to preserve the value of nominal money via the inflation target. Thus, (F3) is fulfilled and bank deposits are considered as "money". This money constitutes the absolute majority of means of payment in circulation in Sweden.

The Riksbank issues money in the form of cash and central bank reserves, where the latter can only be held by banks and some financial market participants, so-called

[9] The banks can actively manage the various debt items on the balance sheet, and can issue bonds, for example. When this happens, the amount of bank deposits in the whole banking system is reduced, as buyers pay the bank with deposits. The easiest way to see this is when a customer buys a bond in his own bank and pays from his balance on his account in the bank – bank deposits are then converted into holdings of a bond.

monetary policy counterparties. The Riksbank also ensures that the exchange rate between bank deposits, cash and central bank reserves is fixed at 1.

Some economists argue that all financial assets can be considered as money to some extent, and that the difference between them is the degree of liquidity, that is how easy it is in practice either to pay with them or to convert them quickly into means of payment.[10] Others focus precisely on the part of the banks' balance sheet that constitutes what we have described above as money, namely bank deposits alone.

3.4 The role of the Riksbank as the banks' bank and the RIX payment system

If there were only one bank in the economy, in addition to cash transactions, payments could be made entirely by moving bank deposits between the bank's customers. Since there are several banks, there needs to be a way of transferring money between them. There are several possibilities.

One option would be that the banks accepted claims on one another, for example Bank a could have accounts with Bank B and vice versa. If a customer in Bank A wants to transfer money to a customer in bank B, Bank A would increase the balance of Bank B's account with Bank A and reduce the balance for its own customer. Bank B would then have a claim on Bank A, and a debt in the form of bank deposits for its customer.

However, this system would be impractical if it resulted in excessive net exposures between banks, which could happen, for example, if their customer bases are different. Suppose, for example, that Bank A has younger customers who borrow to buy housing, while Bank B has older customers who sell their housing to customers in Bank A. This increases Bank B's claim on Bank A as a trend over time.

Another option is that banks regulate imbalances through an asset that is not created by the banks themselves. It could be gold, government bonds or anything else that is easy to move and share.

Most economies have decided that a good alternative is to manage this regulation in central bank reserves, in Sweden's case through the RIX payment system operated by the Riksbank. The system works in such a way that each major bank has one account (actually several, but for the sake of simplicity we can think of it as one account) with the Riksbank. When a payment is to go from Bank A to Bank B, Bank A instructs the Riksbank to transfer a certain amount from its RIX account to the corresponding account in Bank B. The banks have deposited collateral so that their balances can be allowed to become negative. In principle, the system can be operated so that the sum total of the banks' accounts is equal to zero, and central bank reserves are then automatically created when necessary (in the sense that the bank's account balance is allowed to be as negative as the collateral provided permits). However, over the past ten years, the amount of central bank reserves in the system has been allowed to increase as a result of the Riksbank having increased its balance sheet in combination

[10] See Tobin (1963) for an early discussion.

with not offering the banks, as before, the entire surplus of central bank reserves in the weekly certificate auctions.

The central bank reserves discussed here are thus a form of digital central bank money that is only available to the banks, and which they use to pay one another. The question is therefore whether central banks should also issue digital money that can be held by the public and not just by banks. Why should only companies have access to digital central bank reserves, or, let us say, central bank money, and not the public? That brings us to the next section and the question of how digitalisation changes payments in society.

3.5 Digitalisation and new forms of money?

A revolutionary development in the last ten years, which is now changing the monetary landscape, is the emergence of various forms of digital currencies, at the same time as cash appears to be losing ground in the payment market. As we have seen historically, both private and state options are emerging and becoming established. The private options in the digital world are primarily unbacked crypto assets (such as Bitcoin) and what are known as stablecoins .[11] The state alternative to this is the so-called CBDCs – Central Bank Digital Currencies, what we call the e-krona in Sweden.

In the case of CBDCs, there is no generally accepted definition. In the world of central banks and economists, there is sometimes talk of different types of digital central bank money according to purpose and needs. They have often been divided into so-called retail and wholesale CBDCs. The common definition of large payments – wholesale – is time-critical payments between financial participants in settlement systems such as RIX-RTGS. Small payments, often called retail payments, refer to all that are not large payments. The market for small payments is called the retail payment market to make it clear that it is not a market for payments in general (large and small). A retail CBDC would therefore be used for small payments. A wholesale CBDC, on the other hand, is intended to be used for roughly the same kind of large payments as are currently being made through the central banks' settlement systems. The terminology and classification of different CBDCs are not crystal clear. There are also general purpose CBDCs that can be used for both large and small payments. Whether a CBDC is token-based or account-based, the basic idea for both retail and general purpose CBDCs is that they should be publicly available and function in the retail payment market.[12] The concepts retail and general purpose are therefore partly overlapping. The important thing is not the area of use, but the fact that it is a question of state-guaranteed digital payments.

[11] In general, the concept of backed assets is used for those guaranteed by central bank money.

[12] A token-based CBDC usually refers to the CBDC being created as a token within a token-based system, that is, a data file with its own unique value and with a specific tag. The transfer of a token from one party to another does not require the combining of two databases, but rather the almost immediate transfer of ownership, as with banknotes.

As in the past, private and public money cannot be equated. We will return to the reasons for this. Below we describe the different forms of potential digital means of payment.

3.5.1 Stablecoins

A stablecoin is a private digital means of payment that seeks a fixed or, at least, stable value. There are different ways of achieving this. For example, the issuer may hold a basket of low-risk assets, such as fiat currencies, issued by trusted central banks. Stablecoins can also operate a fixed exchange rate regime, for example against an existing currency like US dollars.

To explain how stablecoins work, we can take an example. Let us assume that a private company offers customers the possibility to exchange dollars for “SCoins” (our fictitious stablecoin) and provides SCoins entirely according to demand. When customers want to exchange existing bank deposits for SCoins, the debt side of the company grows as it issues more "coins", and on the asset side the amount of fiat currency grows – in this example, US dollars. If the company does not make any changes on the asset side, this is equivalent to a bank which voluntarily applies a 100 % reserve requirement to deposits, i.e. holds the same amount of central bank reserves in the bank's account in the central bank as its customers have in their accounts in the bank. The business model is now based on the fact that the company offers a lower return on SCoins – in reality usually zero – than they themselves receive in return on their central bank reserves at the US central bank.[13] Customers are attracted by the fact that the company offers its customers to transfer SCoins to other account holders, just as a normal bank allows its customers to transfer money to other customers in the bank.

The company differs from a normal bank with regard to *how* it allows customers to transfer SCoins to one another, and this is where technology development comes into play. SCoin can open up its systems and allow payments 24/7 and even allow SCoin transfers to be linked to so-called smart contracts, which, based on certain triggers, automatically transfer SCoins between customers.[14] This also means that stablecoins could possibly offer cheaper and faster cross-border payments – something that is expensive and slow in the traditional system.

Note, however, that this technology development does not only apply to stablecoins. In principle, there is no obstacle to private banks using the same technology to enable their customers to do the same with bank deposits. In practice, however, the regulations applied to banks, but not to stablecoins, may prevent them from doing so.

[13] An alternative business model is to sell information about the payment habits of their customers. This option only works if the technical solution on which the currency is based does not offer anonymity.

[14] A smart contract is a digital contract that uses block chain technology. The contract contains conditions and a code to be executed if the contract conditions are met. No third party needs to verify whether the contract's conditions are met; this is done automatically, directly in the contract code. If the contract conditions are met, the code in the contract is automatically executed. Smart contracts are therefore secure, traceable and completely transparent.

One weakness of stablecoins is that in practice they do not function as the ideal variant above, but the company that issues them can choose to hold more risky assets as collateral. If the company does not have sufficient equity, this construction risks causing instability and a bank run if customers start to doubt the company. This is exactly the same type of mechanism as in classic bank runs in crisis situations, where customers begin to doubt the value of their bank deposits. Stablecoins are not central bank money, even if they are backed by this. Only central banks can issue completely risk-free money.[15]

3.5.2 Unbacked crypto assets

Unbacked crypto assets, such as Bitcoin, differ significantly from stablecoins in that they do not promise a fixed exchange rate against another currency. In this way, we can say that the crypto currencies are only technical platforms. What the creators of a crypto currency need to do to make it attractive is to convince other people that it is valuable. They must therefore regulate the supply of the crypto currency in order to maintain, or increase, its value over time. Something has to take over the role of the central bank in the normal system, and many crypto currencies use a mechanical rule that ensures that the amount of the crypto currency increases in a predictable way that usually means that growth decreases and, in the long term, moves towards zero. This is often done by creating new crypto currency only when verifying payments in the system and by reducing the amount allocated to those verifying payments over time.

This creates the conditions for a kind of pyramid scheme. If demand for the crypto currency increases over time, the exchange rate between the crypto currency and ordinary currencies must increase, because the supply of the crypto currency, in contrast to the stablecoins case, does not adjust at all to demand. This means that those who 'enter' early on will make a lot of money if demand increases, just like those who enter early in a pyramid scheme. Most people who buy crypto currency do not seem to do so to use it as a means of payment (F2), but rather for speculative purposes in the hope that more people will want to do the same thing in the future. In addition, very few prices are set in crypto currency (F1) and the exchange rate against other currencies is very unstable (F3). So far, on the grey scale of what we can call money, crypto currencies have a very low rating. However, this could change later on if the technology for making payments becomes more efficient and more customers choose to hold crypto currency and use it to make payments. Economists tend to talk about “network effects” in the payment context. This means that the willingness to use a means of payment depends on how much others use it and that developments can be very rapid once there is a critical mass of users.

[15] Weaknesses in trust in privately-issued digital currencies during times of unease show that these cannot be equated with government-issued guaranteed money. See, for instance, Gorton (2021). At present, there are several examples of weak crypto exchanges that are probably linked to both the political and economic turmoil.

3.5.3 Does new digital money pose problems for the future payment system?

As a result of this development, part of the payment system falls outside the traditionally regulated banking sector. This may give rise to financial stability risks, as a bank run can occur against both stablecoins and crypto currencies. The stability of the payment system could therefore be affected in the future if more and more transactions are made with such means of payment.

Another problem for central banks concerns the implementation of monetary policy. This is now done by central banks setting the conditions for the banks in the payment system and thereby affecting shorter market rates. If, in future, a larger proportion of transactions were to take place in other means of payment, or if the major banks were to choose to make customers' deposits directly transferable to other recipients using the same kind of technology, a large proportion of payments would be made outside of the central bank's payment system. It is likely that the central banks would then have problems controlling short-term market rates and would have to develop the monetary policy toolbox to find alternative ways of dealing with the situation.

This system would also remind us of the historical period before central banks were granted a banknote monopoly: at that time, competing banks issued banknotes that circulated freely in the economy. If users started to doubt the solvency of the issuing bank, the exchange rate between notes could deviate from 1, even though they were referring to the same currency. In the late 19th century, it was decided, partly because of these problems, but also because the seigniorage that comes with the right to issue banknotes should go to the state, to instead give the central bank a monopoly on the issue of banknotes. Similar arguments could be put forward for the creation of a state CBDC instead of having many competing private stablecoins.

3.5.4 Central Bank Digital Currencies (CBDC)

A CBDC is basically nothing but central bank money, like cash, except that it is digital rather than physical. As mentioned earlier, these are already in the Riksbank's RIX system but are only available to financial institutions that have accounts there. The CBDCs that we are talking about here are those that are often called retail CBDCs, that is, digital central bank money that can also be held by the public in much the same way as cash.

A CBDC can be designed in many different ways. For example, a CBDC could be a system linked to the rest of the payment system via RIX. That is, the CBDC is in a RIX account and funds are transferred from private banks when their customers switch to CBDCs, which increases the balance on this account and reduces the account balances of the transferring banks.

Since the Riksbank began to examine the issue of a CBDC in 2016, the international discussions on CBDCs have developed rapidly. There is now a broad debate on CBDCs among researchers and economists and central banks around the world. Over 80% (BIS 2021) of the world's central banks are analysing the role a CBDC could play in

their respective jurisdictions.[16] There are already officially released CBDCs in emerging economies in particular, such as the Bahamas, Nigeria and Jamaica. A CBDC is seen above all as a means of modernising the payment system, but also of reducing many of the risks of a digitalised environment. However, there are also many ongoing experiments with CBDCs, or pilot projects, which are circulating in the economy and used by ordinary people to buy goods and services.[17] The most well-known is the Chinese pilot project, which has more than one hundred million users. Extensive CBDC projects are also underway in the United States and the euro area.[18]

One could say that the CBDC has now entered some form of phase two. The first phase consisted of initial analysis and research into the phenomenon and surveying both the advantages and risks of a CBDC. In the second phase, it is not only a question of deciding *whether* to issue CBDC, but also of examining how to *design*them. Most central banks want to preserve the role of the private sector in the payment system and all issued CBDCs and CBDC pilots are based on private operators distributing CBDCs, such as banks and other payment service providers. The vast majority of these also have limits as to how much CBDC can be kept by private individuals to eliminate the risk of deposits flowing out of the banking sector. Central banks are also looking at how CBDCs could be used to make cross-border payments more efficient.[19]

However, the arguments for the introduction of a CBDC are still diverse and depend to a large extent on national circumstances and the exact problems that different nations are facing in their debate on whether or not to introduce a CBDC. There is also no uniform standard for the design of a CBDC, in the way that exists for banknotes and coins. However, analysis and knowledge in this field are moving forward, and there are some established grounds that many central banks currently support (see BIS and Coalition of Central Banks 2020). The G7 (consisting of France, Italy, Japan, Canada, the United States, the United Kingdom and Germany) has also published a list of thirteen principles to be followed by CBDCs (see G7 2021). Going forward, we will probably see general recommendations and agreements issued by governments and central banks on this matter.

4 A CBDC from a legal perspective

The central role of law in the monetary system means that a specific discussion of the legal implications of a CBDC is needed.

From a legal perspective, it does not really matter how the basic premise of the legal order that value should be generically tradeable is satisfied, as long as there is a tradeable means of payment of some kind. At the same time, there is a problem with a clear legal dimension if there is no central bank money. It then becomes difficult to explain what bank money actually is. Claims, yes, but on what and on whom? If a bank customer sues the bank for payment, should the bank be obliged to pay with bank

[16] See, for example, Söderberg et al. (2022).

[17] For an overview, see, for example, the Atlantic Council (2022).

[18] See for example ECB (2022), Brainard (2020) and White House (2022).

[19] For example, see BIS-IMF-WB (2022).

money? Central bank money is quite simply needed as a kind of anchor in the legal system. In Sweden, central bank money in the form of banknotes and coins has almost disappeared because the physical form of representation is impractical. It must therefore be given another form of representation, which in the light of developments cannot be anything other than electronic.

4.1 The two design options

On the question of central bank money, we have already noted that forms of representation other than paper and metal are possible. However, with regard to the object represented, that is, the value that banknotes and coins in daily circulation are considered to have, there is probably no further development step following the abolition of the gold standard. The notion of a value linked to certain forms of representation and with a currency as a measure of value is an extremely advanced and socially important, but also in some respects fragile, concept. For it to be maintained, care and maintenance are required of the social institutions, and in particular the legislator and the central bank. The introduction of electronic central bank money should therefore involve as limited an intervention as possible in the established concept. This suggests that the form of representation (the paper in the banknotes and the metal in the coins) is dematerialised, but retains the object of representation (the value it represents, the purchasing power) as it is. Exclusive access to and handling of electronic cash will then be a 'handle' to the value to which banknotes and coins are also 'handles' to, namely purchasing power.

However, one alternative is to not only create an electronic form of representation, but also to change the object of representation to a state equivalent of "bank money" (i.e. means of payment in the form of monetary claims on a banking institution). This is not a dematerialisation of notes and coins, but a negotiable electronic form of representation for monetary claims on the state, which are intended to function as means of payment in much the same way as bank money does. For such a claim to arise, some kind of reciprocity is needed (cf. the deposits or debts that are a prerequisite for the creation of bank money).

In the following, the two possibilities – electronic representation of (a) the same object of representation as banknotes and coins (i.e. purchasing power), and (b) negotiable claims on the state on (ultimately) cash (i.e. currently banknotes and coins) - will be contrasted, mainly from a legal perspective.

4.2 Some legal comments on the two design options

Banknotes and coins (physical cash) are thus a form of representation of money in the sense of purchasing power as the object of the form of representation. Purchasing power is a position of economic power created and maintained by the central bank with cash as its instrument and social trust as its precondition.

Bank money, on the other hand, is in legal terms a claim on (ultimately) cash, albeit that the claims can usually be met with bank money and that the system is in that sense circular (a monetary claim can be met with bank money that is a monetary claim). Unlike cash (banknotes and coins), bank money does not have a specific form

of representation but could be given one in the form of a promissory note (which, however, as mentioned, would possibly conflict with the central bank's monopoly on the issuance of banknotes).

Cash may only be issued by the central bank. It is created by the bank's "banknote printing press" and distributed through a system coordinated with the banking system. Bank money is created by deposits or lending.

Electronic central bank money can be created following the pattern of either cash or bank money. The former implies a new electronic form of representation of purchasing power as the represented object, i.e. an electronic form of cash. The latter also implies the introduction of a new electronic form of representation, but with a claim (for cash) on the state as an object of representation. It can also be described as the former entailing the introduction of an electronic banknote (or coin) and the latter the introduction of an electronic promissory note (with the state as the debtor).

An electronic form of representation with purchasing power as the object of representation of (i.e. electronic cash) can function alongside notes and coins (i.e. physical cash) without requiring the existence of notes and coins. The choice between having only one form of representation (in the long run electronic) or two forms of representation (one electronic and one physical) is, from a legal system point of view, unimportant. On the other hand, electronic central bank money in the form of (monetary) claims presupposes, from a purely systemic point of view, the existence of cash (i.e. notes and coins, unless electronic cash is introduced) as a kind of anchor in the system.

The requirements for the electronic form of representation should essentially be the same regardless of whether electronic central bank money is created on the model of cash or on the model of bank money, but in the former case, as mentioned above, the object of representation remains unchanged, while claims on the state as the object of the electronic form of representation would be something new (albeit a step backwards in development, to the time prior to the abolition of the gold standard, when a banknote represented a claim on the state). If the object of representation is money claims, this leads to the application of the procedural and legal system for claims with several complications (concerning, for example, prescription, set off and interest), which most certainly require special modifying legislation.

Electronic cash can be based on what applies to banknotes and coins for general linguistic, management and legal purposes. The linchpin is the possibility to use them. A legal condition for this is that the holder's effective control (power over the flow) of his electronic cash corresponds to what is the case for physical cash. Provided that this power to control the flow can be ensured technically, the need for legislation is in principle limited to clarifying that a transfer of electronic cash is legally equivalent to a handover of physical cash. This does not preclude consideration of more detailed civil law legislation, which would appropriately cover and, as far as possible, equate electronic and physical cash.

Due to their physical form, banknotes and coins must have specific denominations. This is not the case for electronic cash. Regardless of design, the funds are presumed

to be registered in some form of electronic wallet in a manner similar to bank money for the holder. However, the absence of denomination cannot be assumed to have any civil law implications. Nor does the construction of the electronic wallet seem to have any legal significance, as long as the holder has exclusive access to the electronic cash.

When central bank money is handled electronically, it becomes possible to control and trace it in a different way than when handling physical cash. If electronic cash is to function in a similar way to physical cash in practical terms and in the application of the civil law rules applicable to physical cash, the technical possibilities for users to trace and control it should be limited to what applies to physical cash. The recipient of electronic cash should know no more than who has given it to them, and the payer should know no more than who they are paying. More detailed knowledge of the electronic flow may open up for restitution and other legal claims that disrupt marketability.

4.2.1 Electronic cash is preferable to claims on the state

Regardless of whether electronic central bank money is constructed as electronic cash, that is, as a digital equivalent of physical cash, or as claims on the state, it requires an electronic form of representation. How this is designed will probably not be more than marginally dependent on the construction. The difference concerns the object of representation; physical cash or claims on the state.

Electronic cash would represent the same as physical cash, that is, purchasing power. It is simply a matter of dematerialising the physical representation in the form of paper and metal in the same way that paper shares have been dematerialised into book-entry shares.

Electronic central bank money would represent claims for (ultimately) banknotes and coins. While the legal status of monetary claims as a means of payment is not new, the use of claims on the state as a means of payment is not known to be widespread in any western state.

The difference between cash and claims becomes apparent when considering the question of issuance. Electronic cash can be issued on the same practical and legal basis as physical cash, with the only difference that the "banknote printing" and other requirements are entirely electronic. The claim option presupposes a deposit scheme, which will be a practical innovation and may be assumed to require specific legislation.

For Sweden, the need for civil law regulation of electronic cash can be assumed to be small, as it will function in the same way as physical cash. Basically, all that is needed is to clarify that this is the case, and that the transfer of electronic cash is legally equivalent to the physical handing-over of banknotes and coins. Under the claims option, the procedural and civil law regulations on monetary claims would apply. The need for legislation will therefore largely depend on what derogations should be made from these regulations. The questions concern whether the state can be sued

for payment and, if so, what should apply. What is the state going to pay with? What about interest and prescription regulations? Etcetera.

The conclusion is that, from a mainly civil law perspective, electronic central bank money in the form of electronic cash as a counterpart to physical cash is preferable to electronic central bank money in the form of claims on the state.

5 The role of the state in the payments market and the need for an e-krona

As payments are increasingly made digitally, we are using private money more often and the state's presence in the payment system is decreasing. In practice, we could ultimately end up with a system similar to that of the United States in the 19th century, where state money had virtually no role and instead a variety of privately issued money and potential means of payment circulated. But today there are both physical and electronic options. Since the state has an obligation to ensure the functioning of society at an overall level and since the payment system is a cornerstone of a functioning society, we believe that the role of the state in the payments market needs to be secured. The question to ask is whether the state should stop issuing money as a means of payment to the public? Because this is the development we will have in practice if the state does not issue money in the form of a digital krona in the future.

The public's overall confidence in the money system is based on the fact that their private digital money can be easily exchanged for state-guaranteed money, cash. We believe it is likely that this arrangement has resulted in private money held in different banks having a one-to-one exchange rate to each other and to cash. The public can rely on the fact that there is a state alternative, cash, to complement private bank money. We do not know whether public confidence in private money would be the same if cash did not exist. Nor do we know whether the exchange rate on different private bank deposits would vary during a crisis or in times of turmoil.

We cannot comment on what would happen if the state withdrew completely from the small payments market. But given the major consequences if problems were to arise in the payment system of the future, we cannot wait to act until the consequences become apparent. We therefore believe that an e-krona, as a complement to cash, is needed to ensure that the state maintains confidence in the ability of the monetary system to always exchange private money one-to-one for state money.

We believe that the state needs to maintain a direct presence in the payments market by providing citizens with state money with which they can make payments. In a digital future, this means that state money, via the central bank, should also be digital and not just physical. In other words, in Sweden we need to issue an e-krona to complement cash and private digital money. The direct argument for this is that a payment system that is run entirely privately cannot be expected to meet the societal goals of the payment system. These goals may be different in different countries. But in Sweden they can be summarised in four points:

- *Confidence in the Swedish krona needs to be maintained.* In a situation with several different private digital means of payment but no state money for which these can be exchanged, there is no anchor in the system. Confidence in privately issued money increases when it can be redeemed for state money. This also increases confidence in the Swedish krona as a whole.
- *The resilience of the payment system must be protected.* In a more digital society, payments are also more vulnerable to disruptions. We are also moving towards a more uncertain and conflict-ridden era where aggressions, for example in the form of cyber attacks, can be directed against the payment system even in peacetime. An e-krona could be made more resilient than would be economically feasible for a private operator and also provide an alternative to other digital payment systems in case these were to fail for any reason.
- *All citizens must be able to make payments.* An e-krona could be designed to be used also by smaller groups with special needs that are not economically feasible for private operators to accommodate.
- *Competition in the payments market needs to be maintained.* Payment systems, due to what economists call network effects, promote the emergence of a few monopolistic players. The more people who are connected to a given payment service, the more people and companies the user can reach. This makes it difficult for new payment service providers to enter the market. In cases where several private operators build a payment service together, there is a risk that new entrants cannot join and start competing with the previous operators. In contrast, an e-krona could be designed as an open platform where private operators can develop new services and thus increase competition in the payments market.

An alternative, or at least a complement, to issuing an e-krona is for the state to instead tighten regulation on private issuers of money to try to achieve these goals. Such regulation is undoubtedly very important and will continue to be a cornerstone of a functioning payment system even with an e-krona. But regulation has limitations compared to a direct state presence in the payments market. As we saw in the years before the great financial crisis of 2007-2008, private companies can find ways to circumvent regulations in order to render them ineffective and thus build up significant risks. Regulations also take a long time to implement and evaluate - and then change if necessary. If the state is directly present in the payments market, it is easier to react quickly to changes in the payments market and to act more decisively in crisis situations. Our assessment is also that regulation alone cannot provide sufficient security, especially given the major consequences of a breakdown in any of the payment market functions. A direct state presence in the form of central bank money will also be required in the future.

It is also about politicians needing to decide what position the Swedish krona should have. If digital central bank money is issued in the future in other countries, Swedish citizens can easily use it instead of Swedish kronor. Such a development could ultimately affect the Riksbank's ability to conduct monetary policy, for example. The Swedish krona is therefore exposed to competition and we should have a Swedish

krona that is at least as efficient in transactions as other currencies in our neighbouring countries.

6 Sweden needs state-issued digital money

This article has provided an overview of the question of what money is and the role of the state in the future payments market. Our conclusion is that central bank money in the future needs to remain widely available and then be digital. In Sweden, we have come to call this potential CBDC the e-krona.

Our recommendation is that the state should take its responsibility for the smooth functioning of future payment systems. The regulation of financial agents and payment service providers must therefore be modernised. But we also need - as we have argued in this text - to ensure that the state has a direct presence in the payments market in the form of a CBDC and does not rely exclusively on regulating the activities of private operators. We should not forget that the payment system is changing fundamentally whether we issue a CBDC or not. Ultimately, the impact on the financial system of widespread use of various stablecoins is likely to be greater than the impact of introducing CBDCs especially since, unlike central banks, stablecoin issuers have no explicit purpose to take into account the overall societal effects. Regulation and a CBDC complement one another and both are needed to ensure that we have a functioning payment system in the future.

In 1897, the Riksbank was granted the exclusive right to issue banknotes. The overall aim was to ensure the stability and security of the monetary system for the future by making banknotes completely risk-free and ensuring that their issuance was not driven by profit interests. We do not consider that the Riksbank should have the exclusive right to issue digital money, but the above hundred-year-old arguments hold just as well today to justify the Riksbank being given the task of issuing a new legal tender in the form of a CBDC, an e-krona.

In this article, we have also focused on the legal issues surrounding an e-krona. The reason is that, ultimately, a regulatory framework is needed to introduce a new digital means of payment and set the framework for this. The conclusion is that electronic central bank money in the form of electronic cash, as a complement to physical cash, is preferable to electronic central bank money in the form of claims on the state.

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Cross-border payments in the spotlight

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Cross-border payments are important for many of us, but they can be slow, costly and complicated. The good news is that they have improved and are receiving increased attention from both the private and the public sector. This article gives an overview of the alternatives for making cross-border payments, their costs and regulation, as well as the ongoing initiatives to enhance these payments. We also take a look at the underlying processing mechanics of cross-border payments.

1 Cross-border payments are important – and improving

Cross-border payments are important for many of us. We pay cross-border when we travel, when we buy things from abroad over the internet, when we send money to relatives and friends in other countries, and in many other situations. Businesses and public sector entities also pay cross-border, for instance when they buy equipment, services and parts from abroad. Efficient cross-border payments ease trade, which is essential for growth and prosperity, while money sent abroad often constitutes a major share of families' income in receiving countries.

However, paying cross-border can be both expensive and complicated. For instance, a payer will often experience a currency cost of around two per cent of the purchasing price when paying with a Swedish payment card outside Sweden. Further, making a transfer from your Swedish bank account to a bank account outside Europe is usually cumbersome, takes time and can be expensive.

The good news is that cross-border payments appear to be improving. Fees and time lags have decreased, thanks a great deal to new market players and EU regulation. At the same time, new initiatives by standard setters, infrastructure providers and public authorities can open up for more competition and further improvements in cross border payments.

A key international initiative is the so-called G20 roadmap for enhancing cross border payments. The roadmap aims at reducing cost and increasing speed of cross-border payments worldwide as well as improving transparency and accessibility. We explain the G20 roadmap in section 4.

For someone new to this area it can be quite laborious to gain an overview of the alternatives to cross-border payments, how they work, what they cost, how they are

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regulated and what is going on in this area more generally. The aim of this article is to give an easy-to-read introduction to the subject of cross-border payments.

The article is organized into three main sections**.** In the first (section 2), we consider cross-border payments from the user perspective, i.e. from the perspective of an individual or a business. In the second (section 3), we look under the bonnet and explain how cross-border payments are processed. And finally (section 4), we describe ongoing initiatives to improve cross-border payments.

2 Cross-border payments from the user perspective

In this section, we look at the alternatives that end-users have when they make or receive cross-border payments. We distinguish between four alternatives: (i) card payments, (ii) bank transfers, (iii) cross-border payments using other kinds of payment service providers than banks, and (iv) other forms of cross-border payments.

In general, the end-user's choice of alternative in a specific situation is down to availability, convenience, costs, speed and security. Habits and knowledge may also play a role. End-users often have less information about the alternatives to cross-border payments than they do when it comes to domestic payments.

2.1 Card payments

Card payments are common when people travel and when individuals purchase goods and services from abroad over the internet.

Payment cards can be used in other countries when if they belong to an internationally recognized card scheme. Basically all cards issued in Sweden are Visa or Mastercard and can therefore be used abroad. Furthermore, most retailers in Sweden accept Visa and Mastercard and some accept other international card schemes like American Express, Diners and China Union Pay.

Digital wallet solutions like Apple Pay, Samsung Pay and Google Pay can also be used internationally. These digital wallets are payment applications on mobile phones where individuals register their payment cards. For retailers it makes no difference if a customer pays by tapping a payment card or a mobile phone, as both are in fact card payments. Furthermore, the legislation for card payments described below also applies to digital wallets.

Card payments are the most common way of making cross-border payments. Based on information from market participants, we estimate Swedes' card payments abroad at around 300 million per year. The total value of these payments could be close to 100 billion Swedish krona. Likewise, we estimate foreigners' card payments in Sweden at approximately 150 million per year – or about 4 per cent of all card payments in Sweden.

The terms governing the use of payment cards, including abroad, are described in standardized card holder agreements. They mainly reflect provisions in the EU's

Payment Service Directive (PSD), implemented in Sweden in the Payment Services Act.[1] The directive regulates aspects such as the required information to card holders before and after a transaction and liability in case of fraud.

Together with other EU legislation, the PSD also regulates practices regarding fees for card payments and currency conversion costs. The rules on such fees and costs differ between card payments where both the card holder and the retailer are located in the EU and card payments where only one of them is in the EU. Below, we explain the relevant legislation in more detail.

2.1.1 Fees

Both the retailer and the card holder may face transaction fees.

Retailers normally pay a fee to their payment service provider, the so-called *card acquirer*. Basically, the card acquirer ensures that the retailer receives the money from the card payment. Examples of card acquirers active in Sweden are Bambora, Nets and Payex. Typically, the fee paid by the retailer to the card acquirer is calculated as a percentage of the purchasing price.

Card holders are usually not charged a transaction fee by their payment service provider, the so-called *card issuer*, often a bank. But, if the legislation allows, the retailer may decide to levy a fee on the card holder. This practice, where the retailer passes the fee paid to the card acquirer onto the card holder, is called *surcharging*.

Fees for card payments are often claimed to be excessively high due to competition problems.[2] This goes for both domestic and cross-border card payments. In Europe, EU legislation has reduced the fees paid by retailers to card acquirers, see Box 1. The legislation also forbids retailers from surcharging.

The legislation covers only card payments where both the card holder and the retailer are located in the EU. If a card holder comes from e.g. the US, retailers may be charged a higher fee by their card acquirer. Further, if card holders from Sweden uses their payment card outside of EU, they may be asked by the retailer to pay a fee. Unfortunately, we have not found any data on surcharging outside of EU.

[1] Directive (EU) 2015/2366 on payment services in the internal market, often referred to as 'PSD2'.

[2] See e.g. Testimony of Ed Mierzwinski and If Europe can rein in credit card fees, why not us?

Box 1 – Regulation of fees for card payments

Most card payments are made with so-called four-party schemes, see Figure 1 below. The parties in such a scheme are the card holder, the retailer, the card issuer and the card acquirer. An additional party is the scheme owner, for instance Visa or Mastercard. The scheme owner sets the rules of the scheme and licenses the card issuers and the card acquirers. Typically, the scheme owner also operates a network that processes payments within the scheme.

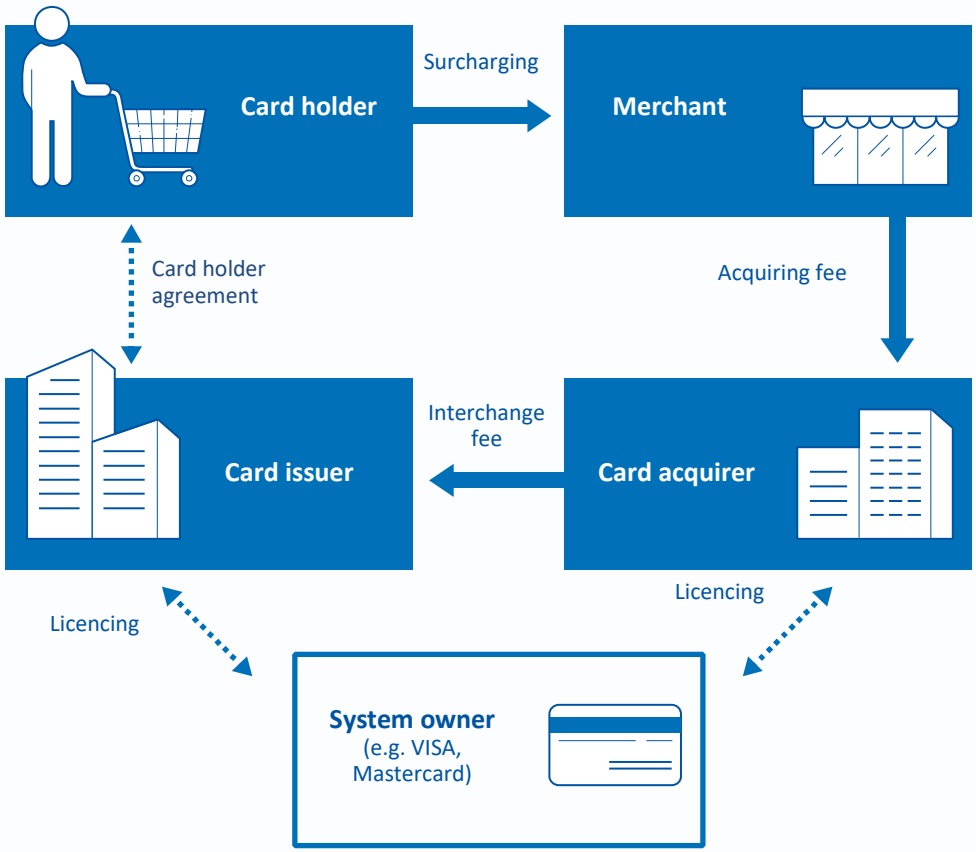
Fees in four-party schemes play an important role in balancing costs and incentives. As described in the main text, normally only the card acquirer charges a transaction fee, not the card issuer. To ensure that both are compensated, part of the fee paid to the card acquirer is usually transferred to the card issuer as an interchange fee.

Interchange fees have been subject to legal inquires in many jurisdictions, including the EU. This reflects the fact that such a fee, especially if determined by card issuers and card acquirers together, i.e. multilaterally, may effectively constitute a lower limit for the acquiring fee. In practice, no card acquirer will offer their service at a fee below the interchange fee as this would entail a loss. In that sense, the interchange fee becomes de facto a collectively agreed minimum price for card acquiring.

In 2015, the competition problems of interchange fees in the EU were addressed by a regulation. The Interchange Fee Regulation, IFR, introduced a cap on those fees of 0.2 per cent of the payment value for debit cards (in Swedish *bankkort)* and 0.3 per cent of the payment value for credit cards. The cap applies to payments where both the card issuer and the card acquirer are located in the EU. It only applies to cards issued to private persons, not to commercial cards, that is, cards used for business expenses.

Complementing the Interchange Fee Regulation, the revised Payment Service Directive, PSD2, also approved in 2015, introduced a ban on surcharging payment cards covered by the IFR. As regards payment cards not within the scope of the IFR, e.g. commercial cards and payment cards issued outside of the EU, it is up to national legislation to regulate surcharging. In Sweden, surcharging is prohibited on all payment cards.

Figure 1. Card payment schemes: participants and fees



Note: Figure shows who participates in a card scheme and who possibly pays fees and to whom: The participants are cardholders, merchants, card issuers, card acquirers and system owners who can be, for example, Visa or Mastercard. The cardholder may pay a fee to the merchant. The merchant pays a fee to the card acquirer. The card acquirer pays a fee to the card issuer.

2.1.2 Currency conversion costs

The *currency conversion cost* is levied on the card holder. The cost results from the difference between the exchange rate applied by the card issuer (or, in certain situations, the card acquirer, see below) and the market exchange rate. Normally, the cost is expressed in terms of a percentage mark-up on a reference exchange rate reflecting the market rate.

For the currency conversion costs, we need to distinguish between two options. Either the card holder pays in local currency, that is, the currency of the retailer. Alternatively, the card holder pays in their own currency.

Normally, the card holder is asked to pay in the currency of the retailer, e.g. in euro at a retailer in the euro area. In this case, currency conversion is done by the card issuer. In practice, what happens is that the card issuer withdraws Swedish krona from the card holder's account and delivers foreign currency, e.g. euro, to the card acquirer as part of the process of settling the transaction.

The PSD imposes information requirements on the card issuer regarding the currency conversion. In the card holder agreement, the card issuer should explain how the exchange rate on foreign currency payments is determined. In addition, following the payment, the card issuer should inform, 'without undue delay', the card holder about the exchange rate used.

The exchange rate mark-up often differs between card issuers and types of payment cards and may also depend on the currency. According to Konsumenternas.se, the exchange rate mark-up among larger Swedish card issuers typically lies between 1.5 and 2.0 per cent.

Card holders may also be offered the option to pay for a purchase abroad in their own currency, i.e. Swedish krona for card holders from Sweden. This is known as *dynamic currency conversion* (DCC). With DCC, card holders know already at the point of purchase the amount in krona that will be withdrawn their account.

Also with DCC, the retailer is ultimately paid in local currency, e.g. euro. The currency conversion, however, is done by the card acquirer, who receives Swedish krona from the card issuer and pays the retailer an amount in euro. The latter may differ from the price in euro, depending on how the currency conversion income is shared between the acquirer and the retailer.

At the time of payment, it can difficult for a card holder to assess a DDC offer to pay in Swedish krona relative to paying in local currency. This will depend on the currency conversion costs of each alternative and requires calculations 'on the spot'.

To facilitate comparisons, recent EU legislation has introduced new transparency obligations for both card issuers and providers of DCC.[3] Both are required to express the exchange rate applied as a mark-up above the latest available reference exchange rate from the ECB. In addition, for payments in EU currencies, card issuers should regularly remind card holders about the size of the mark-up, e.g. by text message.

2.1.3 Total costs for card payments

To summarize, cross-border card payments entail costs for both card holders and retailers, see Table 1. Swedish card holders incur currency conversions costs when they use their payment card abroad and perhaps also transactions fees if surcharging is applied. Swedish retailers pay acquiring fees, which may be higher when the card holder making the payment is from a country outside of the EU.

Table 1 also includes indications of the fees and currency conversions costs that Swedish end-users are charged. Uncertainty prevails, especially regarding transaction fees for non-EU card payments. The table suggests, however, that card payments within the EU may on average be significantly cheaper than other cross-border card payments, due mainly to the EU legislation described above.

[3] Regulation (EU) 2019/518 amending Regulation (EC) 924/2009 as regards certain charges on cross-border payments in the Union and currency conversion charges.

Table 1. Costs of cross-border card payments for Swedish card holders and retailers

	Card holders	Retailers
Transaction fees	0 per cent in the EU, but could be around 2 per cent outside of the EU	0.35 per cent up to around 2 per cent when card holder is from outside the EU
Currency conversion costs	Typically around 1.5–2.0 per cent	Normally 0 per cent
Total costs	From 1.5 per cent in the EU to 4 per cent outside of the EU	From 0.35 per cent in the EU to around 2 per cent outside of the EU

Note: The cost indications are based on the authors' own calculations and assessments. The estimated upper limit for the transaction fees of 2 per cent should be seen in light of information about post-Brexit increases in interchange fees (see Box 1) for card payments involving UK card holders and retailers up to 1.5 per cent.

2.2 Bank transfers

Cross-border bank transfers are common for purchases of larger items like cars, boats and properties. They are also used for payments of taxes, for gifts and when sending money to friends and relatives abroad. In addition, bank transfers are the usual way businesses pay foreign suppliers. Cross-border bank transfers can be initiated from a bank branch or the payer's computer or mobile banking application.

Based on information from banks in Sweden, we estimate the total number of outgoing cross-border transfers at around 30-35 million per year. The total value of cross-border bank transfers, however, greatly exceeds the value of cross-border card payments, due mainly to large-value payments between businesses. We estimate the number of incoming cross-border bank transfers at around 25-30 million per year.

A payer initiating a cross-border bank transfer must provide information about the payment (amount, currency, debiting date, etc.) and the payee. Besides name and address, required details on the payee comprise the latter's bank, expressed by the Bank Identifier Code, BIC, and bank account. Within the EU, the bank account should be stated as the International Bank Account Number, IBAN.

Rules governing cross-border bank transfers are described in the general terms and conditions for bank account holders. As for card payments, they are covered by provisions in the PSD. Certain requirements in the PSD only apply to transfers within the EU. For instance, within the EU, a bank transfer in an EU currency must not take longer than one banking day (or two banking days if the transfer is initiated in paper form).

Furthermore, as for card payments, rules on fees and currency conversion costs differ for banks transfers within and outside the EU. We explain this in further detail below.

2.2.1 Fees

Fees for cross-border bank transfers in Europe are regulated by EU legislation, see Box 2. The legislation forbids banks from charging a higher fee for a cross-border transfer

in euro than for a corresponding domestic transfer in the currency of the bank's home country. Hence, banks in Sweden are not allowed to charge a higher fee for a cross-border transfer in euro than for a similar domestic transfer in Swedish krona.

In assessing whether the above requirement is fulfilled, 'corresponding' is the key word. For instance, two payments are only similar if they are initiated the same way. Thus, if an order for a cross-border payment in euro is provided from a branch, the bank may charge a higher fee than for a domestic transfer in Swedish krona initiated via the payer's internet banking solution, which is often free for the payer.

In Sweden, it was decided that the EU legislation on cross-border payments in euro should also apply to payments in Swedish krona. Accordingly, banks in Sweden are not allowed to charge a higher fee for a cross-border transfer in Swedish krona than for a corresponding domestic transfer. As the volume of cross-border transfers in Swedish krona is limited, in practice, the consequences have been minor.

In contrast, for cross-border bank transfers outside the EU, fees are not regulated. For such a transfer, the banks will typically charge a fixed fee that is independent of the amount sent, and a currency conversion cost. According to the fees listed on Moneyfromsweden.se and Konsumenternas.se, the fixed fees are at least 50 kronor per payment. Below, we look at the currency conversion cost.

2.2.2 Currency conversion costs

As for card payments, cross-border bank transfers typically entail a currency conversion cost for the payer. The cost, that is, the difference between the exchange rate applied by the bank and the market exchange rate, depends on the currency and may vary with market conditions. The currency conversion cost may also be higher, if the bank charges a low transaction fee, and vice versa.

Observations from Moneyfromsweden.se suggest that the conversion cost varies quite a lot. In some cases it is close to zero but in most cases it is approximately 1 per cent. However, the total cost of sending money as bank transfers can also be very high. We found several instances on Moneyfromsweden.se where the cost of sending 1,000 Swedish krona could be as high as 400 Swedish krona.

The currency conversion costs of bank transfers are also subject to certain transparency requirements. They follow from the same EU regulation as for card payments. For instance, prior to a transfer, banks should inform the payer about the estimated amount to be withdrawn from their account, including currency conversion costs. Those requirements apply also to bank transfers outside the EU.

Box 2 – Regulation of fees for cross-border payments in Europe

Fees for cross-border payments in Europe, including bank transfers, are regulated in an EU Regulation from 2009.* An earlier version of the regulation was approved in 2001. At that time, shortly after the introduction of the euro, the payment market in euro was still highly fragmented along national borders with large cost differences between domestic and cross-border payments. The regulation forbad banks to charge a higher fee for a cross-border payment in euro than for a corresponding domestic payment in euro. The European banking sector reacted by committing to a vision of establishing the Single Euro Payments Area with a common infrastructure that could bring down banks' own costs of cross-border payments in euro.

The regulation from 2001 included a clause which allowed non-euro area countries to 'opt in' with their national currency. The Swedish government immediately decided to make use of this clause for Swedish krona. As a consequence, banks in Sweden were not allowed to charge a higher fee for a cross-border payment in Swedish krona than for a similar domestic payment in Swedish krona. As fees for domestic payments in Swedish krona, including bank transfers, are usually quite low, if not zero, this decision was restraining on banks' pricing. Yet, as the volume of cross-border bank transfers in Swedish krona is limited, in practice the effect was minor. Later, also the Romanian government decided to opt in with its national currency, the Lei.

While the update of the regulation in 2009 was more of a technical nature, in 2019 the requirements on banks were strengthened. This followed an observation that fees for cross-border payments in euro from non-euro area countries were still high despite the banks having access to an efficient payment infrastructure in euro. Via an addendum to the regulation, banks in non-euro area countries, including Sweden, were forbidden to charge a higher fee for a cross-border payment in euro than for a corresponding domestic payment in their national currency.** In practice, this has forced banks in non-euro area countries to lower their fees for cross-border bank transfers in euro significantly, often making such transfers free of charge.

The addendum to the regulation in 2019 also included provisions to increase the transparency of currency conversion costs, see the main text.

Note: * Regulation (EC) 924/2009 on cross-border payments in the community and repealing Regulation (EC) 2560/2001. ** Regulation (EU) 2019/518 amending Regulation (EC) 924/2009 as regards certain charges on cross-border payments in the Union and currency conversion charges.

2.3 Transfers using other payment service providers

A third alternative for cross-border payments is *money transfer operators* (MTOs) that specialize in sending and receiving money across borders.

MTOs have traditionally offered their services at physical outlets, including agents in the form of smaller shops. There, people could – and still can – transfer money to recipients in other countries by handing over cash or drawing funds from a bank account. The money is then transferred to a bank account abroad or made available to the recipient, often in cash, against identification or a code.

This kind of MTO service is an option for people without a bank account to send and receive money across borders. As such, the service has played an important role in the global financial system for years, ensuring that money earned by immigrants often from poorer regions of the world could be channelled back to their home countries. Examples of MTOs that provide this service include Western Union and Moneygram.

In recent years, a new type of 'digital only' MTOs has appeared. These have no offices or agents, but allow customers to initiate transfers from a webpage or mobile application. By operating without physical outlets, digital MTOs are able to keep down costs. International providers of this service are for instance Paysend, Remitly, Revolut, Wise and WorldRemit, while Transfer Galaxy and XBath are Swedish examples.

These new MTOs offer cheaper cross-border payments than more traditional services. Consequently, the average price quotes have fallen over the last years (Engström and Reslow, 2022). For instance, the average cost of sending 1,000 Swedish krona from Sweden to Latin America has fallen from 80 Swedish krona in 2016 to 20 Swedish krona in 2022. However, we have limited information regarding the extent to which these services are actually used, and more and better data is needed (Engström and Reslow, 2022).

Payments via MTOs are regulated by the same EU legislation as bank transfers. Yet, while bank transfers are governed by the general terms and conditions for account holders, MTO transfers are in legal terms 'single transactions'. Accordingly, MTOs are obliged to provide the payer with certain information (execution time, charges, reference exchange rate applied, etc.) both prior to and after each payment.

2.4 Other cross-border payments

Cross-border payments without direct involvement of payment service providers are possible as well. One example is cash payments. Swedes can exchange Swedish krona for foreign bank notes and coins and use those abroad, and vice versa. Yet, although no payment service provider takes part in the transaction, they still play a role. For instance, before a Swede can pay in cash in Germany, she needs to get euro notes and coins, typically from a payment service provider. And a Swedish retailer receiving notes and coins will usually deposit the cash with a bank.

Cross-border payments may also be made in crypto-assets. Such assets come in different forms. One type of crypto-assets is 'free-floaters' like Bitcoin, which fluctuate significantly in terms of purchasing power. Another type is so-called stablecoins, which have their value tied to a group of assets. Until now, crypto-assets have played a limited role in payments. However, stablecoins are viewed by some as a potential future solution for cross-border payments (see e.g. FSB, 2022a).

Finally, cross-border payments may also occur through informal value transfer systems, so-called IVTS. Such systems go by names like Hawala (Middle East), fei ch'ien, or flying money (China) and phoe kuan (Thailand). IVTS are based on trust and work through a network of agents. Often, those agents have primary business activities other than sending money and balance their positions by under-invoicing exported or imported goods. We have no information on the volume of transfers via IVTS.

3 Looking under the bonnet: the processing of cross-border payments

In this section we take a brief look at the underlying mechanics of the processing of cross-border payments. By *processing* we mean everything that happens within and between the payment service providers of the payer and payee during a cross-border payment. A large part of the problems with high costs, long time lags and lack of transparency in cross-border payments originate from there.

The processing of cross-border payments involves exchanging both information in the form of payment messages and liquidity. The exchange of liquidity is often referred to as *settlement*. In the following, we distinguish between four kinds of processing: (i) on-us money transfers, (ii) transfers via correspondent banks, (iii) transfers in cross-border payment systems and (iv) transfers in single-platform systems.

3.1 On-us money transfer

An *on-us money transfer* can be used when both the payer and the payee are customers at the same bank/banking group or the same MTO. In this case the payment is a simple book-keeping exercise within the same financial institution as all that is needed is to debit the payer and credit the payee. If the payment is from one currency to another, the transfer will involve an exchange rate. However, no infrastructure or parties outside the bank are needed for the transfer, and the payment can be quick. However, sometimes the transfer is nevertheless delayed, according to the banks due to opening hours of the FX market.

3.2 Correspondent banking

For most cross-border bank transfers, the payer and payee are customers in different banks. In such situations, the payment processing typically involves correspondent banks. A *correspondent bank* is a bank that offers deposit accounts for other banks and processes payments on their behalf.

An example of how a cross-border bank transfer involving a correspondent bank can work is the following. A customer at a Swedish bank initiates a transfer in US dollars to a recipient in the US. The Swedish bank sends a message through SWIFT to its correspondent bank in the US.[4] The message contains information about the transferred amount and the recipient, including relevant bank details. The correspondent bank debits the Swedish bank's US dollar account and forwards the payment to the recipient's bank through the US payment systems. The recipient's bank concludes the transaction by crediting the payment to the recipient.

Cross-border transfers often involve more correspondent banks than in the example above. This is the case, for example, for transfers to recipients in countries where the Swedish bank does not hold deposits in a correspondent bank. Then, additional banks, or intermediaries, will have to be involved, and the transaction chain lengthens. This adds to costs and extends the duration of the transfer. It also tends to increase uncertainty about the overall conditions of the payment.

In recent years, the number of correspondent banks has decreased.[5] One reason is the increasing requirements on such banks stemming from anti-money laundering and counter-terrorism financing regulations. As a consequence, many correspondent banks have left countries where they see a risk of this sort of criminal activities, so called de-risking. In addition, MTOs, that are reliant on correspondent banks to move liquidity between countries, claim that they are no longer welcome as customers with these banks.

Large Swedish banks employ several correspondent banks. Smaller banks may rely on a limited number of correspondent banks or other Swedish banks for their cross-border payments. This may generate additional costs and make the process take longer.

3.3 Cross-border payment systems

Cross-border payments may also be processed in so-called cross-border payment systems, also called multilateral platforms. Some of these handle only one currency, like the ECB's systems for payments in euro.[6] These systems are still multilateral, though, as they cover different countries. Other systems handle several currencies, for instance payment card networks and the Nordic P27 system under development, see below.

Larger Swedish banks are present in the euro area and take part in the ECB's payment systems, where they can initiate payments. The currency-crossing part of a payment

[4] SWIFT, the Society for Worldwide Interbank Financial Telecommunication, is the main global network for financial messages. A SWIFT message may contain payment instructions as well as other information that is relevant for the transaction.

[5] See New correspondent banking data - the decline continues and CPMI quantitative review of correspondent banking data.

[6] ECB's payment systems are TARGET2 for large value payments and TIPS for instant payments. Other systems for euro payments are, for instance, the ones operated by EBA Clearing, a clearing house owned by major banks in Europe. EBA Clearing owns and operates a number of payments systems, including EURO1 for large-value payments (an alternative to TARGET2), STEP2 (the main batch payment system in euro) and RT1, which clears the majority of instant payments in euro.

from a Swedish account will then take place within the same institution's balance sheet, but find its way to the recipient in another European bank through the ECB's system and/or other European payment systems.

In all cross-border payment systems, or multilateral platforms, liquidity needs to be moved from the payer's to the payee's bank. Sometimes this involves correspondent banks.

3.4 Single-platform processing

Finally, cross-border payments can also be processed by a solitary service provider acting at the top of the banking infrastructure. This is sometimes referred to as single-platform processing.

In single-platform processing the service provider only holds customer funds (if at all) during execution of the payment. Moreover, normally the agreement with the payer concerns only a single transaction. Also, there is often no relationship between the service provider and the payee, which may not even know of the service provider's involvement.

Single platform processing usually involves two steps. First, the service provider receives funds from the payer, e.g. as a card payment or a bank transfer. The funds, in Swedish krona, are deposited in an account held by the service provider with a Swedish bank. As second step, the service provider pays out the funds, in foreign currency, to the recipient abroad. This occurs from a bank account held by the service provider in the recipient's country directly to the payee or to the payee's bank account.[7]

4 Initiatives to improve cross-border payments

While some cross-border payments have become less expensive in recent years, overall, the basic problems of these payments remain. In most jurisdiction, cross-border payments are still significantly more costly, take longer time and are less transparent than domestic payments. These problems may be larger in poorer countries with an underdeveloped payment system, but are relevant also for many people living in Sweden, see Engström and Reslow (2022).

The good news is that cross-border payments are now receiving more attention than before. From 'having been the forgotten corner of the global financial plumbing' (Cunliffe, 2020), these payments have moved up the political agenda internationally. Today, many public and private initiatives in the field of cross-border payments are ongoing. An important catalyst has been the ambitious G20 programme to improve cross-border payments.

[7] Both on-us transfers and single platform processing and some multilateral platforms are or involve what the BIS (2018) coined "closed loop" solutions. These are solutions where the movement of funds between countries and the currency conversion takes place within one institute only.

4.1 The G20 programme

In 2020, G20 leaders adopted a 'roadmap' for enhancing cross-border payments. This followed extensive work by central banks and international organizations to describe the problems of cross-border payments and identify their root causes, or frictions (FSB, 2020a). Based on this, 19 workstreams – or building blocks – to address the frictions were defined (CPMI/BIS, 2020). Finally, a comprehensive plan with concrete actions (the roadmap) was developed and presented (FSB, 2020b).

Box 3 describes the identified frictions of cross-border payments and the G20 programme in more detail. Overall, most of the building blocks were focused on the existing payment infrastructure as well as rules and regulations with an impact on cross-border payments. In addition, three building blocks were more forward-looking, exploring the possible role of multilateral platforms, stablecoins and central bank digital currencies in enhancing cross-border payments.[8]

One building block, the first of the 19 workstreams, was mandated to develop a common vision for cross-border payments and global targets. In October 2021, G20 leaders approved a set of targets, see Table 2. They have been defined specifically for wholesale payments (i.e. payments between financial institutions), retail payments and remittances as well as for the four problem areas, that is, costs, speed, transparency and access.

Table 2. G20 Targets for the Cross-Border Payments Roadmap*

		Payment type		
		Wholesale	**Retail**	**Remittances**
Target area	**Cost**	No target	Global average cost of payment to be no more than 1 per cent, with no corridors with costs higher than 3 per cent by end of 2027.	Global average cost of sending USD 200 remittance to be no more than 3 per cent by 2030, with no corridors with costs higher than 5 per cent.
	Speed	¾ of payments available to payee within one hour and ¼ within one day by end of 2027.		
	Access	Access to at least one service for all (90 per cent of individuals in the case of remittances) by end of 2027.		
	Transparency	All payment service providers to provide at least total transaction cost by end of 2027.		

* Simplified. For details see FSB (2021b).

Compared to the current state of cross-border payments, the targets are ambitious. An example is the target for end-users' total costs for retail payments. It says that by the end of 2027, these costs should not exceed 1 per cent on average and 3 per cent for any country corridor. As explained in section 2, today, card holders' and retailers'

[8] The work on new payment infrastructures and arrangements was led by Sveriges Riksbank.

combined costs of a cross-border card payment, including currency conversion costs, typically exceed these levels.

Also the target for the costs of remittances is considerably below the current level of costs. The target reaffirms the United Nations' Sustainable Development Goal for the cost of remittances. Accordingly, the global average costs of sending the equivalent of 200 US dollar should be no more than 3 per cent by 2030, with no country corridors having costs exceeding 5 per cent. Today, the global average costs of such remittances is 6.4 per cent, and in many corridors the costs are much higher (World Bank, 2022).

Currently, the Financial Stability Board is working on a proposal to monitor fulfilment of the global targets (FSB, 2022b). For Sweden, regularly assessing the targets will require further work and more data than currently available. Yet, for remittances Sweden may be close to achieving the targets for costs and speed, see Engström and Reslow (2022). Moreover, Sweden, like other European countries, should be in a good position to satisfy the targets for transparency and accessibility.

Box 3 – Frictions in cross-border payments and the G20 programme

In 2020, a group of central banks and international organizations analysed the problems of cross-border payments (FSB, 2020a).They identified seven frictions in cross-border payments today:

- **Fragmented and truncated data formats:** Data formats for payments vary across countries and infrastructures. This complicates processing and reconciliation and leads to delays and higher costs.
- **Complex processing of compliance checks:** Countries differ in their implementation of e.g. rules to combat money laundering and terrorist financing. This hampers automation and delays payments.
- **Limited operating hours:** In most countries, opening hours of payment systems are limited to normal business hours. This delays processing, particularly in corridors with large time zone differences.
- **Legacy technology platforms:** Much of the technology supporting cross-border payments dates back many years and has a domestic focus. This limits automation and interlinking of payment systems.
- **High funding costs:** To enable rapid settlement, banks must preposition foreign currency or have efficient access to FX markets. Both entail large costs, especially for illiquid or non-tradeable currencies.
- **Long transaction chains:** Chains of linked correspondent banks are typically required to transmit payments across currencies. A longer transaction chain increases cost and delays.
- **Weak competition:** The frictions above create barriers to entry for intermediaries. This limits competition among providers of cross-border payment services.

To address the frictions, further work was organized in 19 building blocks, structured around various focus areas (CPMI/BIS, 2020). An important focus area was regulation, supervision and oversight, where further coordination is needed. Another focus area was the current payment infrastructure, including opening hours, access and liquidity arrangements. A separate focus area was also new payment infrastructures and arrangements and their possible role in improving cross-border payments. Three specific ‘innovations’ in the form of multilateral platforms, stablecoins and central bank digital currencies were selected for deep-dive analysis in individual building blocks. A new working group, Future of Payments, was established for this purpose.

Finally, for each building block a multi-year action plan was developed and presented as ‘the roadmap’ to enhance cross-border payments (FSB, 2020b). The ensuing work, involving both public and private sector entities, has led to a broad range of analysis and recommendations that can be expected to guide the international work on cross-border payments for years to come.

An overview of the G20 programme and the reports published with involvement of the international community of central banks can be found at the Bank for International Settlements (BIS) webpage.

4.2 Central bank initiatives

Central banks have an important role to play in improving cross-border payments. This follows naturally from the frictions described in Box 3. Several of them can be reduced by appropriate central bank actions like broadening access to payment systems, extending their opening hours, linking payment systems and establishing efficient liquidity arrangements.

The central banking community is involved in many initiatives that can affect Swedes' cross-border payments.

4.2.1 Cross-currency settlement service

One of these is an initiative where the ECB and the Riksbank are exploring a service to settle instant payments across currencies. In May 2022, the Riksbank launched a new service, RIX-INST, for settlement of instant payments in Swedish krona.[9] The ECB launched its real time settlement system called Target Instant Payment System (TIPS) in November 2018. The two systems use the same hard- and software (the 'TIPS platform'). This might facilitate an efficient instant payment service across the respective currencies. Such a service would make it easier for banks to offer real-time payments (like a payment with Swish, the Swedish mobile payment solution) between accounts in euro and Swedish krona. The central banks in Denmark and Norway have expressed interest in the service as well, which may eventually allow for instant settlement of payments also between the Nordic currencies.[10]

4.2.2 Linking faster payment systems

The Nexus initiative, coordinated by the BIS Innovation Hub in Singapore, is a model for connecting domestic faster payment systems into a platform for cross-border payments. The basic idea behind Nexus is to allow domestic payment systems to achieve multi-country reach by providing a standardized way for these systems to speak to each other. As an important difference to the TIPS-based service described above, Nexus will have to be complemented by liquidity arrangements to settle the payments.

In 2021, BIS Innovation Hub Singapore issued a blueprint describing Nexus.[11] This also marked the start of the test phase in which the faster payment systems in Singapore, Malaysia and the euro area (TIPS) were connected, processing simulated payments. Lessons learned from this will be used to further improve the design of Nexus. In general, Nexus is viewed as one of the most promising initiatives in improving cross-border payments. In Sweden and the Nordics, the work on Nexus should be followed closely as a possible solution to achieve reachability with other jurisdictions.

[9] Although the service is there, Swedish banks have yet to migrate payments to the system.

[10] The central bank of Denmark will use the TIPS platform and the central bank of Norway is considering if it shall use the TIPS platform.

[11] BIS Innovation Hub and the Monetary Authority of Singapore, *Nexus: a blueprint for instant cross-border payments*, July 2021. See Nexus Overview.

4.2.3 Connecting CBDCs

Some central banks are engaged in work exploring how so-called central bank digital currencies (CBDCs) can help in improving cross-border payments. Earlier this year, as part of the G20 roadmap described above, the BIS/CPMI, IMF and the World Bank published a report on how CBDC systems can facilitate cross-border payments (BIS et al., 2022). The report also describes existing cross-border CBDC projects.

A recent cross-border CBDC project is called Project Icebreaker and is a collaboration between Sveriges Riksbank, the Bank of Israel, Norges Bank, and BIS Innovation Hub Nordic Centre.[12] This project will develop a 'hub' to which participating central banks can connect the domestic CBDC systems that they are testing. The objective is to test some specific key functions and the technological feasibility of interlinking different domestic CBDC systems. This may enable immediate retail CBDC payments across borders, at a significantly lower cost than existing systems. The project will run until the end of the year, with a final report expected in the first quarter of 2023.

4.3 Private-sector initiatives

Several private-sector initiatives to improve cross-border payments have been launched as well. Some were announced well before the G20 roadmap, and a few are already in operation. The strong political focus on cross-border payments signalled by the G20 programme may also have encouraged market participants to start developing new services. In the following, we describe a few private-sector initiatives relevant for Swedes' cross-border payments.

4.3.1 Single Euro Payments Area

One of the most important initiatives in recent years to improve cross-border payments is the establishment of the Single Euro Payments Area (SEPA). SEPA is the label for the vision of a common payment area in euro consisting of the entire EEA, that is, the EU countries and Iceland, Liechtenstein and Norway, as well as Switzerland and the United Kingdom. The fundamental principle is that within SEPA there should be no borders when making a euro payment; it should be no more complicated or costly to make a payment from Berlin to Paris than from Berlin to Hamburg.

The mechanics behind SEPA basically consists of a set of rulebooks that describe how payments should be processed between banks. The rulebooks are owned and maintained by European Payments Council, an organization with mainly banks and bankers' associations in Europe as members. EPC was established in 2002, following the approval of the EU regulation described in Box 2. Later, the regulation was supplemented by further legislation making use of the common rulebooks mandatory for euro payments across the EU.[13]

[12] See Project Icebreaker: Central banks of Israel, Norway and Sweden team up with the BIS to explore retail CBDC for international payments.

[13] Regulation (EU) 260/2012 establishing technical and business requirements for credit transfers and direct debits in euro and amending Regulation (EC) 924/2009.

Swedish banks are members of the EPC and offer their customers cross-border payments in euro based on the SEPA rulebooks. If a recent proposal by the European Commission is approved, banks in Sweden will also be obliged to offer instant payments in euro according to the SEPA standards.[14]

4.3.2 P27

P27 is an initiative to establish, within the Nordics, a common region for domestic and cross-border payments. Unlike SEPA, P27 will span multiple currencies, initially euro, Danish krona and Swedish krona. The name, P27, refers to the initiative's aim to improve payments for the 27 million inhabitants of the Nordic countries, including Norway, which originally was part of the project scope.

The banks behind the initiative have formed a company, P27 Nordic Payments, which in Sweden will take over from Bankgirot as provider of clearing services. The payment messages follow standards set by Nordic Payments Council, an EPC-like organization with banks and their associations as members. The standards will be aligned closely with those in SEPA.

P27 has the potential to improve cross-border payments in the Nordics, particularly if the new clearing service facilitates instant payments between accounts in different currencies, e.g. Danish krona and Swedish krona. Alternatively, this may be the case if P27 is complemented by common payment solutions, for instance a Nordic service for bill payments.

4.3.3 SWIFT GPI

In 2017, SWIFT launched its global payment innovation service, called SWIFT gpi. This is a set of business rules and digital tools to improve the speed and transparency of cross-border payments via correspondent banks. SWIFT member banks who commit to SWIFT gpi agree to provide same-day use of funds, transparency of fees, end-to-end payments tracking and unaltered transfer of information. Today, more than 75 per cent of all cross-border SWIFT payments are sent via SWIFT gpi, and more than 1,000 banks, including Swedish banks, have joined the service.[15]

The processing time of payments sent via SWIFT gpi is generally short but varies significantly. The average payment processing time is 8 ½ hours, while the median is 1 ½ hour (CPMI/BIS, 2022). Longer processing times tend to occur in low and lower-middle income countries. In these countries, capital controls and related compliance processes, weak competition, limited operating hours of payment systems and the use of batch processing by beneficiary banks may tend to prolong processing times.

In 2021, SWIFT also introduced SWIFT Go, a service intended for cross-border payments by small businesses and consumers. Based on tight service level agreements between participating banks and pre-validation of data, the service

[14] See European Commission, Proposal for a Regulaton amending Regulation (EU) 260/2012 and (EU) 2021/1230 as regards instant credit transfers in euro, 26 October 2022.

[15] See The digital transformation of cross-border payments.

promises processing of payments within seconds at low and predictable costs. At the time of writing, more than 200 banks, including a few major banks in Sweden, have joined the service. Recently, also the international card schemes Visa and Mastercard have launched cross-border payment services, i.e. Visa Direct and Mastercard Cross-Border Payment Services.

4.3.4 ISO 20022

Parties involved in a non-cash payment need to exchange information about amounts, account numbers, dates, and so on. For this exchange to work, the parties need a shared language. Furthermore, if the payment process is to rely entirely on computers, the messages containing this information must be structured so that the receiving computers can read and process the message correctly. It is therefore useful with a common payment messaging standard that provides clear definitions of the information and data formats (field lengths, codes, character sets) that can be exchanged between parties.

The International Organization of Standardization (ISO) has developed a global and open 'recipe' for setting payment message standards called ISO 20022. While banks and financial institutions have previously used different standards, they have now developed and are implementing standards based on ISO 20022.

In March 2023 the Eurosystem and ECB will migrate to standards based on ISO20022. Worldwide, the transition is expected to proceed until 2025, which is SWIFT's end date for the old format and the old standard. The Riksbank and the Swedish market plan to change to messaging standards based on ISO 20022 during a transitional period which ends in 2025.

ISO20022 will help make it possible for larger amounts of smoothly-running payments to be made over national boundaries. The new standards based on ISO 20022 mean less need for manual handling in the payment flow between banks. Among other things, the cost of compliance with regulatory requirement on anti-money laundering (AML) and counter terrorism financing (CTF) can be reduced and the payment process automated. The process might very well bring benefits in terms of lower costs, higher speed and more transparency for payments in and out of Sweden.

5 Conclusions

While some cross-border payments have become less expensive in recent years, overall, the basic problems of these payments remain. In most jurisdiction, cross-border payments are still significantly more costly, take longer time and are less transparent than domestic payments. These problems may be more severe in poorer countries with underdeveloped payment systems, but are nevertheless relevant for many people living in Sweden.

The good news is that cross-border payments are likely to improve. Cross-border payments are in focus for both the public and the private sector these days. The public sector is considering how they can contribute, for instance by providing new

settlement services and regulation. In the private sector, entrepreneurs see new business possibilities and standard setters and regulatory bodies are also active. An important catalyst for many of these initiatives has been the ambitious G20 programme to improve cross-border payments.

However, continued improvements require further efforts and attention from both the public and the private sector. And the stakes are high: trade is essential for economies' growth and prosperity, and efficient cross-border payments facilitate trade. In addition, there is a social dimension as money sent abroad often constitute a major share of families' income in receiving countries.

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Remittances – the overlooked payments

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The G20 countries have recently adopted a new roadmap with the ambition to make cross-border payments more efficient. The new roadmap also include specific targets for remittances, which have grown fivefold in recent years and are an important source of revenue for many countries. The targets are ambitious and therefore the private and public sectors need to work together to ensure that they are achieved. High-quality statistics is needed to evaluate target achievement and to make important policy decisions. There is some room for improvement in this department. Statistics on cross-border payments are often of low quality and low priority. This is particularly true for remittances. Improvements are under way, but more can and should be done. This article takes a closer look at remittances based on the available data and describes the development work under way to improve the knowledge and efficiency of remittances. We also make a first assessment of how well Sweden is meeting the new targets.

1 Introduction

International payments are often more expensive, slower, less accessible and not as transparent as domestic payments. To improve international payments, the G20 countries therefore initiated a comprehensive work programme in 2020 to achieve faster, cheaper, more transparent and inclusive cross-border payment services that would improve the situation for citizens worldwide by supporting economic growth, international trade, global development and financial integration. Sweden, as a small and open economy, has a lot to gain from this if it is done in the right way.

In this article, we take a closer look at remittances, that is, the cross-border payments we often associate with the money that migrants send back to family and friends in their country of origin. For many countries, remittances are an important source of income. It is estimated that more than 70 countries receive remittances worth more than 3 per cent of GDP. However, remittances have been neglected and often overlooked when various initiatives to improve payments have been launched. It is natural that domestic payments are a higher priority because the volumes are much

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higher. When cross-border payments are discussed, it is often only retail payments or payments between financial institutions that are in focus. However, remittances are receiving more and more attention, and it is welcome that the G20 countries have adopted a roadmap to improve international payments in general, including remittances.

In 2021, the G20 countries adopted ambitious targets to provide a common vision for cross-border payments. The targets are defined in terms of cost, speed, access and transparency. They are also separately specified for payments between financial institutions (wholesale), retail payments and remittances.

High-quality statistics is needed to evaluate target achievement and to make sound policy decisions. There is some room for improvement in this department. Statistics on cross-border payments are often of low quality and low priority. This is particularly true for remittances. However, with the data available today, we can make an initial assessment of how well Sweden is fulfilling the remittance targets. Sweden is doing well in this respect and should be well placed to meet the targets. However, the statistics on and knowledge of remittances could be improved. Improvements are under way, but more can and should be done.

The article is structured so that in the next section we describe in more detail what remittances are, why they are important and how they work. In section three, we present survey data from the Riksbank and data from moneyfromsweden.se that describe what remittances look like from a Swedish perspective. In section four, we describe the G20's work to improve cross-border payments and the targets that the G20 has developed. We also present a first assessment of how well Sweden is meeting the G20 remittance targets in this section. In section five, we discuss the importance of having high-quality statistics and the improvement projects that are under way. Section six contains a concluding discussion.

2 Remittances – an important source of income for many countries

In this section, we look at how remittances are defined in statistics and describe some existing statistical problems. We also look at global statistics that highlight why remittances are important and describe in general how they work.

We often think of remittances as the money that migrants send to family and friends in their country of origin. But remittances don't have to be about money. It can also be ideas, behaviours, identities, human capital or knowledge that migrants acquire abroad or in another part of the country, and transfer to their community of origin (Levitt, 1998).

However, global estimates and the statistical definition of remittances include more monetary transactions than we often think of as remittances. This is because the statistical definition used to collect data on remittances is broader and not dependent on migration status. The International Monetary Fund (IMF), which is the main

provider of statistics on international remittances based on national data, defines remittances as the sum of: [1]

1. **Compensation of employees**
   This refers to the income earned by temporary migrant workers in the host country, and the income of workers employed by embassies, international organisations and foreign companies, or "the income of border and seasonal workers and other short-term workers employed in an economy where they are not resident and of residents employed by foreign entities".[2]
2. **Personal transfers**
   These refer to all transfers, monetary or non-monetary, made or received by resident households to or from non-resident households.

The World Bank provides annual estimates of remittance flows globally and bilaterally based on national balance of payments statistics compiled by the IMF. According to estimated data for 2020, remittances have increased fivefold over the past 20 years and represent an important source of income for many countries. More than 70 countries receive remittances worth more than 3 per cent of their GDP (see Figure 1). Remittances are also often a relatively stable source of income. According to the World Bank (2021a), remittances also proved to be relatively resilient during the COVID-19 pandemic. Remittance flows declined by only 1.6 per cent in 2020, which compares with global GDP falling by a whole 3.3 per cent.

The UN agency International Fund for Agricultural Development (IFAD) estimates that one billion people send or receive remittances. Migrant workers send an average of USD 200 each month, which on average is only 15 per cent of what they earn, but can represent as much as 60 per cent of income for those who receive the money. However, the cost of sending money is high. The average cost of a remittance is 6.3 per cent of the value sent (World Bank, 2021b). Assuming a total volume of just over USD 700 billion per year, this means that about USD 45 billion per year ends up in the hands of intermediaries instead of the final recipients (Georgieva, 2022).

However, it must be said that there is considerable uncertainty in the data currently available on remittances. The first type of remittances – compensation of employees – can potentially overestimate remittances if a country has a large UN and/or embassy presence, or if there are factories owned by transnational corporations and employing large numbers of workers. Indeed, those employed there are counted as "non-residents" or migrants in the country, and all their wages are recorded as remittances (Alvarez et al., 2015).

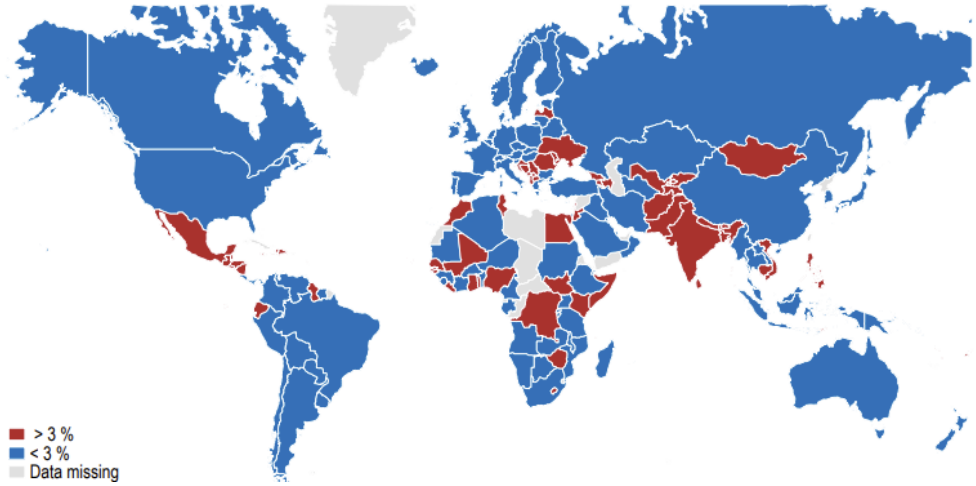
[1] See IMF (2009a,b) for more details on how remittances are defined and guidelines on how to include them in national statistics.

[2] Note that the entire income of temporary migrant workers is included in this definition, even if part of the income is never actually transferred to the country of origin because migrants still have to meet their own living expenses. Furthermore, the earnings of staff employed by foreign employers (such as embassies or transnational corporations) are counted as remittances, as these officials, diplomats, military personnel and others are considered resident in the country of origin.

The second type of remittances – personal transfers – may also potentially overestimate the number of remittances made, relative to the common understanding of the definition, as cross-border remittances are counted regardless of where the individuals live and what their nationality or country of birth is. Thus, neither the recipient nor the sender needs be a migrant, but can be a citizen with no ties to another country.

Figure 1. Remittances received by country as a share of GDP

Per cent, year 2020



Note. Data based on inflows according to the World Bank for 2020. Estimate for May 2022.

Sources: The World Bank and the Riksbank.

When comparing remittance estimates over time, it is difficult to distinguish how remittance flows actually change from changes in how they are measured and defined (Clemens and McKenzie, 2014). Another problem concerns how to estimate bilateral remittances, i.e. remittances between two specific countries. Bilateral remittances are estimated using weighted data on how many migrants there are in both countries, and their weighted income (Ratha and Shaw, 2007). However, the lack of important high-quality and detailed data on the number of migrants in a given country makes it very difficult to estimate this with certainty.

Another problem is that official estimates often focus on remittances transmitted through official channels, such as banks. As a result, many transactions that are carried out via money transfer operators, post offices, mobile money transfer companies or informal transfers such as through friends or relatives are not included in some countries' statistics. Official remittance figures are therefore likely to be underestimated.

Different remittance methods

There are three main ways of making remittances: bank transfer, payment via money transfer operators (MTOs) and informal value transfers.[3] Regardless of the payment method used, an international payment usually requires an exchange between different currencies. Usually, money will also be moved between different agents. This can be done in different ways.

Many bank transfers go through the so-called correspondent banking system, where banks in different countries have accounts with each other via bilateral agreements. It is not uncommon for a payment between two countries to have to go through several banks and even several countries before it reaches its final destination. This is because not all banks have accounts with each other, nor does every bank have a correspondent bank in every country.

Payments can also be made via a payment service providers specialising in remittances, such as MTOs. These payments and arrangements can look a little different. A common solution is for the payment to be made entirely within a single payment service provider. However, this solution requires that both the payer and the payee have an account there. For example, both PayPal and Wise offer this possibility. Another solution is for the payment service provider to operate in both countries and thus also offer cash services, as Western Union does, for example.

Remittances can also be made more informally via a form of transfer often called "hawala" transactions. They rely on an informal value transfer system based on a large network of money brokers.[4]

A hawala payment involves the payer giving money to a money broker in country A. The payer and the money broker then agree on a password that acts as a payout code for the recipient in country B. The money broker in country A gives payment instructions and the password to a money broker in country B and the final recipient can then contact the money broker and receive the money using the password. In this transaction, the money broker in country A has now become indebted to the money broker in country B. The system relies on the broker in country B trusting that this debt will be settled at a later date.

Another form of informal transfer is sending cash by post or giving to friends and family travelling between countries.

[3] See Claussen and Mølgaard Pedersen (2022) for more details on different methods of making and processing cross-border payments, of which remittances are a subset. Processing payments is an umbrella term for what happens to a payment within and between the payer's and the payee's banks.

[4] Hawala is Arabic and means transfer or sometimes trust. Although money brokers are spread all over the world, they are mainly located in the Middle East, North Africa, the Horn of Africa and the Indian subcontinent. Hawala follows Islamic traditions but its use is not limited to Muslims. Other models of informal transfers exist in other parts of the world: fei ch'ien ("flying money") in China, phoe kuan in Thailand and the Black Market Peso Exchange in South America.

3 Remittances from a Swedish perspective

Cross-border payments are thus not as efficient as domestic ones, but we also know less about them – especially remittances. Statistics on them are often scarce and those that do exist are often of lower quality than for domestic payments. From a Swedish perspective, we normally send more remittances abroad than we receive. On the other hand, Sweden's official statistics on remittances have previously been misleading, indicating the opposite.[5] Nevertheless, current data can give us some insights.

According to data from Money from Sweden (moneyfromsweden.se), there are big differences between payment corridors and different types of payment services.[6, 7] Looking at average list prices, the cost can often amount to 6–7 per cent of the amount sent, which is in line with global cost estimates from the World Bank. If we instead look at list prices calculated using the three cheapest services within each payment corridor, the cost is around 2–3 per cent. So there are cheaper alternatives.

Figure 2 shows what it costs to send SEK 1,000 from Sweden to different continents. It shows that it is most expensive to send money to Asia, Africa and South America. However, costs have fallen over time and it is mainly to these continents that it has become cheaper to send money (see also Figure 7). It is difficult to say with certainty why costs have fallen. One possible explanation is that more operators are offering these services, which contributes to higher competition and lower prices. However, a more in-depth investigation is needed to understand what has contributed to the drop in costs. The cost of sending money to other countries within Europe has remained relatively stable at below 2 per cent over time.

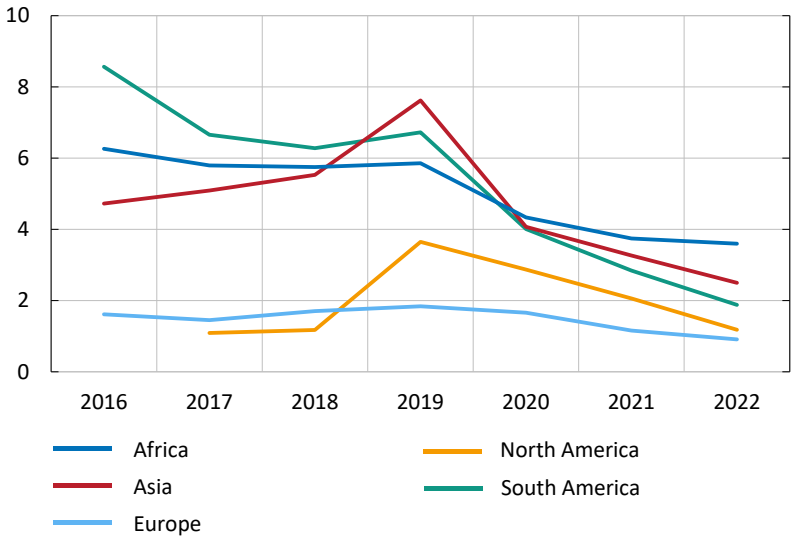
[5] Statistics Sweden are working to improve and correct this misleading information (see section 5).

[6] Money from Sweden is a government-funded price comparison service to compare how much it costs to send money abroad using different companies. The web service is free of charge, completely independent of all market players, run by the Swedish Consumer Agency and certified by the World Bank.

[7] Payment corridors consist of payment flows between one country and another.

Figure 2. Costs have decreased over time

Cost of sending SEK 1,000 from Sweden to different continents, per cent



Note. Average per continent calculated on the basis of "smart" means (three cheapest options per country and quarter).

Sources: Money from Sweden and the Riksbank.

Today, however, we have little knowledge of what services people living in Sweden actually use, to which countries they make remittances and how much money they send. This makes it difficult to calculate what remittances actually cost households. A reasonable assumption is that households are rational and choose the cheapest options. However, it is unclear whether households are aware of all the players in the market and they may also be sceptical about new, less well-known players.

In order to obtain more information about which agents are used and where the money is sent, the Riksbank included more questions about remittances in its latest survey of payment habits in Sweden.[8] Of the 2,089 people interviewed, around 10 per cent (216 respondents) stated that they regularly send money abroad to private individuals. The majority of these (8.2 percentage points) stated that they send money less than once a month, some (1.4 percentage points) that they send money every month and a few (0.2 percentage points) that they send money every week.

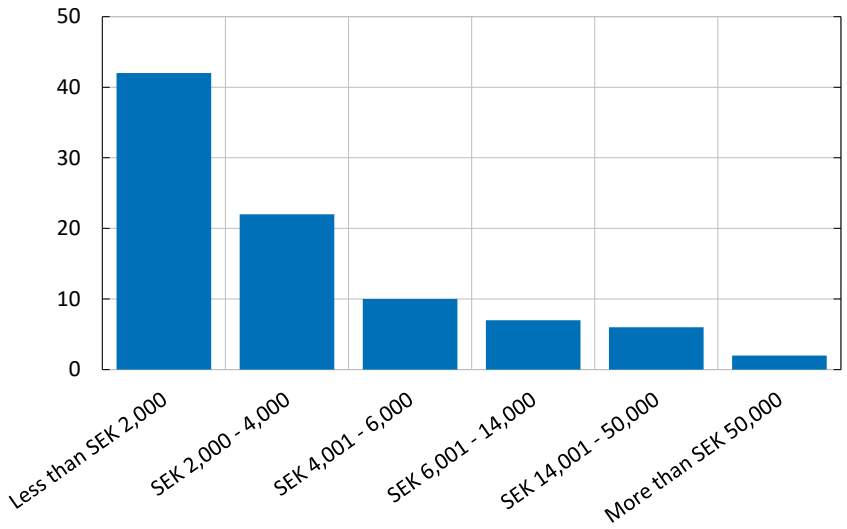
Most send relatively small amounts and the most common way is by traditional bank transfer. Figure 3 shows that almost one in two people sends an amount of less than SEK 2,000, and Figure 4 shows that more than one in two people made a traditional bank transfer the last time they sent money abroad. Figure 4 also shows that despite many new players, the more traditional players still dominate and that informal

[8] Since 2010, the Riksbank's survey on payment habits in Sweden has been conducted every two years to provide a picture of payment habits and how they change over time. The latest survey was conducted in spring 2022. A total of 2,089 randomly selected persons between the ages of 18 and 84 were interviewed. Of these, 500 were interviewed by telephone and 1,589 were interviewed online. The data collection period was 14–30 March 2022.

transfers via, for example, mail and personal contacts still occur, albeit on a small scale.

Figure 3. Most common to send amounts under SEK 2,000

Answer to the question: "How much money (in Swedish kronor) did you send on the last occasion?", per cent

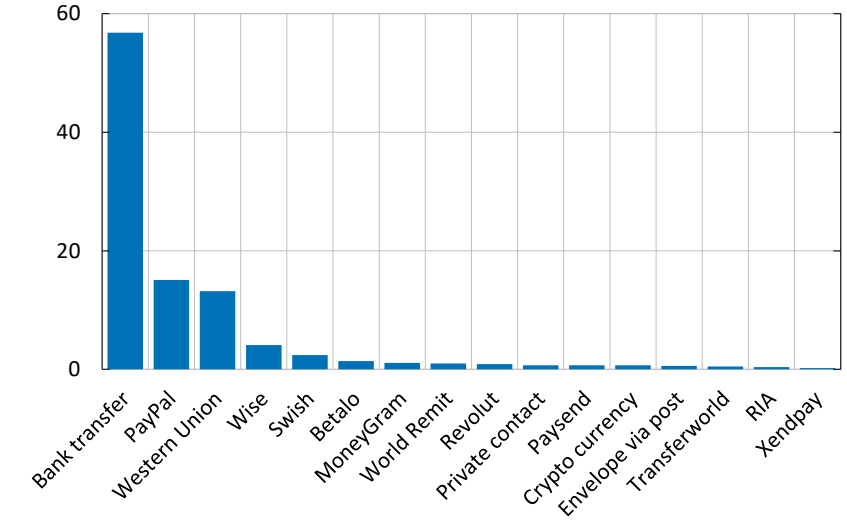


Note. Weighted results to reflect the Swedish population based on 216 interview responses.

Source: The Riksbank.

Figure 4. Traditional bank transfer is most often used

Responses to the survey question "Which method did you use as a private person to send money to a private person abroad on the last occasion?", per cent



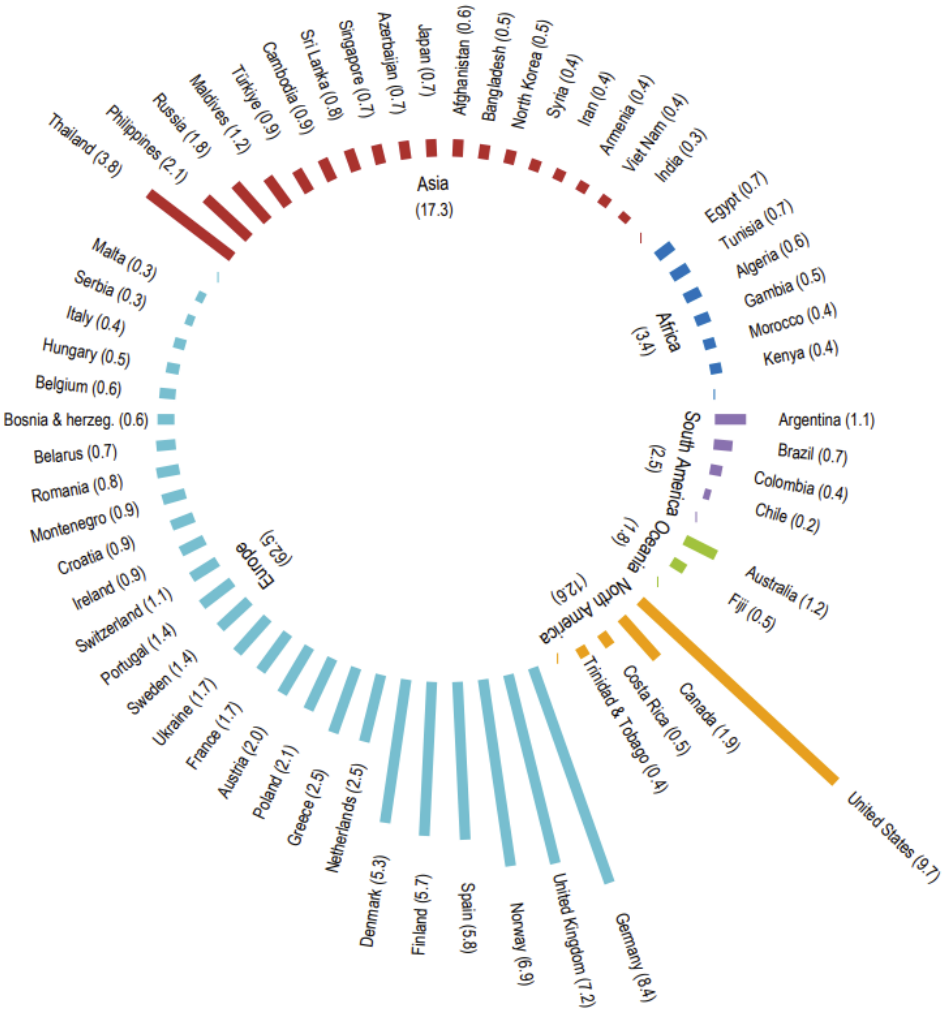
Note. Weighted results to reflect the Swedish population based on 216 interview responses. Note that Swish is not available abroad. However, it is possible to "swish" money to recipients abroad if the recipient has an account and has activated Swish before travelling abroad.

Source: The Riksbank.

Figure 5 shows the countries to which respondents send money. What we can see is that the US and Germany stand out as recipient countries, but also that the majority of remittances go to countries in Europe. A potential problem with the survey is that we may have missed the group in society that is responsible for the remittances that we often envisage when we think of classic remittances – that is, the survey does not really capture immigrants to a sufficient extent.

Figure 5. Most payments are made to the US and Germany

Responses to the survey question "Which country did you send money to on the last occasion?", per cent



Note. Weighted results to reflect the Swedish population based on 216 interview responses. Figures in brackets indicate percentages.

Source: The Riksbank.

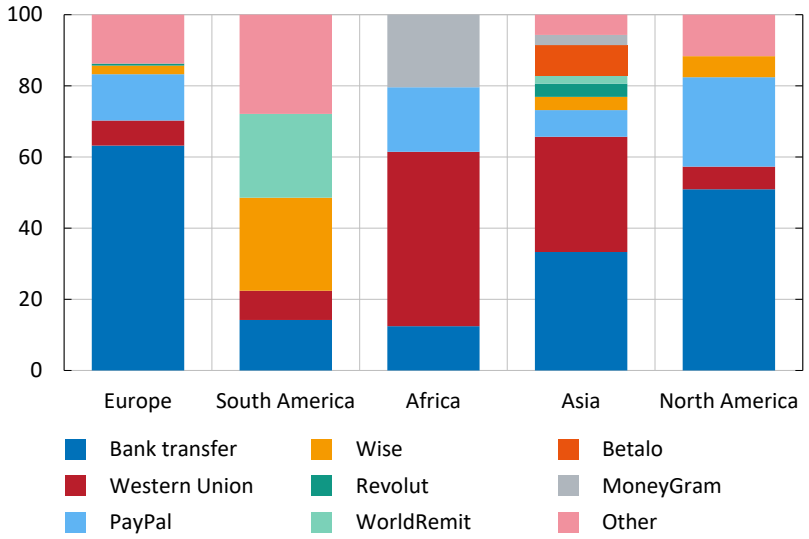
If we take a closer look at the payment services used to send money to different continents, we see some differences. Figure 6 shows that the majority of transfers to Europe and North America are made through traditional bank transfers, followed by PayPal and Wise. For Asia, traditional bank transfers and Western Union are the most common. We also see that there is a greater number of payment services used for

transfers to Asia compared to those to Europe and the US. To Asia, players such as Betalo, WorldRemit and Moneygram are also used.

For sending money to Africa and South America, the results indicate that it is mostly done through Western Union, Wise and WorldRemit respectively. However, it should be remembered that this result is based on a small number of observations and should be interpreted with caution.

Figure 6. Payment services used to different continents

Per cent



Note. Weighted results to reflect the Swedish population based on 216 interview responses. Other also includes the response options 'Don't know' and 'Don't want to answer'.

Source: The Riksbank.

4 Global targets for remittances

Large sums of money are thus being sent between countries and, for many countries and people, remittances are an important source of income. However, cross-border payments are often more expensive, slower, less accessible and not as transparent as domestic payments. To remedy this, in 2020, the G20 countries initiated a major effort to improve cross-border payments. This section describes the targets adopted by the G20 countries and makes an initial assessment of how well Sweden is meeting the targets in terms of remittances.

In 2020, the Financial Stability Board (FSB) was asked to draw up a plan for how to organise this work in cooperation with the Bank for International Settlements Committee on Payments and Market Infrastructures (BIS CPMI). The 'roadmap', described in more detail in FSB (2020), is divided into 19 workstreams – or building blocks – that examine different issues with the aim of addressing obstacles to cross-border payments.[9] The seven major problems mentioned are inadequate data

[9] Of the 19 building blocks that have been set up, the first 16 are focused on improving current infrastructure and arrangements for payments between countries. The last three, building blocks 17, 18

standards, long transaction chains, non-overlapping business hours, old technology, high funding costs, complex compliance controls and poor competition.[10]

One building block, the first of the 19 workstreams, has drawn up global targets for the cost, speed, availability and transparency of cross-border payments. As part of this work, the working group has also developed specific targets for remittances (see Table 1). In 2022, the FSB also published an interim report with an initial assessment of how the targets will be measured and followed up (FSB, 2022).

Table 1. G20 targets for remittances

	Target
Cost	The global average cost of sending a remittance of USD 200 should be no more than 3 per cent by 2030 and there should be no payment corridors with costs higher than 5 per cent.
Speed	By the end of 2027, a large majority (75 per cent) of remittances in each payment corridor should reach the beneficiary within one hour of payment initiation and, for the rest of the market, within one business day.
Availability	More than 90 per cent of individuals (including those without bank accounts) wishing to send or receive a remittance payment should have access to a means of electronic remittance to and from abroad by the end of 2027.
Transparency	All payment service providers must provide a list containing, at a minimum, information on payments to and from abroad that can be read by payers and recipients. This should include total transaction cost showing all relevant fees and currency conversion charges, time to deliver money, tracking of money and terms of service, and should be available by the end of 2027.

Note. A payment corridor consists of payment flows between one country and another. Payment initiation refers to the time at which the payment order is received by the payer's payment service provider. In addition to remittance targets, targets have also been developed for retail payments and payments between financial institutions.

Source: FSB (2021).

Based on the information we have today, we can make an initial assessment of how Sweden is currently meeting the targets adopted by the G20. Although targets are set at the global level, regional and country-specific assessments should also be made to better evaluate changes and identify various challenges.

Cost

The cost target uses the UN Sustainable Development Goals, which are part of the 2030 Agenda for Sustainable Development. This means that the average cost of sending a remittance of USD 200 should be no more than 3 per cent of the amount sent globally by 2030 and there should be no payment corridors with costs higher than 5 per cent. To measure the cost of remittances, the FSB suggests using the World Bank's Remittance Prices Worldwide (RPW) database. In Sweden, however, we can go

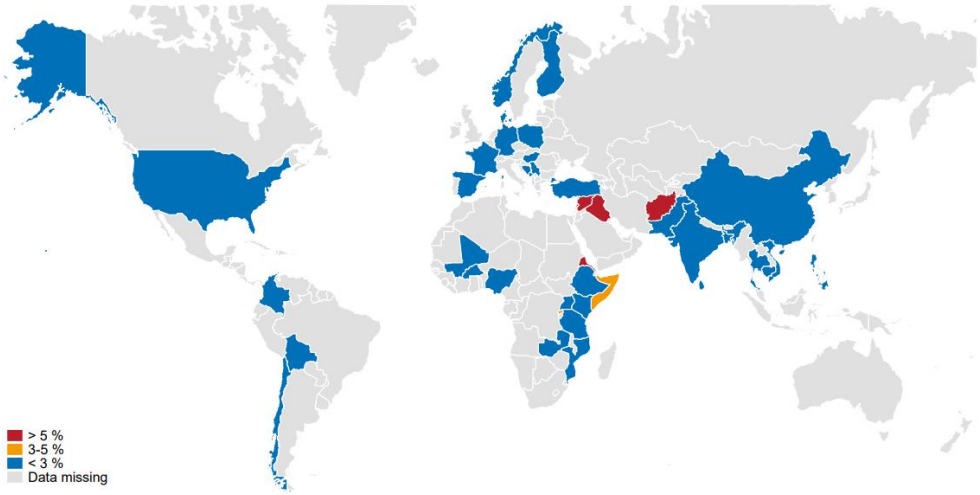
and 19, are more forward-looking and are examining how new platforms (called multilateral platforms) and new forms of money (such as stablecoins and central bank digital currencies) can improve payments between countries. The Riksbank has played a major role in this work as First Deputy Governor Cecilia Skingsley chaired the Future of Payments Working Group, which coordinates building blocks 17, 18 and 19, until she left the Riksbank. See also Segendorf and Skingsley (2022) and Claussen and Mølgaard Pedersen (2022).

[10] See Box 3 in Claussen and Mølgaard Pedersen (2022) for additional details.

directly to the source, which is Money from Sweden. In Figure 7, we can see that most of the payment corridors monitored by Money from Sweden have a cost below the 3 per cent target. However, there are payment corridors such as payments to Afghanistan and Iraq that exceed the 5 per cent ceiling.

Figure 7. Cost to send SEK 1,000 from Sweden

Per cent



Note. Calculated using the smaRT average sample (three cheapest options, May 2022).

Sources: Money from Sweden and the Riksbank.

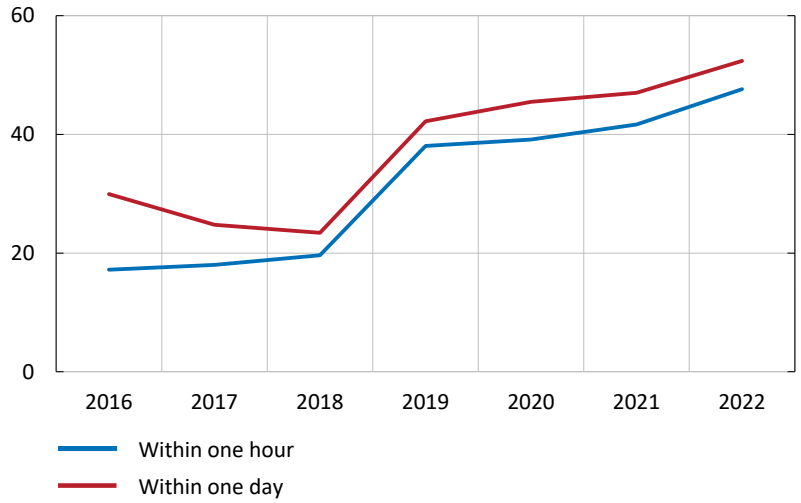
We can see in Figure 7 that the data from Money from Sweden is not comprehensive. However, the sample monitored by Money from Sweden aim to capture the countries that receive the largest share of flows from Sweden. As the majority of the world's countries are not included, data on the cost of making transfers to them is therefore missing.

Speed

The target is for the vast majority of remittances to reach the recipient within one hour and for no payments to take longer than one working day. The target is to be met by the end of 2027 and the FSB proposes two indicators: the proportion of services offering transfers within one hour and the proportion of services offering transfers within one working day. According to data from Money from Sweden, which can be seen in Figure 8 below, 48 per cent of services offer transfers within one hour and 52 per cent within one day. It can also be seen that there has been an improvement in recent years.

Figure 8. Proportion of services delivered within one hour or one day respectively

Per cent



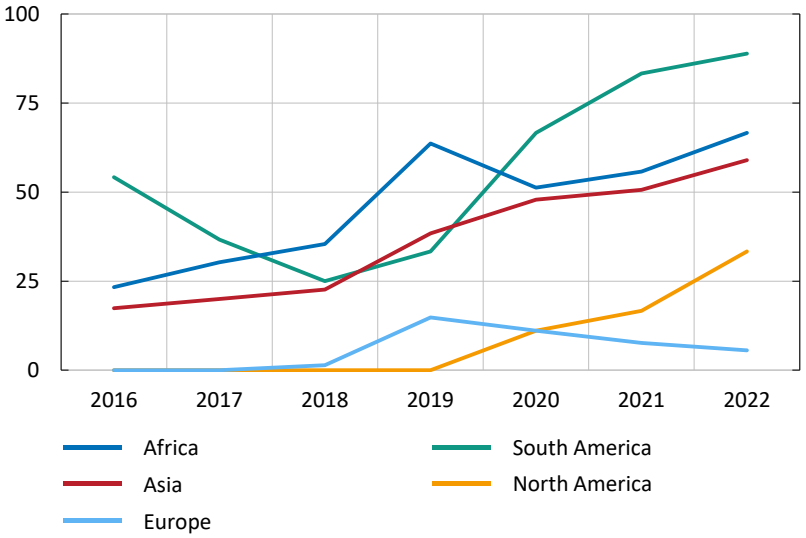
Note. Percentage of services delivered within one hour and one day respectively. Calculated using the smaRT average sample (three cheapest options within each payment corridor and quarter). If we instead calculate the percentage based on all available services, the figures fall to 33 per cent within one hour and 42 per cent within one day.

Sources: Money from Sweden and the Riksbank.

When we look at the number of services offering transfers within one hour to different continents in Figure 9, we see that transfers within Europe are the slowest.

Figure 9. Proportion of services with delivery time within one hour

Per cent



Note. Percentage of services with delivery time within one hour by continent. Calculated using the smaRT average sample (three cheapest options within each payment corridor and quarter).

Sources: Money from Sweden and the Riksbank.

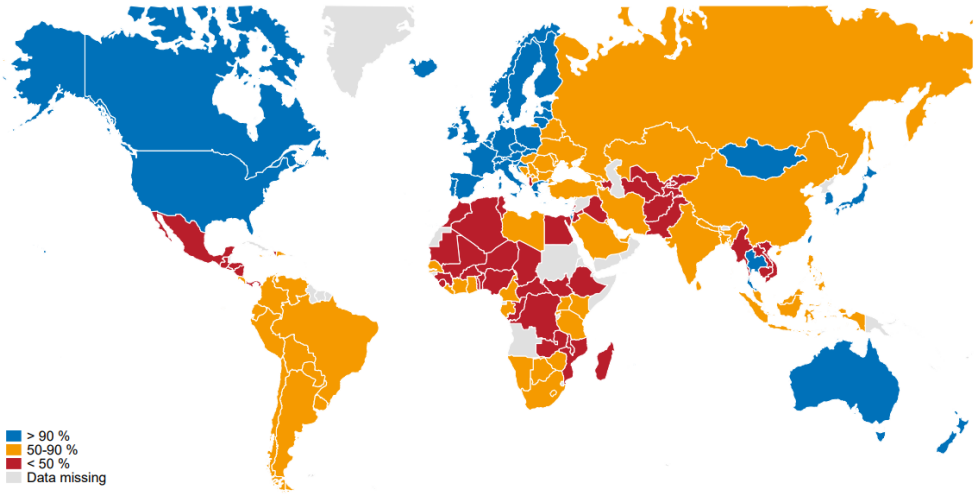
At first glance, this may come as a surprise. But a closer look at the data shows that this may be because bank transfers are relatively cheap within Europe, but they are slow and do not take place within one working day. More noteworthy is the trend that the share of fast payments has decreased in Europe in recent years, while it has increased for other continents. It is difficult to draw definitive conclusions about the reasons for this trend due to the lack of detailed statistics but one possible explanation is that the share of bank transfers has increased as they have become cheaper.

Availability

The goal for availability is that there should be access to electronic means of payment – even where there is no access to traditional bank accounts. This is to be achieved by the end of 2027. According to the Global Findex Database, more than 99 per cent of Swedes aged 15 or older have access to a bank account. In recent years, however, there have been more complaints from individuals who have been denied access to a bank account (FI, 2021). There are also indications that the problem is even more widespread among certain groups such as newly arrived immigrants or foreign students. Most Swedish banks offer international payments, but not to all countries. As Figure 10 shows, access to a bank account is good in Sweden, while it is much worse in many other countries. This creates problems for those living in Sweden who want to send money to friends and relatives in countries where access to bank accounts is poor.

Figure 10. Access to bank accounts

Percentage (15 years and over) with access to a bank account



Note. For the majority of countries, data for 2021 are shown. For those countries where data for 2021 are missing, data for 2017 are shown where available.

Source: Global Findex Database.

Transparency

Finally, there is a transparency target so that end-users are clearly informed of all the costs they need to pay, how long the payment is expected to take and the rules and

conditions that apply. The transparency target must also be met by the end of 2027. According to the FSB, the payment service provider should provide users with clear information on exchange rate charges and other relevant fees, expected delivery time and how the payment can be tracked. The FSB further suggests evaluating how well the target has been met by looking at whether national legislation sets sufficient requirements for transparency and whether payment intermediaries actually provide the information in a clear manner. In Sweden, there are legal requirements for transparency, mainly through the Payment Services Act. Through Money from Sweden, we see that information is available on the fees and exchange rates offered by the different payment brokers. However, it is difficult to say from this that the information is provided in a simple and transparent way to customers.

5 Evaluating the targets requires high-quality statistics

Using the data available today, we can, as demonstrated above, make an initial assessment of how well Sweden meets the G20 remittance targets. However, in order to make a more comprehensive assessment and gain a deeper understanding of the Swedish remittance market, better statistics is needed. This is also important if good policy decisions are to be taken and evaluated. There are some challenges here. Statistics on payments between countries, and especially remittances, are often of low quality and have not been prioritised in the past.

However, some improvements are being made. For example, the World Bank, together with the IMF, UN, OECD, Eurostat and various national authorities, has launched an international working group to improve data on remittance flows.[11] This has become an increasing priority as these flows have become an important source of external financing in low- and middle-income countries.

Improvements are also under way in Sweden. For example, the new Sveriges Riksbank Act, which enters into force on 1 January 2023, gives the Riksbank a mandate to collect data on payments. In other words, it opens up the possibility of establishing regulations for how payment statistics are to be collected, including remittances from Swedish operators offering these services.

The possibility of obtaining data on remittances from Swedish operators via a regulation could improve the statistics but it would still not provide a comprehensive picture. With an increasing number of international payment service providers and digital payment solutions, it is difficult for a single country, on its own, to measure all transactions sent to and from it. Many of the transactions initiated over the internet take place via the websites of foreign operators and, as these are not registered in Sweden, it is difficult for Swedish authorities to obtain statistical data from them. In order to have a comprehensive picture of the remittance market and the flows to and from different countries, it is therefore necessary that reliable statistics are available in each country where these operators are registered and that there is good international cooperation.

[11] See International Working Group on Improving Data on Remittance Flows Concept Note | KNOMAD.

An improvement project is also under way at Statistics Sweden, which compiles Sweden's official statistics on remittances. In 2022, Statistics Sweden expanded the number of companies from which it collects data to cover a larger share of operators offering remittance services. Statistics Sweden has also implemented a new method to calculate the inflow of remittances to Sweden. In brief, the new method is based on Statistics Sweden using the same quota estimation as other countries that are comparable to Sweden. This will correct the previous misleading picture in which the inflow of remittances to Sweden has appeared to be larger than the outflow.[12]

But more can and should be done to get a better picture of which services, both formal and informal, are used to make traditional remittances. As mentioned earlier, there is a risk that surveys aimed at a representative sample of the population do not sufficiently capture the group in society that is most likely to make traditional remittances. More questions would also need to be asked of households to gain a more in-depth understanding of their payment habits to and from abroad. It would therefore be desirable to have a targeted survey specifically on remittances that accurately captures the groups that most often make these.

6 Concluding discussion

The G20 countries have adopted a comprehensive roadmap and ambitious targets to make cross-border payments more efficient. The private and public sectors in Sweden need to work together to ensure we reach these targets. The work now being undertaken by the G20 can be seen as a response to the public sector's dissatisfaction with the current efficiency of cross-border payments and its perceived need to both guide and drive the private sector. Neither the private nor the public sector can solve the existing problems by themselves. Payments between countries only work well if there is harmonisation, common standards and a reliable legal framework – areas where the public sector has now promised improvement. Ultimately, however, it is the private sector that must deliver the end products to customers.

Statistics on remittances are often of low quality. Internationally and nationally, some improvement projects are now under way. This work is essential for making good policy decisions and for evaluating different options and changes.

Survey data can be helpful to understand how households act and what services they use. However, it is difficult to interpret survey data on remittances. On the one hand, surveys risk missing members of society responsible for what we often think of as traditional remittances, meaning immigrants sending money to family and friends in their country of origin, and, on the other hand, respondents may find questions about remittances and payments sensitive and difficult to answer.

The Swedish Consumer Agency offers a high-quality and important service with Money from Sweden. However, this service only covers a limited number of actors and countries. It would be desirable to expand the sample. Better statistics and

[12] Revisions of historical series will be made in the next general revision of the statistics in 2024.

knowledge could provide important guidance on which countries and actors to monitor.

However, if the Money from Sweden sample were to be expanded and a targeted survey of remittances developed, the costs would also be higher. Who should bear these costs is unclear. Several authorities work with remittances, although no one authority has any clear responsibility. It would be desirable for these authorities to intensify their cooperation and consider whether they could share certain costs.

As described above and in Claussen and Mølgaard Pedersen (2022), cross-border payments are often based on correspondent banking, where banks in different countries have accounts with each other and offer payment services to each other. These relationships are particularly important for smaller banks and money transfer operators. A large share of international payments are thus made via correspondent banks. However, the number of correspondent banks decreased by 20 per cent between 2011 and 2018, despite an increase in the value of payments over the same period (Boar et al., 2022). According to Boar et al. (2022), the banks have mainly withdrawn from countries in which supervision and controls on illicit financing have been poor. Another reason for the trend of fewer correspondent banks concerns the costs and risks that come from regulatory compliance controls, such as money laundering rules. This lengthens transaction chains and reduces competition, making transactions more expensive and slower for end-users.

At the same time as the banks themselves are leaving some countries altogether, other money transfer operators are also finding it more difficult to open accounts with banks in order to offer remittance services to their customers. This development is worrying, as it could harm financial integration, increase the cost of international payments or force end-users to use more informal services.

Although Sweden is probably at the forefront in terms of achieving the G20 targets, it should continue to work actively internationally to create a basic infrastructure for payments between countries. Faster, cheaper, more transparent and more inclusive payment services between countries would improve the lives of citizens all over the world. Sweden, as a small and open economy, has a lot to gain from this if it is done in the right way.

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Monetary policy and inflation in times of war

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When major and unusual events such as a war occur, there is no 'manual' for how to act as an economic policy-maker. All wars are different – in terms of their scale and duration, their location and their impact on the world around them. Instead, one must try to find parallels with previous historical episodes and study the research literature on the economic consequences of war to see if it is possible to find common denominators. It is clear, however, that war often leads to higher inflation in one way or another. In this article, we will first briefly review what research literature has to say about the connection between war and inflation. Then we will take a look back at earlier episodes when war was associated with rising inflation in Sweden, and draw some conclusions from this.

1 Introduction

In February 2022, Russia invaded Ukraine. The consequence has above all been great human suffering and the invasion has become a further strain on the world economy. However, this article does not specifically deal with the war in Ukraine, but with war in general and its economic consequences. The focus is on the effects on inflation, as this is particularly important for a central bank.

In general, the empirical macroeconomist's method usually involves quantitative analysis based on time series for macro variables. The tool is typically econometric models with many observations. Fortunately, war does not occur very often, so there are few observations. This has two important consequences for the analysis of the links between war, inflation and monetary policy: Firstly, the time horizon must be long in order to obtain get a number of observations to study. But even with a long time perspective there are few observations. Secondly, the analysis is therefore by necessity qualitative rather than quantitative.

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2 War often leads to inflation

The fact that war and inflation often go hand in hand has been known for a very long time. Back in around 500 BC, Sun Tzu, Chinese general and author of a book on the art of war, observed:

"Where the army is, prices are high; when prices rise the wealth of the people is exhausted."[1]

What this refers to is, of course, that an army of perhaps tens of thousands of soldiers requires a lot of resources just to be able to feed itself and these can be difficult to raise in a geographically restricted area. Thus, demand rises in relation to the available supply of food and other necessities, and this causes prices to rise.[2] If, as has often been the case throughout history, the army supports itself by looting, it may be able to survive for a while, but for the civilian population, prices will rise because of a smaller supply. Of course, an army could not survive indefinitely in one place, because resources sooner or later run out. In his book "Ofredsår" ("Years of Trouble"), historian Peter Englund has likened the Swedish army during the thirty-year war 1618−1648 to a shark that must be constantly on the move to avoid succumbing (Englund, 1993).

Once a war had started, the armies of the time partly lived their own lives, separated from the state, and largely organised their own supplies, especially of course during campaigns abroad. Inflation therefore increased more locally depending on where the armies happened to be, as a result of the demand for food and other necessities exceeding supply.

2.1 Rising demand and printing money

When a country rearms and fights a war, inflation can also rise in the whole economy for the same reason, that is, that demand rises in relation to supply. A sharp increase in public expenditure as a result of rearmament or war effort increases capacity utilisation in the economy and can therefore lead to higher inflation. In connection with the Second World War, the US economy approached full capacity utilisation, which contributed to a rise in inflation. Some economists argue that it was the US rearmament that finally put an end to the 1930s depression.[3]

The way in which a state finances rearmament or war is also of great importance to the way in which inflation develops. The financing can entail the state increasing taxes, reducing other expenditure than military, raising loans or making the central bank print more money. If a war is financed by increasing taxes or reducing other expenditure, the purchasing power of the public will be reduced. This counteracts the inflationary effect of increased public expenditure. However, it can be politically

[1] Goldstein (2003).

[2] "Inflation" usually means a more sustained increase in the price level. If, for example, prices are raised to a new level but then they do not continue to rise, we are talking about 'one-off inflation', a concept which we will return to later in the article.

[3] See, for example, Vernon (1994). However, others, such as DeLong and Summers (1988), instead argue that the recovery was essentially completed even before the war.

difficult to raise taxes sufficiently.[4] The way that is usually politically easiest in the short term is through printing money. But in the longer term it is perhaps the most harmful, as it almost inevitably results in higher inflation.

A fairly large share of the literature on the effects of war on inflation is about the financing of war. A review of the effects on inflation of the United States' wars, from the American Revolution in 1775−1783 to the First Gulf War 1990−1991, shows that minor wars have usually been financed through higher taxes or increased borrowing or a combination of these (Rockoff, 2015). However, in the case of major wars, the point where these two methods of financing have been considered exhausted has often been reached, and the government therefore turned to the money printing press. The result has often been a considerably higher inflation rate.[5] The two world wars are examples of this.

After a war, sovereign debt has often increased considerably. At the same time, it may be difficult to raise tax revenue in the same way as before the war. This may be because the political situation has become more unstable or the economy's production capacity has declined.

In such a situation, there may be a great temptation for a government to try to alleviate the situation by using the money printing press to finance current expenditure and pay off the loans. Difficulties in generating sufficient tax revenue are considered to be an important explanation for the use of the money printing press in countries such as Germany, Austria, Hungary, Poland and Russia after the First World War, thus resulting in high inflation there. Financing through the printing press also led to the largest hyperinflation in modern times, that in Hungary in 1945-1946.[6] According to some estimates, prices at their fastest then doubled in fifteen hours (Hanke and Krus, 2012).

2.2 Inflation often also rises in the rest of the world

The factors we have mentioned so far are those that can contribute to higher inflation in countries that are, or have recently been, directly involved in a war.

But war can also cause higher inflation in the rest of the world. The war itself can generate increased demand on the world market for various products such as oil and certain metals. The warring countries can also be important exporters of some commodity or product which they can no longer produce or export as a result of the war. The latter results in lower supply and higher prices on the world market. Examples include the increases in oil prices that arose in connection with, for

[4] For example, Hamilton (1977) notes the difficulties for the US administration in obtaining taxes to finance the American War of Independence 1775–1783: "Our revolutionary ancestors were willing to fight … for [the] country; but hardly anyone was willing to pay taxes for it." (p. 14). Hall and Sargent (2022) compare US funding for 'three World Wars', where the third world war refers to the war against COVID-19. They find that tax financing was considerably lower during the coronavirus pandemic than during the First and Second World Wars.

[5] The Vietnam War is an exception, to the extent that it can be described as a minor war. Part of the funding then came through printing money.

[6] Bomberger and Makinen (1983). Another possibility is that the government simply refuses to pay its debts, which is of course associated with major problems with regard to future confidence.

example, the Yom Kippur war 1973, when the oil-exporting countries in the Arab world decided to cut their exports, and the war between Iraq and Iran that started in 1980. Following Russia's invasion of Ukraine, rising energy and commodity prices have been an important explanation for inflation rising globally.

War can also force many people to flee, which requires increased public spending in the countries where the refugees are received. This may have some effects on inflation in the recipient countries. The most pronounced example of huge waves of refugees is, of course, in connection with the Second World War. A more recent example is the people who fled from the war in Syria, and we are now seeing a similar development as a result of the war in Ukraine.

A war could also greatly increase geopolitical uncertainty, which may mean that countries not directly involved in the war choose to arm and increase their public spending. However, greater uncertainty about the future may also mean that the private sector chooses to postpone investment and increases its precautionary saving. There are thus counteracting effects on aggregate demand and thereby on inflation.

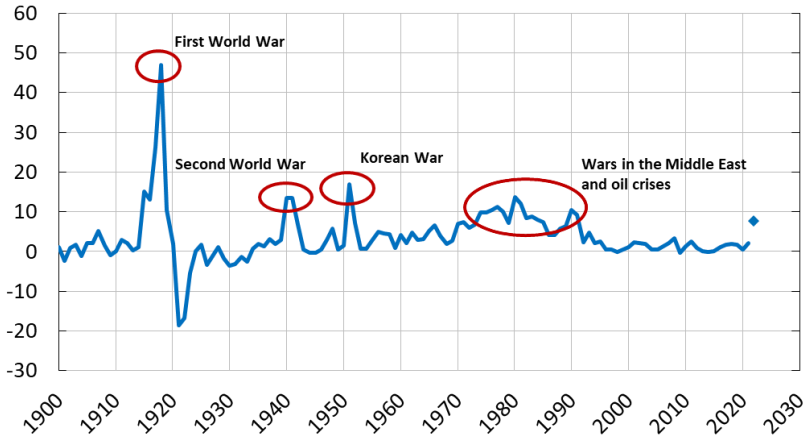
All in all, there are a number of different ways, both on the demand and supply sides, in which war can lead to inflation rising, both in individual countries and in the world economy as a whole.

3 Four periods of high inflation since the year 1900

The fact that war leads to inflation becomes quite clear when studying a longer time series for inflation. Figure 1 shows inflation in Sweden from 1900 onwards.

Figure 1. Swedish inflation 1900-2022

CPI, annual percentage change



Note: The dot for 2022 refers to January-October.

Source: Statistics Sweden.

There are some occasions when it has been higher than 10 per cent, sometimes much higher. All of them occur in connection with war or some other type of conflict. A few

periods have short-term peaks, where inflation rapidly falls back again, while inflation in the 1970s and 1980s was fairly high over a longer period of time. Although inflation did not always exceed 10 per cent, we have chosen to regard the latter as a continuous period.

We intend to go through each of these periods – why inflation rose, why it fell back again, and how economic policy-makers thought and acted.

3.1 Highest inflation in connection with the First World War

The inflation during the First World War is by far the highest in the whole period and peaked in 1918 at 47 per cent. This episode is also special because the high inflation was followed by a severe deflation, that is, a fall in the general price level, 1921–1923. Fortunately, we have not experienced any such dramatic fluctuations in inflation since then.

In his book "Money and Power" on the history of the Riksbank, Gunnar Wetterberg notes that at this time the Riksbank's governors were faced with a series of questions that neither they nor most other scholars knew how to deal with. The war and the first post-war years thus became a difficult time for monetary policy (Wetterberg, 2009, p. 256).

The organisation of the monetary system played a major role in the course of inflation. Prior to the war, Sweden had a gold standard, which had been introduced in 1873 in connection with the establishment of the Scandinavian monetary union. The gold standard meant that the krona was linked to gold and that the Riksbank had an obligation to exchange notes for gold at a fixed price. This meant that the krona had a fixed exchange rate against other countries with the same system. The gold standard was abandoned in connection with the outbreak of war in 1914, because in the uncertain times, companies and individuals began to exchange their banknotes for gold on a large scale. The same thing happened in other countries.

In the countries directly involved in the war, the war efforts required rapid and immediate funding. Budget deficits grew and were financed by the government borrowing from the central bank, that is, through printing money. The money supply and price level thus rose sharply around the world. The war and international rearmament caused the demand for Swedish products to rise dramatically, and the increased exports gave a considerable boost to the economy. Swedish inflation toward the end of, and shortly after, the war has been described as a classic price, wage and profit spiral in an environment with growing access to money and bank credits, speculation and a shortage of fuel, commodities and labour.[7]

The Riksbank was thus rather uncertain as to how it should act. At this time, it was mostly academic economists who believed that one could slow down inflation by raising the discount rate, the period's equivalent to today's policy rate, while the Riksbank was more hesitant (Lundberg, 1983, p. 56). The fact that economic policy-

[7] Lundberg (1983). The introduction of the eight-hour day in July 1920 contributed to the shortage of labour.

makers did not share the view that the interest rate can be used to influence inflation was not, of course, a good starting point and in itself a partial explanation for the fact that inflation could rise so sharply.

An interesting, but perhaps not so well-known, event during this period was that Eli Heckscher, professor at the Stockholm School of Economics and internationally renowned national economist, actually caused a bank run at the Riksbank in 1920.[8]

Although the inflation peak had passed, inflation at the beginning of 1920 was still so high that Heckscher thought that the Riksbank should raise the discount rate significantly. When the Riksbank did not want to do this, Heckscher decided to do something about it.

The right to exchange notes for gold had ceased in connection with the outbreak of the war in 1914, but was reintroduced in 1916. However, since an export ban on gold had been introduced in 1914, this did not mean in practice that the gold standard had been re-established. The export ban allowed the gold price to differ between countries and the value of the krona to change against other currencies. This was also the case as the krona depreciated against the dollar.

At the US Federal Reserve, the price of one kilogram of gold in the depreciated Swedish currency was SEK 3,600 at the beginning of 1920. At the Riksbank, the price of one kilogram of gold was instead SEK 2,480. *If* the export ban were to be lifted, then a considerable arbitrage gain could be made.

Heckscher decided to draw the general public's attention to this fact and did so through an article entitled “Den nya prisrevolutionen” (The new price revolution), published in the daily newspaper Stockholms Dagblad on 11 March 1920. The article was more or less an explicit encouragement to readers to withdraw their money from the bank and go to the Riksbank to redeem it for gold:

“Anyone who brings SEK 1,000 in banknotes to the Riksbank has the legal right to receive 50 20 kronor pieces and these currently have a value of SEK 1,450. It is true that the amount cannot be realised immediately, namely not as long as the gold export ban remains, or the gold content of the Swedish currency is not officially reduced. However, 45 per cent profit on the most risk-free among investments is worth quite a long wait.”[9]

The ‘pieces’ that Heckscher referred to were the gold coins denominated in SEK 20, which existed at that time. Indeed, the result was an onslaught of people wanting to redeem their banknotes at the Riksbank, which was therefore forced to raise the discount rate to increase the yield on alternatives to redeeming banknotes and thus defend the gold reserve. In connection with this, the Riksbank requested release from the obligation to redeem banknotes for gold, which was subsequently also granted.

[8] See, for example, Fregert (2013) and Hasselberg (2021).

[9] Heckscher (1920).

3.2 ...but it was also followed by deflation and recession

However, shortly afterwards, the price trend was reversed. There were various reasons, including the weakening of international economic activity. But the most important reason for the severe turnaround in general prices was connected with the view of the monetary system that prevailed at the time.

The political view was that Sweden should return to the gold standard as soon as possible, and to the parity that had applied before the war. To make this possible, the krona needed to be strengthened, which required bringing down prices and wages (Wetterberg, 2009, p. 270). It was therefore recognised that a period of deflation would be required.

Knut Wicksell, perhaps Sweden's most famous economist, was among those who argued that the gold standard should not be reintroduced, but should be abandoned for all time. He argued instead for a free standard, without any metallic base (Wetterberg, 2009, p. 271). On the other hand, he too seems to have supported the idea that the price level needed to be lowered and that this would not cause any major problems, given that the policy was expected (Boianovsky, 1998).

Swedish monetary policy became more restrictive than in other European countries and in the United States. The tightening caused real interest rates to rise sharply and the economy to enter a recession. In 1924, Sweden was the first European country to return to the gold standard at the pre-war parity. However, the cost of deflation in the form of unemployment and stagnation had been extremely high, and this undermined confidence in the gold standard as a monetary system (Jonung, 2000).

3.3 Second World War and Korean War gave short-term inflationary peaks

At the time of the Second World War, economic policy-makers were determined not to repeat the mistakes of the First World War. Extensive regulations such as currency regulation and rent regulation were introduced early on to dampen expectations that inflation would rise sharply.[10] Nevertheless, inflation rose quite a lot during the first years of the war, but in 1942 the government approved a programme drafted by a specially appointed commission. The main objective of the programme was to stabilise prices and the most important means of doing this was a general price and wage freeze. Interestingly, the commission did not include the interest rate in its report when discussing means of influencing economic activity and inflation. The view at this time too was that the interest rate should mainly be regarded as a cost factor, especially from a political point of view.[11]

[10] See, for example, Jonung (2017).

[11] Wetterberg (2009), p. 314. The Social Democratic Government's post-war policies were focused on full employment and keeping interest rates down, known as low interest-rate policy. Instead, fiscal policy would steer economic activity. The Riksbank opposed the low interest-rate policy and Riksbank Governor Ivar Rooth tendered his resignation in 1948.

This policy was much more successful than that conducted in connection with the First World War. There was no post-war recession, and the inflation peak was short-lived and was not followed by any appreciable deflation.[12]

Developments during the Korean War in 1950–1953 followed the same pattern, with a high but short-lived peak in inflation. The upturn was preceded by a devaluation against the dollar in 1949, which Sweden and a number of European countries carried out to meet the competition from American industry. After the outbreak of the war, international inflation rose sharply. The price increases on commodities were particularly high. Profits in the Swedish manufacturing industry rose markedly and resulted in a price and wage build-up process, where wage costs rose by at most about 20 per cent a year.

The Minister of Finance at the time, Per Edvin Sköld, took a number of measures: Excise duty on sales of cars was raised, building regulations were tightened, the forest industry had to deposit some of its large profits in special accounts and an investment tax was introduced (Åsbrink, 2019). The interest rate was also raised by half a percentage point, which, according to a modern yardstick, may seem rather modest given the circumstances. Altogether, this meant that inflation was short-lived on this occasion too, and it is also known in the history books as ‘one-off inflation’.

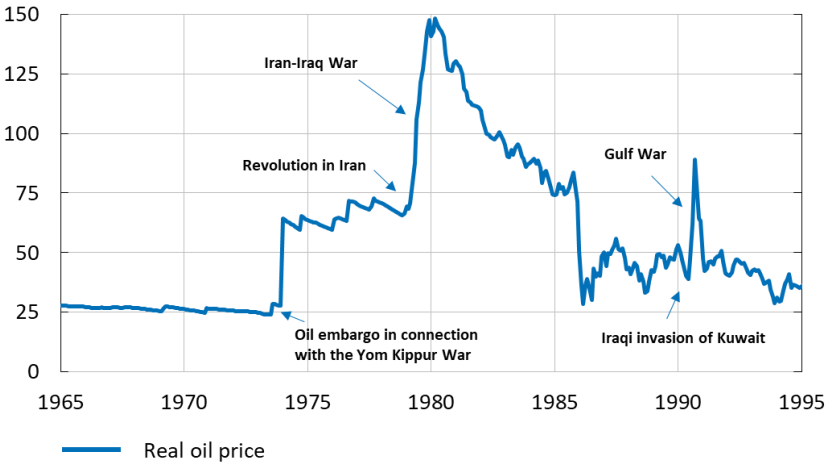
3.4 Expansionary policy during the most recent inflation period

As for the longer period of high inflation from the early 1970s, the link to war is not as obvious as in the previous episodes, but it is there in the form of several wars and conflicts in the Middle East that affected the price of oil (see Figure 2).

[12] According to Statistics Sweden’s annual statistics, inflation was −0.4 per cent in 1944 and 1945.

Figure 2. Real oil price

USD/barrel



Note: Real prices have been computed with the CPI October 2022 in United States.

Sources: U.S. Bureau of Labor Statistics (BLS), U.S. Energy Information Administration and the Riksbank.

The two oil crises in 1973–1974 and 1979–1980, often referred to as OPEC I and OPEC II, play quite an important role in this process. OPEC I was preceded by the so-called Yom Kippur War of 1973 between Egypt and Syria on the one hand and Israel on the other. OPEC II is linked to the revolution in Iran in 1979, which led to a significant loss of oil production that was not matched by the other oil-producing countries. When Iraq then invaded Iran in 1980, the situation became even worse. The price of oil also rose, but very briefly, when Iraq attacked Kuwait in 1990.

However, the policy that was conducted during this period also played a significant role. It became, for various reasons, on average too expansionary or, as it is called, too accommodative. In economic textbooks, this period of high and long-term inflation in the world is known as 'The Great Inflation'. This usually refers to the period 1965−1982, where the 'the Volcker disinflation', the tight monetary policy conducted by then head of the Federal Reserve Paul Volcker to curb inflation in the United States, is regarded as the endpoint.[13] For Sweden, it is more appropriate to refer to a period that both starts and ends about ten years later.

The Swedish economy was wrestling with serious economic problems during this period. Perhaps the main concern was the strong domestic inflation trend with price and wage spirals that collided with attempts to maintain a fixed exchange rate, and therefore led to recurring cost crises and devaluations. Another reason, which was partly connected to this, was that fiscal policy was often too expansionary, with rapidly rising public spending and tendencies toward structural deficits as a result. In addition, there was a deregulation of the credit market in the mid-1980s, which would

[13] Drechsler et al. (2020) provides an alternative explanation for 'the Great Inflation' in the United States, which is based on the failure of the monetary policy transmission mechanism. A special law, Regulation Q, imposed a ceiling on the banks' deposit rate. When the Fed raised the interest rate to slow down inflation, this ceiling meant that the interest rate changes made no difference for most people. When Regulation Q was lifted at the end of the 1970s, monetary policy once again had an impact and inflation fell.

lead to far greater problems than were anticipated when the reform was implemented (Economic Commission, 1993).

On the international arena, the German reunification in 1990 created a local German economic boom and inflation that caused the Bundesbank to raise its policy rate. This attracted large amounts of capital to Germany as investors in other countries sought the high return on the German capital market. This in turn increased the tensions within the European exchange rate mechanism, the ERM. Other countries were forced to raise their policy rates to maintain the exchange rate parities, despite the fact that this worsened the already weak economic activity there. In addition, in Sweden, the tax reform of 1990–1991 made borrowing more expensive. From having been negative, the real interest rate rose in a short time to around 5 per cent, in what has been called the 'real interest rate shock'.

In the early 1990s, this contributed to a severe economic downturn in the Swedish economy, which also coincided with a financial crisis largely caused by excessive lending to households and companies. Unemployment rose sharply and public finances deteriorated dramatically. The krona was put under strong pressure by investors who expected Sweden to devalue again soon and, in November 1992, the Riksbank was forced to give up its defence of the fixed exchange rate.

It had become clear that the type of policy Sweden had pursued for a number of decades had reached the end of the road, and needed to be fundamentally reshaped. Instead of defending a fixed exchange rate, the task of monetary policy from now on would be to keep inflation low and stable around 2 per cent. For its part, fiscal policy would focus considerably more than previously on keeping public finances in good condition so as to maintain market confidence. Looking back now, 30 years later, we can see that the restructuring was successful. We have not had any problems with excessive inflation since then, until recently when inflation has once again risen towards the levels from the 1970s and 1980s. The problem has usually been the reverse, that is, that inflation has been lower than the target.

4 Some conclusions from the history of inflation

So what conclusions can be drawn from this review of Swedish inflation history since 1900? One conclusion, which was also in some way the starting point, is that inflation tends to rise in connection with war, and that this also applies in countries like Sweden, which has been fortunate not to be directly involved in any war during this period.

Another conclusion is that the first three inflation peaks in the 1990s were so short-lived that expectations of higher inflation in the longer term were never built into price- and wage formation.

A third conclusion is that the reason why high inflation *was* so short-lived on these occasions was either that politics became too tight and caused a severe recession, as in connection with the First World War, or that inflation could be parried by far-reaching regulation and direct control of price-setting and wage-formation, as in

connection with the Second World War and the Korean War. However, such tools have proved to do more harm than good in the long run, and are therefore in principal discarded from the political toolbox.

It is sometimes said that economic policy-makers often base their actions during a crisis on the interpretation of the previous crisis (Jonung, 1999). This means that one sometimes gets things wrong and tends to 'fight the last war'. But if we are at the beginning of something that turns out to be a longer period of lastingly higher global inflationary pressures, it is the last period of high inflation, during the 1970s and 1980s, from which we have the most to learn. That is our fourth conclusion.

5 More difficult for monetary policy to deal with supply shocks

For our continued reasoning, we need to refer to some economic theory. An economy is constantly exposed to what in economist speak are called shocks, which in principle refers to a rapid and unexpected development. Some shocks are positive and imply, for example, that economic activity improves and unemployment decreases. Other shocks are negative and lead to recession and higher unemployment. Shocks can be divided into demand shocks and supply shocks, depending on whether demand or supply is developing unexpectedly.

The economic impact of the war in Ukraine can be described as what textbooks call a negative supply shock. This means that activity in the economy is declining, *at the same time* as prices are rising. In other words, the effect will be stagflationary, that is, we will have a combination of lower growth and upward pressure on inflation.[14] Earlier examples of negative supply shocks are the oil crises in the 1970s. In addition, the war in Ukraine was preceded by another supply shock – the pandemic – when large parts of the world economy closed down and distribution chains were broken. As described earlier, war does not always entail a negative supply shock. In connection with the Korean War, for example, there was talk of the 'Korea boom', because inflation was then largely due to increased *demand* for Swedish goods and it increased economic activity and inflation.

For a monetary policy decision-maker, supply shocks are more difficult to deal with than demand shocks. If inflation rises because demand has risen unexpectedly, the remedy is simple: The central bank raises the policy rate and thus suppresses both inflation and demand, thereby reducing the risk of the economy overheating.

[14] There is broad agreement among economists regarding this conclusion. The IGM Forum at Chicago Booth regularly asks a panel of leading economists in Europe and the United States to what extent they agree or disagree with different statements. The survey published on 8 March included the following statement: 'The fallout from the Russian invasion of Ukraine will be stagflationary in that it will noticeably reduce global growth and raise global inflation over the next year'. A very large majority agreed, while nobody thought that would not be the case. The European panel's responses are presented at https://www.igmchicago.org/surveys/ukraine/ and the American at https://www.igmchicago.org/surveys/ukraine-2/. The results are summarised by Vaitilingam (2022).

But if inflation rises as a result of a negative supply shock, the problem is more complex. If most people assume that the effect on inflation is transitory, the problem does not need to be so great. The central bank can then simply wait until inflation falls back. However, one risk that is always present is that price impulses spread to other prices and start to affect economic agents' expectations. These may then expect inflation to remain high, or even rise further. What we have seen in Sweden and other countries recently is that the inflation impulse that was initially mainly supply-driven has started to spread in the economy and caused the more underlying inflation to rise.

This creates a tricky balancing act for monetary policy: At the same time as one wants to maintain confidence in the inflation target and prevent inflation from becoming entrenched at a high level, one wants to avoid pursuing a policy so tight that the economy enters a deep recession. As we saw, this was what happened after the First World War, although the motive then was to return to the previous *price level* rather than bring down inflation. To be a little drastic, one can say that the task facing the central banks is to avoid 'The Great Inflation 2.0', and to do so at the lowest possible cost in terms of lower production and higher unemployment.

6 The conditions are better than before

The conditions for coping with this balancing act are quite good for Sweden and at least considerably better than they were when inflation began to rise in the mid-1970s. There are several reasons for this.

Firstly, in 1993 we decided to adopt an inflation target in the Swedish economy. During the most recent period of lastingly high inflation in the 1970s and 1980s, the idea was that inflation would be kept down by means of the fixed exchange rate. The fixed exchange rate was expected to have a disciplinary effect on price-setting and wage-formation, as excessive inflation in relation to the rest of the world would lead to difficulties for the export industry and increased unemployment. However, as we noted earlier, this did not work very well. Expressed in economist terms, there was no credible nominal anchor in the economy, that is, a clear, quantified benchmark for price-setting and wage-formation. Today, we have one in the form of the inflation target. During the period of inflation targeting, long-term inflation expectations, in the way we can measure them, have remained fairly stable at around 2 per cent.

This does not, of course, mean that the Riksbank can sit with its arms folded when inflation rises and expect inflation to return to the target 'by itself'. The fact that long-term inflation expectations are firmly anchored to the target is because economic agents *expect* the Riksbank to act when needed. The fact that there is a credible nominal anchor today of course makes things easier, even though the outcome ultimately hinges upon the way monetary policy is conducted.

Secondly, Swedish wage-formation works in a completely different way than in the 1970s and 1980s. One important reform was the so-called Industrial Agreement, under which the manufacturing industry has set the benchmark for wage negotiations and ultimately steered wage cost increases in the entire economy for over twenty

years. In this way, international competitiveness is taken into account when Swedish wages are set. The relationship between this benchmark and the inflation target has not always been crystal clear. For instance, employers' representatives have sometimes expressed the view that the inflation target is outdated and should not be used as a base in wage negotiations. However, this was during the extended period when inflation tended to be at the lower end of the target. However, as developments now show, we must assume that inflation will sometimes be above the target as well. Hopefully, this will further underline the importance of the inflation target as a nominal anchor for the Swedish economy, both upwards and downwards, so to speak. Should it now be the case that we are entering a longer period of lastingly higher inflationary pressures – which we do not know yet, of course – then our assessment is that the forms of wage-formation we have today will act as a built-in and useful brake in the system when it comes to counteracting a wage-price spiral.

Thirdly, a stricter and more robust fiscal policy framework was introduced after the 1990 crisis. This has contributed to public finances now being in a much better shape than they were in the 1980s and 1990s. A large and growing sovereign debt may raise inflation expectations, if agents suspect that the government may eventually try to solve the problem of sovereign debt by inflating it away. What this means is that the central government reduces the real value of the debt by letting inflation rise. However, unlike in the 1970s and 1980s, we now have a number of control mechanisms in place, which means that this potential source of excessive inflation has in practice been eliminated.

It is nevertheless important that fiscal and monetary policy interact in a proper way. When monetary policy is tightened to bring inflation down, there may be reason to pursue a targeted fiscal policy that seeks to mitigate the negative consequences for households and companies that are particularly affected by the weaker economic conditions. It is however important to avoid broad fiscal stimulus measures, as they may drive up aggregate demand and make it necessary to raise interest rates even further.

During the past year, inflation has risen to higher levels than ever during the period with an inflation target. In that sense, it is the first time that inflation targeting policy has been put to the test 'on the upside' in earnest. However, it is also true that we now have an economic policy framework in place that provides favourable conditions for dealing with the situation.

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The Riksbank's bond purchases: who sold bonds to the Riksbank?

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Like many central banks, the Riksbank has purchased government bonds and private sector securities to make monetary policy more expansionary and as a complement to traditional interest-rate policy. Who has sold bonds to the Riksbank and what does this tell us about the transmission of bond purchases? In this article I use Financial Account data and new microdata on Swedish securities holders to assess which sectors sold bonds to the Riksbank.

Over the period 2015 to 2021, I find that foreign investors have accounted for a large share of sales of government and private sector bonds to the Riksbank. As a group, foreign investors show a greater propensity than domestic investors to adjust their portfolios of Swedish government bonds in conjunction with the Riksbank's purchases and with changes in bond supply. Although foreign investors have been active sellers of the bonds the Riksbank has purchased, they have rebalanced their portfolios of Swedish assets toward assets with more risk. These findings highlight the important role of foreign investors in the transmission of bond purchases in a small open economy.

1 Introduction

In the years following the global financial crisis, many central banks purchased bonds on a large scale as a complement to traditional interest-rate policy when policy rates were at or near their effective lower bound. Bond purchases were also a key feature of the monetary-policy response to the financial and economic disruptions due to the covid-19 pandemic. Purchases alleviated strained market functioning and ensured that financial conditions remained accommodative and supportive of the recovery.

The literature on the effects of bond purchases has focused on the effects on interest rates. Both in Sweden and abroad, central-bank bond purchases have exerted downward pressure on bond yields. But how this effect has arisen is less well understood. Many channels have been proposed. Bond purchases are thought to

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lower bond term premia by inducing portfolio rebalancing and removing duration risk, lower liquidity premia by improving market functioning when markets are distressed, and lower expectations of future policy rates (Bhattarai and Neely 2022).[1]

This paper aims to shed light on portfolio rebalancing in Sweden. Which types of investors have sold bonds to the Riksbank and how have they rebalanced their asset portfolios? What are the implications for the transmission of bond purchases?

I analyse data from the Swedish Financial Accounts and new microdata on Swedish Securities Holdings to assess which sectors have ultimately sold bonds to the Riksbank. While participation in the central bank's purchase operations is limited to the central bank's counterparties, these counterparties can sell bonds either from their own inventory or on behalf of investors who do not participate directly in the operations.[2] With Financial Accounts and Securities Holdings data, it is possible to see beyond who participates in the purchase operations to map out how sectoral bond holdings have evolved during the Riksbank's bond-purchase programs.

I find that foreign and domestic investors sold Swedish government bonds to the Riksbank in about equal measure during the bond purchase program 2015 to 2017. However after controlling for the historical relationship with the supply of government bonds, the Riksbank's holdings and other financial factors, foreign investors show a greater propensity than domestic investors to adjust their holdings of government bonds in response to the Riksbank's purchases and to changes in the supply of government bonds. Experience of the pandemic purchases echoes this finding, with foreign investors the primary seller of the types of the bonds that the Riksbank purchased, including government, municipal and mortgage covered bonds.

Although foreign investors sold government bonds to the Riksbank during and following the 2015 – 2017 purchase program, they more than offset their sales of government bonds with purchases of other Swedish bonds. Overall, foreign investors rebalanced their portfolio of Swedish bonds toward higher risk bonds including bank-, covered- and corporate bonds. This does not mean that each individual investor necessarily rebalanced its portfolio in this way, rather the foreign sector as a whole. During the pandemic, foreign investors reduced their holdings of Swedish bonds in total. However, considering the their gross portfolio of Swedish assets including deposits, bonds, loans and equity, foreign investors have since 2015 increased their financing of the Swedish non-financial corporate sector through bonds, loans and equity ownership.

These findings highlight the role of foreign investors in understanding the transmission of bond purchases in a small open economy. This is in contrast to the much of the theory and empirics on central-bank bond purchases which has been developed with larger economies in mind.

[1] Further channels have been proposed: an uncertainty channel by which asset purchases reduce uncertainty about the outlook for economic recovery and the path of the policy rate; a bank lending channel by which increased central-bank reserves and deposits at banks may encourage lending by alleviating financial constraints and encouraging rebalancing of credit portfolios; and an exchange-rate channel.

[2] Birging and Hansson (2021) describe the Riksbank's purchase operations in practice.

2 Bond purchases affect interest rates and volumes

2.1 Central-bank bond purchases have lowered interest rates

The impact of large-scale central-bank bond purchases on interest rates is well documented, especially for the United States, United Kingdom and euro area (see for example Gagnon 2016 and Andrade et al. 2016 for metastudies). Broadly speaking, central-bank bond purchases have exerted downward pressure on the interest rates of those bonds that are purchased, including public- and private-sector bonds. Yields on bonds are not eligible for purchase have also tended to decline but there is less consensus as to whether bond spreads have been compressed.

The experience of Australia, Canada and Sweden indicate that central-bank bond purchases in small open economies are also associated with declines in the yields. However the empirical evidence is mixed. De Rezende (2017) finds sizeable announcement effects of Swedish government bond purchases between 2015 and 2017 and attributes the effects to lower term premia and lower policy-rate expectations. In contrast, Diez de los Rios and Shamloo (2017) find that Swedish bond purchases did not affect domestic term premia and that the observed declines in bond yields were mainly due to purchases signalling lower future policy rates and declines in global term premia. Similarly, Arora et al. (2021) find that the effect of the Bank of Canada's pandemic bond purchase program was relatively weak for long-term yields and the Reserve Bank of Australia's assessment is that effects of bond purchases were smaller than indicated by international studies (Reserve Bank of Australia 2022).

Exchange rates tend to depreciate in conjunction with the announcement of bond-purchase programs, both for large economies such as the United States and euro area (Haldane et al. 2016 and Dedola et al. 2021) and in small, open economies (Melander 2021, Gustafsson 2021 and Reserve Bank of Australia 2022). Indeed, the exchange rate channel may be of special significance for small open economies.

2.2 Preferred-habitat investors are thought to play a role

Of the proposed mechanisms by which bond purchases have effect, the portfolio rebalancing channel posits that by purchasing bonds and reducing the supply available on the market – the "free float" – the central bank induces investors to rebalance their portfolios. To the extent that some investors have strong preferences to hold just the type of bond purchased by the central bank – so-called *preferred-habitat investors* – these investors will bid up the price and down the yield such that term premia on that bond, and its close substitutes, decline. Vayanos and Vila (2021) present a preferred-habitat model of the term structure that illustrates this mechanism. This term premia effect is likely to ripple on to other related asset types as investors are displaced and prices adjust.

Generally speaking, central-bank bond purchases can affect term premia when there are frictions or imperfections that limit investors' ability or willingness to rebalance their portfolios. More specifically, the effect on term premia depends can depend on

the prevalence and preferences of preferred-habitat investors, the availability and substitutability of other assets and the extent to which arbitrageurs can realign prices between asset classes. Investors may have preferred habitats for certain maturities, for certain risk-classes of bonds or for the assets of certain regions or countries.[3]

While some investors may have strong preferences for a certain market segment, or are required to hold certain assets to comply with regulations and liability-matching, other investors may switch more readily to other asset classes, moderating the effects on term premia. Indeed, for the portfolio-balance mechanism to exert an effect on term premia at all, arbitrageurs must be unable or unwilling to completely arbitrage between asset classes. At which price investors are willing to rebalance their portfolios depends on the supply of available substitutes. For example, an investor whose preferred habitat is government bonds might require little compensation in the form of lower term premia to rebalance into municipal bonds. But if municipal bonds are in short supply, the compensation demanded will be greater.

The theories of preferred habitat and portfolio rebalancing stretch far back but there is relatively little empirical research on preferred-habitat behaviour. Giese et al. (2021) document the existence of preferred-habitat investors in different maturity segments of the UK gilts market and find that preferred-habitat investors such as life insurers and pension funds are less price elastic than other investor types. There is more literature on home bias in investment which can be viewed as a kind of preferred habitat behaviour. For example, Koijen et al. (2017) find evidence of home bias in euro area investors.

2.3 International aspects of portfolio rebalancing

In much the same way that imperfect substitutability of assets of different maturities or risk-profile is required for portfolio-rebalancing effects on term premia to arise, some degree of imperfect substitution between domestic and foreign bonds is necessary for domestic purchase programs to lower domestic term premia.

Kabaca (2016) presents a small open-economy DSGE model in which domestic and foreign bonds are traded internationally. In the model, the effectiveness of central-bank bond purchases on the term premium in the small open economy depends on the degree of substitutability between domestic and foreign bonds. The model implies that bond purchases in small open economies are less effective at reducing long-term bond premia yields when home and foreign assets are highly substitutable.[4]

In more concrete terms, consider the perspective of a foreign investor whose preferred investment habitat is Swedish government bonds. If this investor believes that Norwegian government bonds for example have similar attributes, interest-rate,

[3] Preferred habitats may differ because of regulations, transaction costs, specialised expertise and liquidity preferences among other things (Bernanke 2020).

[4] Imperfect substitution across assets is captured in the model with portfolio adjustment costs. In an estimated version of the model based on data for the United States and Canada, asset purchases are half as effective at stimulating total aggregate demand in a small open economy relative to a large economy because of the high substitutability between home and foreign bonds. Moreover, the depreciation of the exchange rate, a key channel in small open economies relative to large economies, is limited.

credit and exchange-rate risk to Swedish government bonds, then the two assets might be good substitutes. In response to lower Swedish yields because of asset purchases in Sweden, this investor might rebalance their portfolio toward Norwegian government bonds rather than to Swedish municipal or mortgage covered bonds.

The model by Kabaca (2016) is echoed in findings for the ECB's government bond purchases. Foreign investors and to a lesser extent banks have been the primary sellers of euro-area government bonds (ECB 2017). Koijen et al. (2017) find that the foreign sector displays more elastic demand for euro-area bonds than do domestic investors, potentially dampening the impact of bond purchases on government bond yields. Moreover, non-residents as a whole tend not to reinvest in the euro area after selling government bonds, reducing the effect of government bond purchases on other euro area assets.

In contrast, the foreign sector has played less of a role in the United States. Carpenter et al. (2015) find that during the Federal Reserve's large-scale purchases of Treasury securities, the primary sellers were the U.S household sector (which they point out is the sector that includes hedge funds) as well as U.S. broker-dealers and insurance companies. These investors were found to rebalance their portfolios toward riskier assets. A similar rebalancing toward corporate bonds is found among institutional investors that sold gilts to the Bank of England (Joyce et al. 2017).

The portfolio-rebalancing channel of asset purchases does not exist in isolation. Bond purchases signal lower future policy rates in some situations (Kaminska and Mumtaz 2022 for the United Kingdom and De Rezende 2017 for Sweden). Experience from the global financial crisis and in the early months of the covid-19 pandemic also indicates that bond purchases are particularly effective at restoring market function and lowering liquidity premia at times of market distress. Researchers differ in their assessment of the relative importance of these channels but all have likely been at work to some extent (Bailey et al. 2020).

3 The Riksbank's bond purchases and data on bond holdings

3.1 Government bond purchases 2015 to 2017

The Riksbank's large-scale purchases of government bonds began in February 2015 as a complementary monetary-policy measure at a time when the policy rate had been cut to –0,1 per cent and further rate cuts would be into untested territory.[5] Purchases started at a rapid pace and tapered somewhat in 2017 and were announced and implemented as a sequence of programs of a given amount over a given time frame. Net purchases ceased at the end of 2017 with purchases and reinvestments thereafter aimed at maintaining the size of the portfolio roughly stable (see Figure 1 and Melander 2021 for a detailed description of the Riksbank's bond purchase

[5] Prior to 2015, the Riksbank made small purchases of government bonds as a preparatory measure to develop systems and operational knowledge in the event that purchases would need to be scaled up.

decisions from 2015 to 2020). The Riksbank initially purchased nominal government bonds issued by the Swedish National Debt Office (SNDO, *Riksgälden*) but in April 2016 broadened eligible securities to include inflation-linked government bonds.

3.2 Pandemic bond purchases 2020 to 2021

In light of the financial and economic disruption caused by the covid-19 pandemic, bond purchases were intensified and broadened in the spring of 2020. As well as renewed purchases of government bonds, the Riksbank announced purchases of covered bonds, municipal bonds and corporate bonds as well as government bills and commercial paper (see Figure 1 and Gustafsson and van Brömsen 2021 for a chronological description of monetary-policy measures during 2020).[6] Only paper issued in Swedish krona were eligible for purchase.

Entering 2020, the Riksbank already owned more than 40 per cent of outstanding Swedish government bonds issued in Swedish krona. Against this background, additional purchases of government bonds during 2020 and 2021 were modest.[7] Bond purchases were instead weighted heavily toward covered bonds and to some extent municipal bonds. Two thirds of the Riksbank's purchases were concentrated in covered bonds and just under twenty per cent in municipal bonds.

The sizeable purchases of covered bonds seen in Figure 1 reflect the large size of that market. By the end of 2021, the Riksbank's covered and municipal bond holdings amounted to 20 per cent of their respective outstanding stock. Purchases of corporate bonds were by contrast modest, amounting to approximately 1.5 per cent of the outstanding stock of SEK-denominated non-financial corporate bonds.

3.3 Data on bond holdings by sector

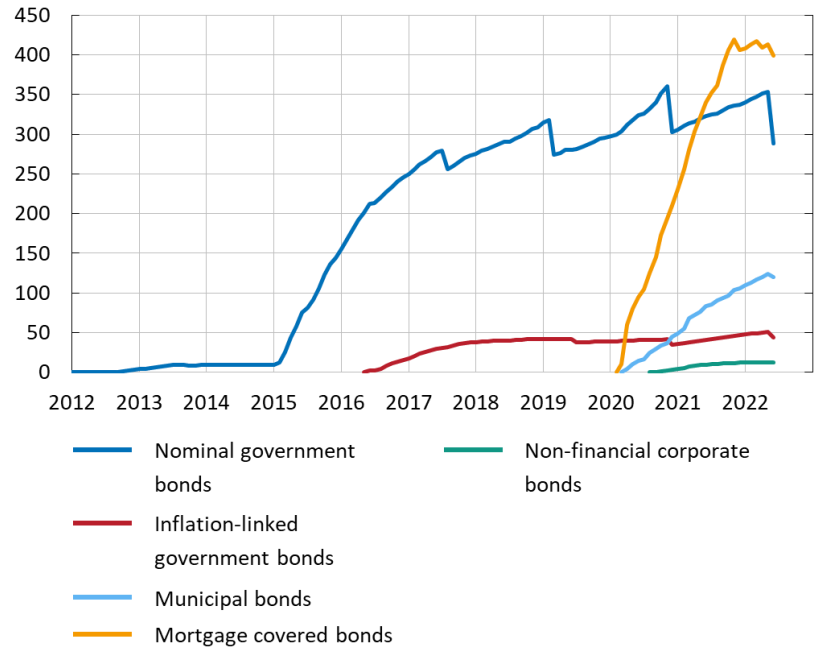
The data come from three sources – the Financial Accounts and Balance of Payments both of which have a relatively long data history and the Swedish Securities Holding statistics starting in 2019. Each data source reports bond holdings by sector and investor type although there are key differences in coverage and methodology.

[6] Municipal bonds include bonds issued by individual municipalities as well as by *Kommuninvest* on behalf of member municipalities.

[7] However, the SNDO increased issuance of short-term government bills and the Riksbank included Treasury bills in its purchase program.

Figure 1. The Riksbank's holdings of Swedish bonds

Nominal value, SEK billion



Source: Sveriges Riksbank.

- The International Investment Position (IIP), a component of the Balance of Payments, reports the foreign sector's holdings of debt securities issued in Sweden, by issuance sector and currency (Swedish krona and foreign currency). The statistics report the net of long and short investment positions of the foreign sector but do not provide a break down of holdings for domestic subsectors as in the Financial Accounts. The IIP data are available from 2006.
- The Financial Accounts (*Finansräkenskaperna*) published by Statistics Sweden reports transactions and holdings of financial assets and liabilities by detailed domestic sectors and by financial instrument including debt securities. Data on end-of-quarter holdings are market valued whereas transactions are changes in holdings net of valuation and reclassification effects. Quarterly data are available from 1996. Bonds issued in Swedish krona are not separately identified from those issued in foreign currencies and until 2019 only long positions in debt securities were reported; thereafter the net of long and short positions.
- The Swedish Securities Holding statistics (*databas för värdepappersinnehav,* VINN) consists of microdata on the ownership of interest-bearing securities on a security-by-security and investor-by-investor basis.[8] The statistics are collected by Statistics Sweden on behalf of the Riksbank. Data on debt securities are available from the first quarter of 2019 and so cover the Covid-

[8] The household sector is identified only in aggregate. VINN also includes data on listed shares and investment fund shares.

19 pandemic purchases but not earlier episodes. The data include long, short and net holdings of domestic investors and the net position of the foreign sector.

All sources are reported on a quarterly basis in Swedish kronor at the end of the period. None are seasonally adjusted. I complement these data sources with data from the Swedish National Debt Office on the outstanding amounts of nominal and inflation-linked government bonds and public bonds in foreign currency measured in both nominal value and market value.

The sectoral definitions of investor types in VINN align with those used in the Financial Accounts. An advantage with VINN is its more granular breakdown of securities by issuer and attribute. This allows separate identification of securities issued in Swedish kronor from those issued in foreign currency and as well as of covered bonds and bonds issued by municipalities and regions. This makes it possible to pinpoint sectoral holdings of the types of bonds that the Riksbank purchased during the pandemic.

The low frequency of the data is well suited to an analysis of how investors' holdings of securities have changed during the Riksbank's bond-purchase programs. While interest-rate changes largely occur upon announcement of a bond-purchase program, the transactions involved in rebalancing portfolios take time to implement.

There are some limitations with the data. A small share of Swedish investment funds are registered abroad and changes in their bond holdings are attributed to the foreign sector.[9] To the extent that some financial institutions that have participated in the Riksbank's reverse auctions (such as Nordea and Danske Bank) register their own inventory of bonds abroad rather than with their Swedish branch, sales from their own inventory will be attributed to the foreign sector. However, when they sell bonds on behalf of domestic Swedish customers, the change in bond holdings is attributed correctly to the domestic sector and likewise for foreign customers to the foreign sector. For these reasons, the analysis should be interpreted according to where investors are registered. However, the discrepancies introduced by this categorisation are small relative to the trends observed in the data.

The different methodologies of the Financial Accounts and Balance of Payments also pose a challenge to the analysis. In the Financial Accounts, the value of securities held by the foreign sector is calculated as the balance of outstanding debt securities not held by the domestic sector. In the Balance of Payments data for the foreign sector have historically been collected by surveys of issuers and from securities depositories.

[9] *Fondbolagens Förening* publishes data on its members' funds registered in Sweden and abroad. Since 2018, the Financial Accounts cover more than 95 per cent of the value of funds reported by *Fondbolagens Förening*. From 2007 to 2017 the share is a little lower with 80 to 90 per cent coverage.

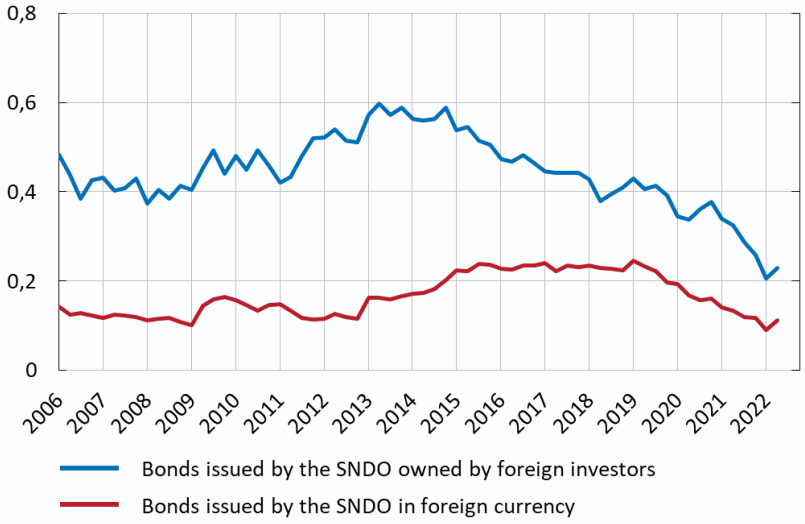
Bonds are issued in Swedish krona and foreign currency

The Riksbank bought government debt denominated solely in Swedish krona but the SNDO also issues public bonds in foreign currency. These bonds are held almost exclusively by foreign investors and allows the SNDO to interact with a wider international investor base.[10] In the event of a sudden need to issue government debt, an existing broad investor base is an advantage.

The share of bonds issued by the SNDO in foreign currency has varied over time, reaching a peak between 2015 to early 2019 (see Figure 2). During this time, the SNDO issued foreign currency bonds on the Riksbank's behalf.

The share of all government and public bonds held by the foreign sector co-varies somewhat with the share of bonds that are issued in foreign currency. However the foreign sector's share of bond holdings fell by 20 percentage points from 2015 to 2019 and did not coincide with a decline in the share of bond issued in foreign currency.

Figure 2. Bonds issued in foreign currency and held by foreign investors
Share of outstanding government and public bonds issued by the SNDO



Source: SNDO and Statistics Sweden.

The share of municipal, covered and corporate bonds issued in foreign currency is somewhat higher – 20 per cent of covered bonds, 30 per cent of municipal bonds and over 50 per cent of non-financial corporate bonds have been issued in foreign currency on average since 2019.[11]

[10] The value of foreign-currency issued public bonds reported by the SNDO corresponds very closely with non-residents' holdings of foreign-currency bonds issued by the Swedish government as reported in the IIP.

[11] Based on data in VINN.

However, since 2019 and 2021 respectively, the Financial Accounts and Balance of Payments data on securities holdings are based on the data in VINN leading to better alignment between the IIP data and Financial Accounts. The Financial Accounts also underwent a methodological change starting 2019 to include short positions in debt securities which presents as a break in the data series for sectors' securities holdings.

Regarding repo transactions -- which are a common form of financial transaction between bond holders and money-market participants – when an investor temporarily sells a bond in a repo transaction, the bond remains on the investor's balance sheet, in line with standard accounting practices. In other words, repo transactions are not registered as sales from the point of view of bond holdings. When an investor, often a bank, sells a security without first owning the bond this generates a short (negative) position. Short positions are incorporated in the IIP data and VINN and in the Financial Accounts after 2019.[12]

4 From whom has the Riksbank purchased?

In this section I illustrate how sectoral bond holdings have changed during periods in which the Riksbank has purchased bonds. For 2015 to 2017 the focus is upon holdings of government bonds whereas for the pandemic period I assess holdings of all the types of bonds that the Riksbank purchased. I complement the descriptive statistics with an econometric analysis of the response of different sectors' government bond holdings to the Riksbank's bond purchases and to other variables.

Figure 3 shows the holdings by sector of Swedish government bonds issued in all currencies reported by the Financial Accounts.[13] I categorise domestic investors into three subsectors whose holdings sum to the holdings of the domestic sector excluding the Riksbank – insurance companies and pension funds;[14] the financial sector including banks, mortgage institutions and investment funds; and the non-financial sector which includes non-financial firms, households and the public sector.[15] The break in the data series in 2019 Q1 is evident, with sharply less holdings attributed to domestic financial sector as short positions were incorporated and a mirror-image increase in holdings attributed to the foreign sector. Even with this methodological change, the pronounced decline in the foreign sector's holdings since 2015 is visible.

The Financial Accounts do not report debt securities issued in Swedish krona separately from debt securities issued in foreign currency (see fact box on page 88).

[12] Prior to 2019, because the Financial Accounts does not incorporate short positions of domestic investors, it potentially overstates the holdings of domestic investors and understates the holdings of foreign investors relative to what is reported in the IIP.

[13] The Financial Accounts report the market value of assets and thus the numbers shown in Figure 3 are slightly higher than the nominal value of holdings reported by the Riksbank and shown in Figure 1.

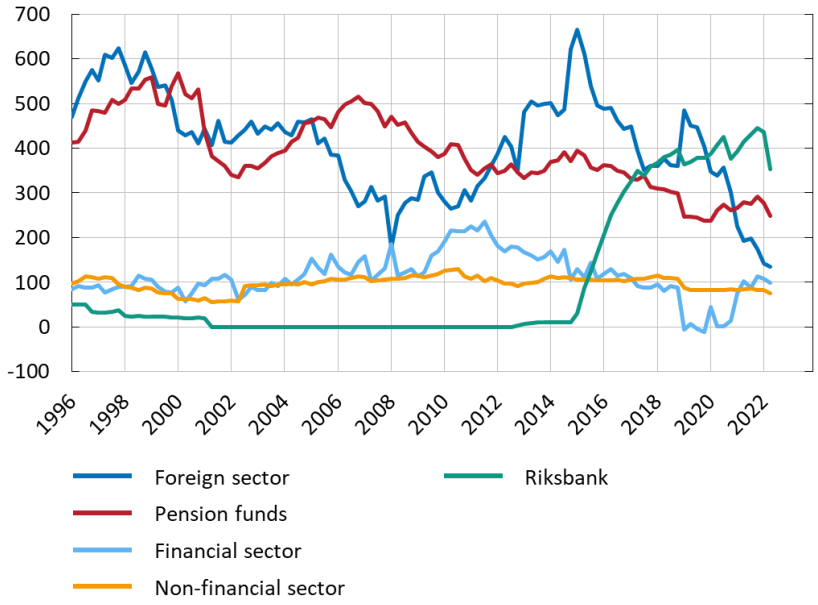
[14] This category includes Sweden's public pension funds (*allmänna pensionsfonder* AP-funds 1, 2, 3, 4 and 6) and *Pensionsmyndigheten*.

[15] This category includes non-profit institutions serving households. The public sector includes public authorities, public companies, municipalities and regions and funds and foundations that are controlled and mainly financed by the state. Within the non-financial sector, an increase in central government holdings of government bonds was offset by a decline in households' holdings when the SNDO ceased issuing *premieobligationer* in 2016.

The Riksbank has only purchased government bonds issued in Swedish krona. To get closer to answering the question of who sold these bonds, Figure 4 shows the share of government bonds issued in Swedish krona held by the Riksbank, the foreign sector and the domestic sector excluding the Riksbank respectively based on the IIP data and the SNDO's issuance statistics. The figure indicates that the ownership share of foreign and domestic investors declined in tandem as the Riksbank increased its ownership share during 2015 and 2017 but that the foreign ownership share has declined steeply since 2021.

Figure 3. Holdings of government and public bonds issued by the SNDO by sector as reported in the Financial Accounts

SEK billion



Note: The data include holdings of government bonds issued in Swedish krona and public bonds in foreign currency by the SNDO. There is a break in 2019 Q1 when the securities statistics in the Financial Accounts were harmonised with VINN and permitted short positions.

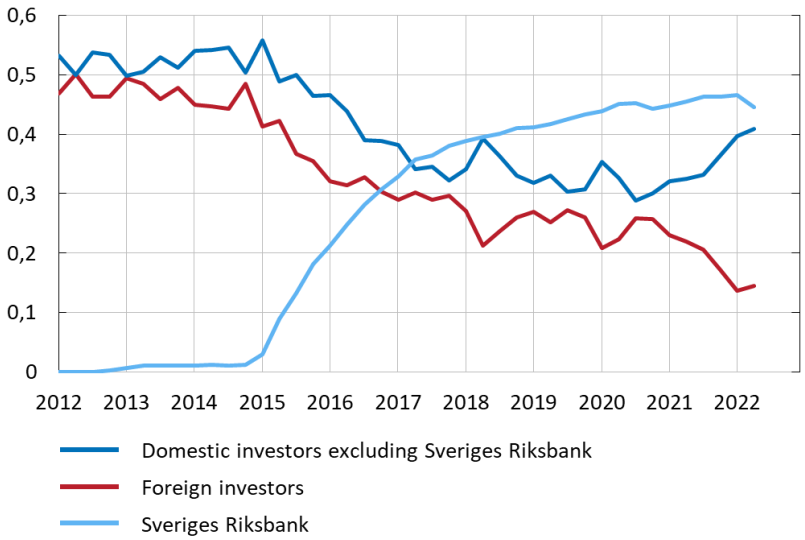
Source: Statistics Sweden.

4.1 Riksbank Swedish government bond purchases 2015 to 2017

Of the Riksbank's net purchases of government bonds for roughly 300 billion between 2015 to 2017 (nearly 350 billion in market value terms), the foreign and domestic sector each accounted for roughly half of the sales (see Figure 5). Net issuance was modest. The Riksbank's ownership share rose to just under 40 per cent of the outstanding stock of government bonds while the respective shares of the foreign and domestic sectors each fell by about 20 percentage points over this period (see Figure 4).

Figure 4. Holdings of government bonds issued by the SNDO by sector

Share of outstanding government bonds issued by the SNDO

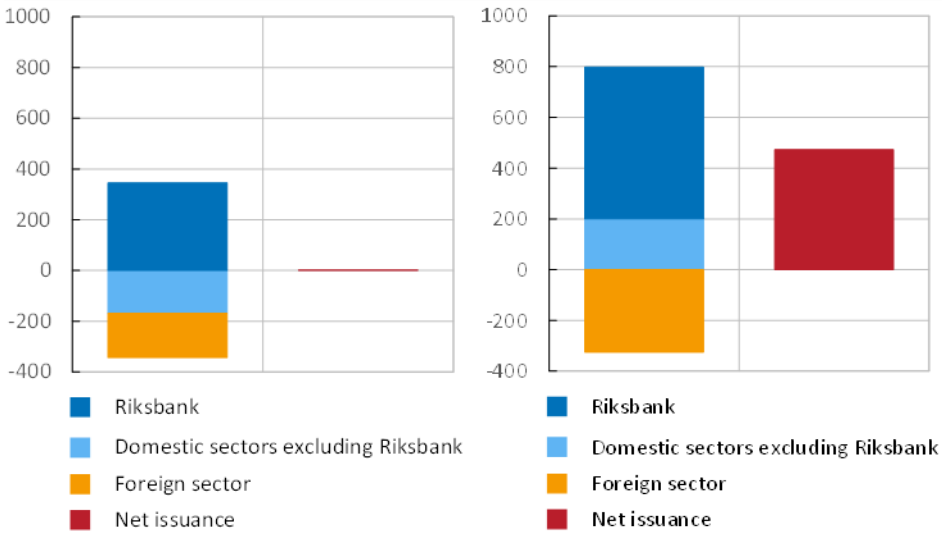


Note. The holdings of the domestic sector excluding the Riksbank are calculated as the market value of outstanding government bonds reported by the SNDO minus foreign investors' holdings of government bonds as reported in the IIP.

Source: Statistics Sweden and the SNDO.

Figure 5. Change in government bond holdings by sector during the Riksbank bond-purchase programs

SEK billion



Note. The left panel shows changes in sectoral holdings and net issuance of Swedish government bonds between 2014 Q4 and 2017 Q4 based on IIP data and the SNDO's data on outstanding debt. The right panel shows changes in sectoral holdings and net issuance between 2019 Q4 and 2021 Q4 of government-, municipal-, mortgage covered- and non-financial corporate bonds issued in Swedish krona reported in VINN.

Source: Statistics Sweden and Sveriges Riksbank.

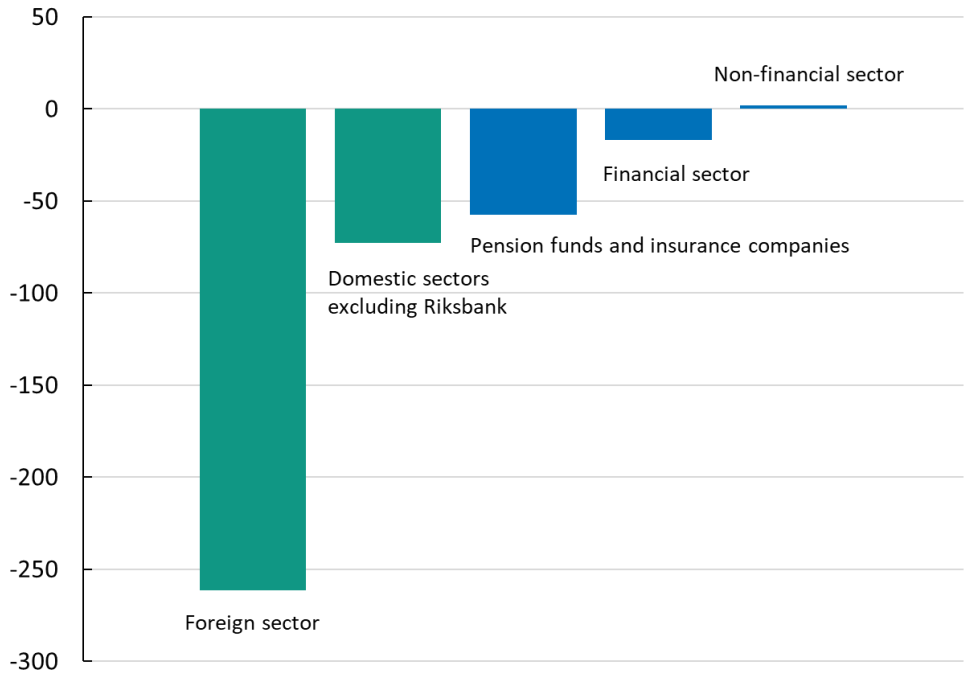
During the initial year of purchases, 2015, the foreign sector shed government bonds rapidly and at a faster than the domestic sector before slowing in 2016 and 2017. Ownership shares varied somewhat during 2018 and 2019 but seen to the end of 2019, which includes the period of reinvestment of the portfolio, the two sectors sold a roughly similar value of bonds to the Riksbank. This is despite the ownership share of foreign investors being on average 10 percentage points lower than the domestic share.

The Financial Accounts attribute three quarters of sales of government bonds to the Riksbank between 2015 and 2017 to foreign investors.[16] Indeed, the foreign sector is reported to have sold 40 per cent of its holdings as of 2014 Q4. Among domestic investors, insurance companies and pension funds were the primary sellers of government bonds (see Figure 6). Even though the absolute value of government bonds sold by the financial sector was modest, the financial sector sold 15 per cent of its initial 2014 Q4 holdings, a similar propensity to the insurance and pension sector. Recall, however, that the Financial Accounts prior to 2019 report only long positions. Domestic sectors' short positions were likely increasing during this period – in particular banks' – so the amounts shown in Figure 6 likely underestimate the sales of domestic investors and overestimate the sales of foreign investors.

[16] The foreign sector's holdings of public bonds issued in foreign currency increased somewhat during 2015 to 2017, by about 30 billion according to the IIP data. Thus the decline in the foreign sector's holdings of bonds issued by the SNDO reported in the Financial Accounts reflects a decline in holdings specifically of government bonds issued in Swedish krona.

Figure 6. Change in holdings of Swedish government and public bonds issued by the SNDO by sector

SEK billion, change from 2014 Q4 to 2017 Q4



Note: The blue bars show changes in the holdings of domestic pension funds and insurance companies and the domestic financial and non-financial sectors and sum to the green bar which shows the change in holdings of the Swedish domestic sector excluding the Riksbank. The data are from the Financial Accounts.

Source: Statistics Sweden.

4.2 Pandemic bond purchases 2020 to 2021

During the covid-19 pandemic, foreign investors continued to be the dominant net sellers of the bonds that the Riksbank purchased (see Figure 5). The Riksbank's bond holdings increased by approximately 600 billion between 2020 and 2021.[17] Domestic investors also increased their holdings by about 200 billion. In part these increases absorbed new issuance, in part the foreign sector sold approximately 300 billion.

Foreign investors continued to sell government bonds, extending the decline in the foreign sector's ownership share sharply from 2021 as seen in Figure 4.[18] Foreign investors also on net sold municipal and covered bonds (Figure 7) with more than half of the Riksbank's purchases of covered bonds sold by foreign investors. Moreover, foreign investors sold a much larger share of their holdings than did the domestic

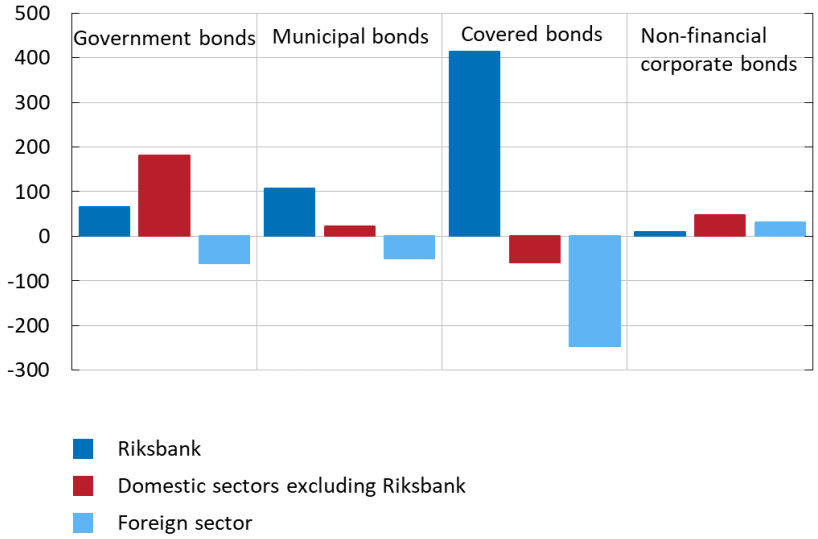
[17] The Riksbank purchased bonds, bill and certificate for a nominal value of 700 billion from March 2020 to the end of 2021. The change in the bond holdings shown in Figure 5 is only 600 million. The difference owes to maturing bonds and that the bill and certificate programs were also included in purchases for 700 billion.

[18] Foreign investors have anecdotally been more active in supplying government bonds to domestic investors in short-term repo transactions as bonds have become scarcer and interest rates on repo transactions have fallen. As explained above, because bonds sold in repo transactions continue to be recorded on the balance sheet of the original owner of the bond, the decline in foreign ownership is not attributable to this possible increase in repo activity.

sector. The foreign sector sold 40 per cent of its 2019 Q4 holdings of Swedish government and municipal bonds (issued in Swedish krona) and 50 per cent of its holdings of covered bonds issued in Swedish krona. In contrast, domestic investors increased their holdings of government and municipal bonds and sold just 4 per cent per cent of their intial holdings covered bonds. Net issuance of non-financial corporate bonds increased during the pandemic and all sectors increased their holdings. The increase in the foreign sector's holdings of non-financial corporate is modest but indicates a small shift toward a riskier asset class in Sweden.

Figure 7. Change in holdings of bonds by sector and by issuer type

SEK billion, change from 2019 Q4 to 2021 Q4



Note. The figure shows the change in holdings of bonds issued in Swedish krona as reported in VINN. Municipal bonds include bonds issued by Kommuninvest, municipalities and regions.

Source: Statistics Sweden and Sveriges Riksbank.

4.3 Econometric analysis of government bond sales

In this section I investigate the relationship between the Riksbank's purchases of government bonds, bond supply and the propensities of sectors to sell bonds.

I follow Carpenter et al. (2015) and estimate a regressions in which the dependent variable is the change in the government bond holdings of a given sector and the key independent variable is the change in the Riksbank's net bond purchases. I also control for changes in the outstanding stock of government bonds, other financial variables and include an autoregressive term. The benchmark estimation takes the following form:

$$d(holding_i)_t = \alpha + \beta_1 d(holding_i)_{t-1} + \beta_2 d(holding_{RB})_t + \beta_3 d(outstanding)_t + \varepsilon_t, \quad (1)$$

where i is an index for the sector that indicates the foreign sector, the domestic sector as a whole excluding the Riksbank, and the three domestic subsectors

described earlier. The regressors $d(holding_{RB})$ and $d(outstanding)$ are the quarterly change in the Riksbank's holdings of Swedish government bonds and the change in outstanding bonds issued by the SNDO. The regressions are estimated on quarterly changes on data in the Financial Accounts from 1996 Q1 to 2022 Q2 because of its long data history and on data from the IIP from 2006 Q1 to 2022 Q2.

Figure 8. Propensity to sell government bonds in response to the Riksbank's purchases

Coefficient estimates of β_2 and long-run coefficient from equation (1)

Note: . The figure show the point estimate of β_2 in blue, the 95 per cent confidence interval as a grey line and the long-run coefficient in orange. Regressions estimated with quarterly data from the Financial Accounts from 1996 Q3 to 2022 Q2.

For estimations with the Financial Accounts data, a dummy variable $Dummy_{2019\,Q1,t} = 1$ in 2019 Q1 accounts for the methodological change in that quarter that causes a one-off jump in the differenced data. The main coefficient estimates are shown in Tables 1 and 2 in the Appendix.

4.3.1 Foreign investors adjust their bond holdings by more than domestic investors

Figure 8 presents the estimates of coefficient β_2, which measures the degree to which sector *i*'s holdings of government bonds adjust in conjunction with the Riksbank's purchases of government bonds that quarter. The figure also shows the implied long-run coefficient from taking into account the distributed lag structure of the equation.[19] We can make several observations from the coefficient estimates.

First, the sign of the coefficients is intuitive – each sector reduces its holdings of government bonds as the Riksbank increases its holdings. The foreign sector sells

[19] The auto-regressive nature of equation (1) means that the long-run effect of a regressor is measured as its coefficient scaled by one minus the coefficient on the lagged dependent variable, $\beta_j/(1-\beta_1)$.

government bonds to a greater extent than domestic sectors. For each 100 billion that the Riksbank increases its holdings of government bonds, the foreign sector is estimated to ultimately sell 69 billion while the domestic sector sells SEK 25 billion.[20] Among the domestic subsectors, insurance companies and pension funds are the primary sellers, selling 17 billion for each 100 billion that the Riksbank purchases. Estimates are smaller and less precise for the financial and non-financial sectors indicating that investors in these sectors are relatively inelastic to the Riksbank's purchases.

Second, the foreign sector also absorbs more of the variation in the stock of than the domestic sector. For each 100 billion increase in the outstanding stock of bonds, the foreign sector absorbs 54 billion and the domestic sector absorbs 39 billion. Among the domestic subsectors, Swedish insurance companies and pension funds account for most of this response and adjust their holdings by 28 billion, the financial sector by 9 billion and the non-financial sector by 4 billion.

Third, the point estimates in Table 1 indicate that foreign investors reduce their holdings of government bonds more in response to the Riksbank purchases than to changes in the supply of government bonds. The reverse is true of the domestic sector. However, one cannot reject the null hypothesis that the coefficient on the Riksbank's purchases is in fact equal to that on the outstanding stock. In other words, investors respond to changes to the free float whether it is due to Riksbank purchases or a change in the outstanding supply of SNDO debt.[21]

4.3.2 Results are robust to financial controls and other data sources

As shown in the box on page 88 between 10 and 25 per cent of bonds issued by the SNDO over this sample have been issued in foreign currency and the foreign sector almost exclusively holds these bonds. The Financial Accounts lump together government bonds issued in Swedish krona and public bonds issued in foreign currency so the dependent variable in equation (1) contains both components. Given that my focus is on how sectors have rebalanced their holdings of the government bonds issued in Swedish krona, I use issuance data from the SNDO to separate for government bonds issued in Swedish krona from public bonds issued in foreign currency and include these as separate regressors. This shortens the sample slightly as the necessary data is available from 2002 Q1. The results are shown in panel 2 of Table 1. As expected, he foreign sector's long-run coefficient on foreign currency bonds is close to 1 and including this variable moderates the estimated response of the foreign sector to changes in the supply of Swedish krona issued government bonds.

A further extension is to control for financial variables which might influence the extent of portfolio rebalancing. To capture international conditions, I include the average of the two-year bond spread between Sweden, the US and Germany and the average USDSEK and EURSEK exchange rate. I also include a measure of option-based

[20] The coefficient point estimates do not add up exactly to 1 but the standard errors around the coefficients permit this interpretation.

[21] Free float denotes the stock of bonds available for trading in the marketplace.

volatility, the VIX, to control for periods of heightened financial volatility. For domestic control variables I include the slope of the Swedish government yield curve (10 year to 3 month), a proxy for BBB corporate bond spreads (I use euro area 5 year BBB bond spreads) and the Riksbank's pandemic purchases of municipal, covered and corporate bonds. Coefficient estimates are shown in the third panel of Table 1.

Among the financial variables which are included, I highlight the coefficient on the VIX. For the foreign sector, the coefficient is negative, indicating that in periods of financial volatility, foreign investors sell Swedish government bonds. For a 10 point increase in the VIX, the foreign investors reduce their holdings of Swedish government bonds by 13 billion SEK while domestic investors increase their holdings by approximately the same amount. For context, the VIX rose by 20 points during the height of the pandemic in the spring of 2020. The sign of the coefficients is consistent with capital outflows by foreign investors during times of financial turbulence.

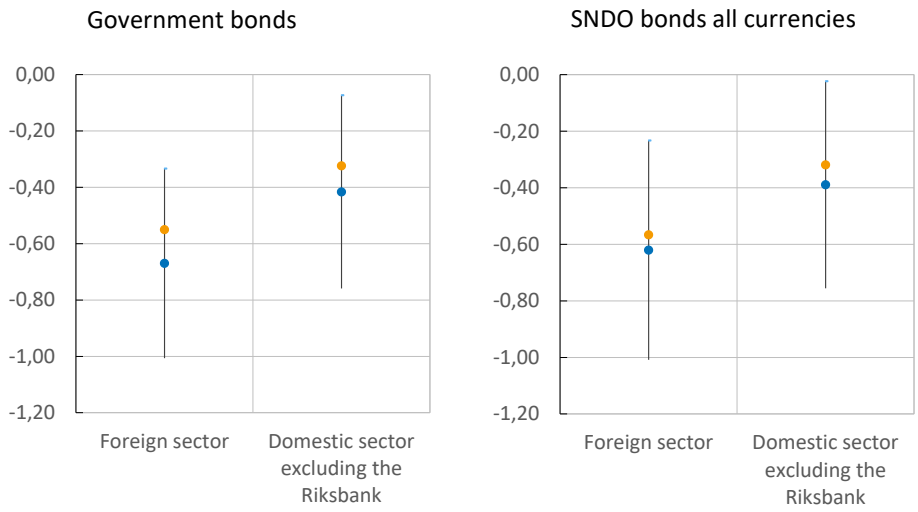
The key results are robust to these different specifications. In all specifications, the foreign sector shows a greater propensity than the domestic sector to reduce its holdings in response to the Riksbank's purchases. In two of three specifications it also adjusts its holdings to the outstanding stock by more than the domestic sector. Insurance companies and pension funds are the dominant seller among the domestic investors. The results are also very similar when estimated on the transaction data in the Financial Accounts net of market valuation effects.

I also conduct the same regression as in equation (1) on a shorter sample of government bond holdings using IIP data and issuance data from the SNDO to isolate holdings of government bonds (that is, bonds issued by the SNDO in Swedish krona). Figure 9 illustrates the coefficient estimates and implied long-run coefficients on the Riksbank's government bond purchases and Table 2 reports the coefficient estimates.

Foreign investors display a more elastic response to the Riksbank's purchases than do domestic investors, confirming the results from the longer sample of Financial Accounts data. The coefficients are statistically significantly different from zero, however, the difference between the coefficients for the two sectors is less pronounced and their confidence intervals overlap. This may reflect the shorter time period for the estimation but may also reflect the fact that the IIP captures the net of short and long positions.

Other factors than those in the regressions surely also play a role in determining a sector's government bond holdings. For example, the liabilities of pension funds and insurance companies, regulations affecting incentives for banks to hold bond inventories, and the risk mandates of investment funds to name just a few. However, with scant information about foreign-sector investors, it is difficult to incorporate these factors.

Figure 9. Coefficient estimates of β_2 and long-run coefficient from equation (1)



Note. The figures show the point estimate of β_2 in blue, a 95 per cent confidence interval as a grey line, and the long-run coefficient in orange. Regressions are estimated with data from the IIP and SNDO. The left panel shows the coefficient estimates in Panel A of Table 2. The right panel shows the coefficient estimates in Panel B of Table 2.

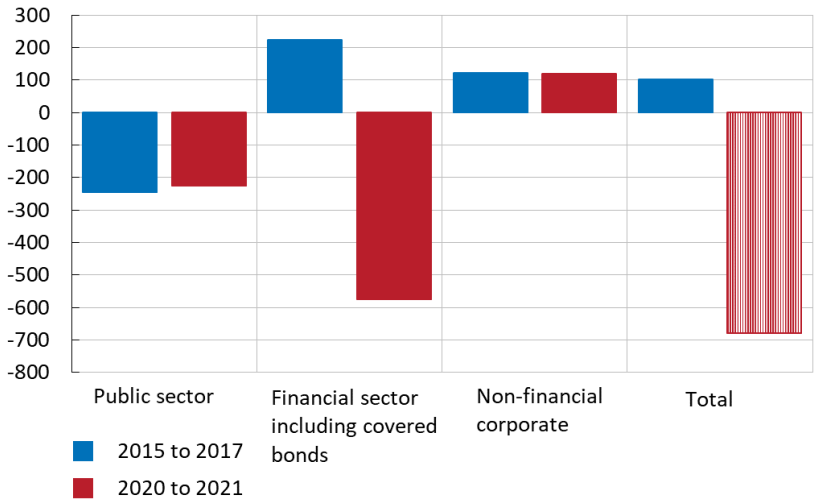
5 How has the foreign sector rebalanced its portfolio of Swedish financial assets?

So far our focus has been on who has sold bonds to the Riksbank. In light of the pronounced role of the foreign sector, how has the foreign sector rebalanced its portfolio in light of its bond sales? Investors displaced from government bonds can rebalance their portfolios along the risk spectrum of Swedish assets or reallocate to alternative investments abroad.

Looking first at the foreign sector's portfolio of Swedish bonds issued in both Swedish krona and foreign currency, Figure 10 illustrates this portfolio grouped into three broad classes – public sector bonds, financial sector bonds including covered bonds, and non-financial corporate bonds. The blue bars are observations for 2015 to 2017, the orange bars for the pandemic episode. The shaded bars to the right show the change in the total bond portfolio.

During 2015 to 2017, sales of public sector bonds (in this case exclusively government bonds) were more than offset by investments in bank, covered and corporate bonds. In other words, foreign investors rebalanced their portfolios toward slightly riskier Swedish bonds. The 2020-2021 episode is somewhat different. Sales of public sector bonds were comparable to the earlier episode, as was reallocation into corporate bonds. However, heavy sales of covered bonds were not fully reinvested in other types of Swedish bonds and as a consequence the foreign sector's total portfolio of Swedish bonds declined.

Figure 10. How has the foreign sector rebalanced its portfolio of Swedish bonds?
SEK billion



Notes. Swedish bonds issued in all currencies from the Financial Accounts. Changes are calculated as follows: 2015 to 2017 is calculated as the change between 2014 Q4 and 2017 Q4; 2020 to 2021 as the change from 2019 Q4 to 2021 Q4. The public sector includes central government and municipalities. Financial sector bonds are bonds issued by financial companies including banks, institutions that issue mortgage covered bonds and other financial companies. Corporate bonds are those issue by non-financial firms. For 2020 to 2021, bonds issued by *Kommuninvest* are included in the Public Sector category, not in the Financial Sector.

Source: Statistics Sweden

Seen from a bigger perspective, the foreign sector's gross financial assets in Sweden increased during 2020 and 2021, largely due to investments in non-financial corporate loans and equity. Indeed since the beginning of 2015, the foreign sector has notably reweighted its portfolio of Swedish assets towards bonds, loans and especially equity in non-financial firms. Whether this development is specifically related to portfolio rebalancing in light of the Riksbank's bond purchase programs or reflects a general international search for yield in a low-interest rate environment we can only speculate about. These descriptive statistics need to be complemented with a systematic econometric analysis to draw firm conclusions.

6 Conclusions and further research

A recurring theme throughout this analysis is that foreign investors have actively sold the bonds that the Riksbank has purchased. Taken as a whole, foreign investors' government bond holdings appear more elastic with respect to the supply of bonds and to the Riksbank's purchases than domestic investors. There are several possible reasons for this.

Foreign investors in Swedish bond markets may, on average, have weaker preferred-habitat behaviour than domestic investors. While I have treated the foreign sector as

one entity, the foreign sector in truth consists of a disparate collection of investors. Investors include pension funds, insurance companies and sovereign wealth funds who are typically thought of as less flexible investors due to liability-matching requirements and mandates that dictate acceptable risk-taking and diversification. But the foreign sector also includes banks who maintain bond inventories for their own and customer trading, and investment and hedge funds who face fewer regulatory constraints and enjoy more scope to seek returns and arbitrage opportunities.

According to indicative data compiled by the IMF on international investment portfolios, about a quarter of the Swedish debt securities held by the foreign sector are held by insurance and pension funds.[22] By comparison, nearly one half of Swedish debt securities held by the Swedish domestic sector are held by insurance companies and pension funds.[23] This difference in composition may lead to different behaviour in the aggregate.

Another possible reason is that from the perspective of an international investor, bonds issued in other countries may be close substitutes for Swedish bonds. Swedish bonds share many of the attributes of bonds of close neighbouring countries in terms of credit rating, return and market liquidity. That a foreign investor is investing in Swedish securities indicates that it has the operational ability and risk mandate to invest in international markets, lowering the threshold to rebalance from one country to another.

Home bias may also drive the tendency of Swedish investors to be relatively inelastic bond holders. Koijen et al. (2017) document home bias in holdings of government bonds across euro area countries and investor sectors. Similarly, risk-averse foreign investors may withdraw from Swedish assets and reduce exposure to the Swedish krona exchange rate during periods of heightened financial risk and uncertainty.

What are the implications of the differences in investor behaviour? According to the theoretical model put forward by Kabaca (2016), interest rate and exchange rate responses to domestic bond purchases are attenuated when investors readily substitute domestic bonds for foreign bonds. But seen from the other direction, this suggests that the less elastic behaviour of the domestic sector may have played an important role for the decline in Swedish interest rates in conjunction with bond purchases. Moreover, for Sweden there is some evidence that the foreign sector has rebalanced its portfolio toward risker Swedish assets, in particular those of the non-financial sector, which is arguably the intended and desirable expansionary flow-on effect of bond purchases.

There are several avenues for further research. The time-series analysis in this paper could be augmented with methods such as local projection analysis to estimate

[22] Data sourced from the Coordinated Portfolio Investment Survey conducted by the IMF, data observation December 2021. Data on investor type is available for only eight countries but together these account for 60 per cent of the foreign sector's holdings of securities emitted by Swedish entities.

[23] Data from VINN, December 2021. This in part reflects the large scale of the collective pension savings system in Sweden (Nilsson et al. 2014).

impulse response functions of sectoral bond holdings. Another promising avenue of research is to fully exploit the micro data in the VINN dataset to explore portfolio rebalancing at the investor level. While the time series dimension of the dataset is short, the cross-sectional richness allows panel estimation of the portfolio rebalancing response to the pandemic bond purchases.

Lastly, the implications for the exchange rate of the foreign sector's role in the transmission of bond purchases is unclear. Theoretically, their presence may attenuate the exchange-rate response because of the high elasticity with which they sell domestic assets. But the capital outflows may bring about more exchange rate depreciation than would occur otherwise. Ultimately the question is an empirical one and the literature on capital flows and exchange rates could be a fruitful starting point to explore the role of the foreign sector's sales of bonds for the exchange rate.

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APPENDIX – Econometric analysis of government bond holdings by sector and the Riksbank's bond purchases

Table 1. Coefficient estimates of equation (1) with data from the Financial Accounts

Coefficient estimates, standard errors and long-run coefficients

	Foreign sector	Domestic sectors excluding Riksbank	Pension funds and insurance companies	Financial sector	Non-financial sector
Panel A: Equation 1, 1996 Q3 to 2022 Q2					
Riksbank purchases, β_2	-0,76***	-0,26**	-0,15**	-0,09	-0,01
$\beta_2/(1-\beta_1)$	-0,69	-0,25	-0,17	-0,07	-0,01
Outstanding stock, β_3	0,60***	0,42***	0,25***	0,11***	0,04***
$\beta_3/(1-\beta_1)$	0,54	0,39	0,28	0,09	0,04
Panel B: Equation 1 controlling for public bonds issued in foreign currency, 2002 Q2 to 2022 Q2					
Riksbank purchases, β_2	-0,65***	-0,35***	-0,13***	-0,15	-0,05
$\beta_2/(1-\beta_1)$	-0,62	-0,31	-0,13	-0,13	-0,04
Outstanding stock, β_3	0,48***	0,53***	0,25***	0,19***	0,06*
$\beta_3/(1-\beta_1)$	0,45	0,46	0,25	0,16	0,06
Foreign currency bonds, β_4	1,21***	-0,25	-0,13	-0,08	-0,04
$\beta_4/(1-\beta_1)$	1,15	-0,22	-0,12	-0,07	-0,03
Panel C: Equation 1 controlling for public bonds issued in foreign currency and financial variables, 2002 Q2 to 2022 Q2					
Riksbank purchases, β_2	-0,66***	-0,32**	-0,15***	-0,10	-0,02
$\beta_2/(1-\beta_1)$	-0,59	-0,27	-0,15	-0,08	-0,02
Outstanding stock, β_3	0,52***	0,47***	0,25***	0,14	0,05*
$\beta_3/(1-\beta_1)$	0,47	0,39	0,24	0,11	0,05
Foreign currency bonds, β_4	1,11***	-0,16	-0,10	-0,01	-0,03
$\beta_4/(1-\beta_1)$	0,98	-0,14	-0,10	-0,01	-0,03
d(VIX)	-1,36***	1,29***	0,15	1,00**	0,20
$\beta_{VIX}/(1-\beta_1)$	-1,21	1,08	0,14	0,76	0,19

Note. The dependent variable is the quarterly change in sector i's holdings of Swedish government bonds (all currencies) expressed in SEK billion. The stars indicate the significance of the estimate coefficient where * indicates significance at the 10 per cent level, ** at the 5 per cent level and *** at the 1 per cent level. The table also reports long-run coefficients, which are the regression coefficient estimates scaled by 1 minus the coefficient on the lagged dependent variable.

Table 2. Coefficient estimates with data from the IIP and SNDO

Coefficient estimates, standard errors and long-run coefficients

	Foreign sector	Domestic sector excluding Riksbank
Panel A: Equation (1) estimated on holdings of government bonds, 2006 Q3 to 2022 Q2		
Riksbank purchases, β_2	-0,67***	-0,42**
$\beta_2/(1-\beta_1)$	-0,55	-0,32
Outstanding stock, β_3	0,57***	0,46***
$\beta_3/(1-\beta_1)$	0,47	0,36
Panel B: Equation (1) estimated on holdings of government and public bonds controlling for public bonds issued in foreign currency, 2006 Q1 to 2022 Q2		
Riksbank purchases, β_2	-0,62***	-0,39**
$\beta_2/(1-\beta_1)$	-0,57	-0,32
Outstanding stock, β_3	0,53***	0,49***
$\beta_3/(1-\beta_1)$	0,49	0,40
Foreign currency bonds, β_4	0,86***	0,08
$\beta_4/(1-\beta_1)$	0,78	0,06

Note. The dependent variable is the quarterly change in sector i's holdings of Swedish government bonds (all currencies) expressed in SEK billion. The stars indicate the significance of the estimate coefficient where * indicates significance at the 10 per cent level, ** at the 5 per cent level and *** at the 1 per cent level. The table also reports long-run coefficients, which are the regression coefficient estimates scaled by 1 minus the coefficient on the lagged dependent variable.

Inflation illiteracy – a micro-data analysis

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Using micro-level survey data from the National Institute of Economic Research's *Economic Tendency Survey*, we find that a relatively large share of Swedish households is ill-informed about the rate of inflation in the economy, with perceived and expected rates of inflation deviating substantially from official measures. Probit analysis of the data indicates that such inflation illiteracy is related to respondent characteristics, including income, education and sex. Finally, we show that the treatment of extreme-value answers has a substantial effect on the aggregated time series typically reported and discussed.

1 Introduction

Surveys of households' perceptions and expectations concerning the macroeconomy, financial matters, and their own economic situation provide important information to both analysts and policymakers. However, survey responses to macroeconomic questions tend to show a fair amount of heterogeneity across respondents. One explanation for this heterogeneity is varying degrees of economic and financial literacy – a feature that has been broadly established in the literature; see, for example, Calvet et al. (2009), Duca and Kumar (2014), Lusardi and Mitchell (2014), Lipshits et al. (2019), and Rumler and Valderrama (2020). Since the degree of economic and financial literacy can also affect households' behaviour, for example with respect to consumption and investment, it has the potential to matter for economic policy; understanding heterogeneity with respect to this issue is accordingly important.[1]

In this article, we study the economic literacy of Swedish households. Data are collected from Sweden's largest household survey – the *Economic Tendency Survey* of

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[1] Heterogeneity in expectations can matter for economic policy as pointed out by, for example, Hommes et al. (2018) and Andrade et al. (2019).

the National Institute of Economic Research (NIER). The survey contains two key variables of interest: 1) the perceived present rate of inflation and 2) the expected rate of inflation one year from now. Using micro-level data from the survey, we find that a substantial share of respondents gives what can be termed "ill-informed" answers – that is, answers that substantially deviate from the official measure of inflation. We denote these respondents as being *inflation illiterate*. Using probit models, we show that the inflation illiteracy relates to key characteristics of the respondents.

In conducting this analysis, we provide further empirical evidence on the issue of heterogeneity among households when it comes to their perceptions and expectations concerning the macroeconomy. Heterogeneity in expectations concerning inflation, interest rates and housing prices has been established by, for example, Bryan and Venkatu (2001a, 2001b), Vissing-Jorgensen (2003), Windsor et al. (2015), Malmendier and Nagel (2016), Ehrmann et al. (2017), and Hjalmarsson and Österholm (2019, 2020, 2021). However, unlike the previous literature, we have in this article an explicit focus on households that are ill-informed about the state of the macroeconomy. New information – regarding both the size of this group and its characteristics – is accordingly provided.

The remainder of the article is organized as follows: In Section 2, we describe the data on perceived inflation and inflation expectations. We present the econometric framework employed and our empirical results in Section 3. Finally, Section 4 provides a discussion regarding the implications of our findings and concludes.

2 Data and descriptive statistics regarding perceived and expected inflation

We employ data from the NIER's *Economic Tendency Survey*. Approximately 1,500 randomly chosen households participate in the survey each month. They answer questions that relate to both their own economic situation and the aggregate Swedish economy. In addition, some of the respondent's personal characteristics – such as income, sex and age – are also recorded in the survey. Answers are collected through telephone interviews and an online questionnaire. The survey was initiated in 1978 and has undergone several revisions since then.[2,3]

The analysis in this article concerns the households' perceived and expected rates of inflation. In the survey, these two questions are phrased as below:[4]

- *Compared with 12 months ago, how much higher in per cent do you think that prices are now?*

[2] For more information about the survey, see NIER (2022b).

[3] Micro data from the survey have previously been used by, for example, Jonung (1981), Jonung and Laidler (1988), Palmqvist and Strömberg (2004), and Hjalmarsson and Österholm (2019, 2020, 2021) to study various aspects of Swedish households' expectations formation.

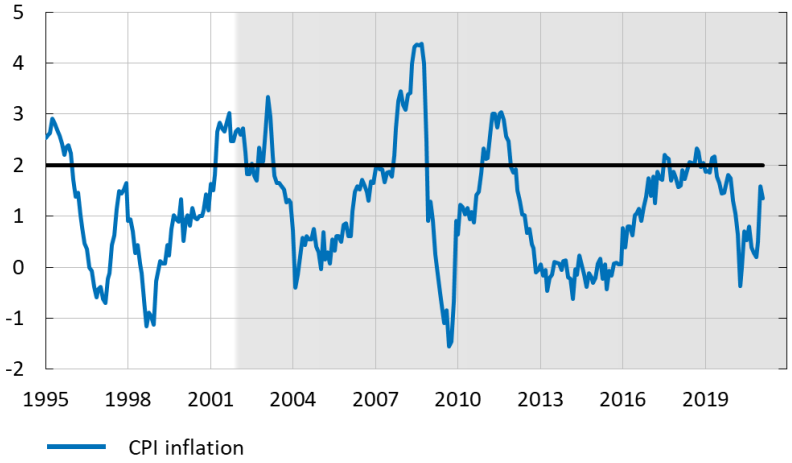
[4] This is the English translation of the questions as presented in NIER (2022b). The actual survey is conducted in Swedish and the original phrasing of the questions can be found in NIER (2022a).

- *Compared with today, how much in per cent do you think that prices will go up (i.e. the rate of inflation 12 months from now)?*

Our sample covers the period from January 2002 to February 2021, which is a period characterized by low and stable inflation following the introduction of the inflation target of two per cent in 1995 (see Figure 1). During this period, inflation, measured by the consumer price index, varied between −1.6 and 4.4 per cent; the average was 1.3 per cent.

Figure 1. CPI inflation

Per cent



Note: Shaded area indicates the sample period for which we have micro data on inflation expectations. The horizontal line represents the Riksbank's inflation target of 2 per cent.[5]

Source: Macrobond.

Most responses to the questions regarding the perceived and expected rates of inflation fall within a range that might be considered reasonable given the historical variation of actual inflation. However, a non-negligible share of the respondents provides an answer of −5 per cent or less, or 10 per cent or more.[6] As Figure 2 illustrates, approximately ten per cent – sometimes as much as twenty per cent – of all households in the survey provide an answer to the two inflation questions outside the −5 to 10 per cent interval.[7] As these responses deviate substantially from the official measure of inflation, we define these respondents as being inflation illiterate. The two cut-off points employed can of course be discussed. An answer of 10 per cent (or more) is obviously not unreasonable in the wake of the dramatic increase in inflation that we have seen during the second half of 2021 and 2022, where, for example, CPI inflation in Sweden reached 10.8 per cent in September 2022. However,

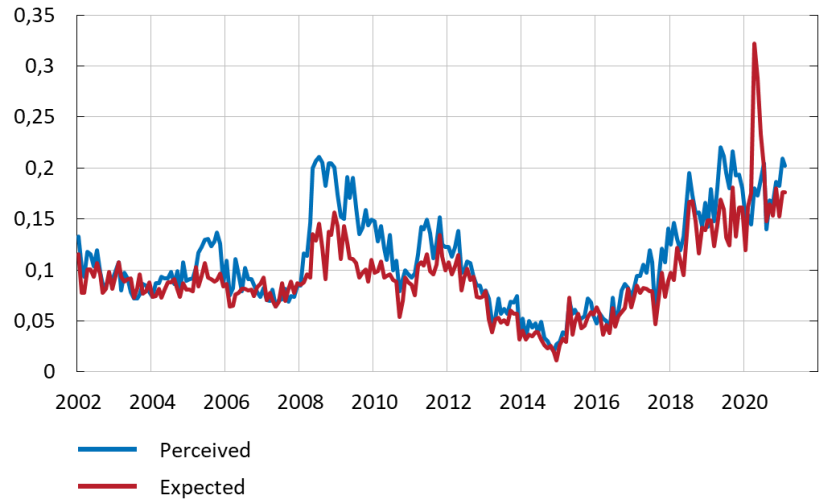
[5] It can be noted that since September 2017, the Riksbank's inflation target is expressed in terms of CPIF inflation. Before then, the target was expressed in terms of CPI inflation. The target level has always been two per cent though.

[6] Pooling all observations in our sample, the correlation between respondents' answers to the two questions is 0.52.

[7] These shares are calculated as the number of respondents who are inflation illiterate divided by the number of respondents who provided an answer to that specific question.

we believe that the cut-off points are appropriate given the stable economic environment of the sample.[8]

Figure 2. Share of respondents that gives the answer ≤-5 per cent or ≥10 per cent



Source: Authors' own calculations.

In order to provide some more information concerning the distribution of the answers, Figures 3 and 4 show time series of the mean, the 10th percentile, the median and the 90th percentile for perceived and expected inflation respectively. Noteworthy is the fact that for both variables, the 10th percentile is almost always given by the number 0. In addition, 0 is also often the median for perceived inflation, pointing to a very large share of the respondents choosing this answer. There also appears to be clustering of answers at 5 and 10, indicated by the fact that P90 for both variables often is given by one of these two numbers.[9] The cluster of answers on certain numbers can also be illustrated using histograms; pooling data across all surveys, this is done in Figures 5 and 6. These figures show that most of the ill-informed responses fall within the range of 10 to 20 per cent; only a very small fraction is less than −5 per cent. Two per cent of all responses indicate an inflation rate of 20 per cent or more, with the highest response being 300 per cent (truncated from the figure).[10]

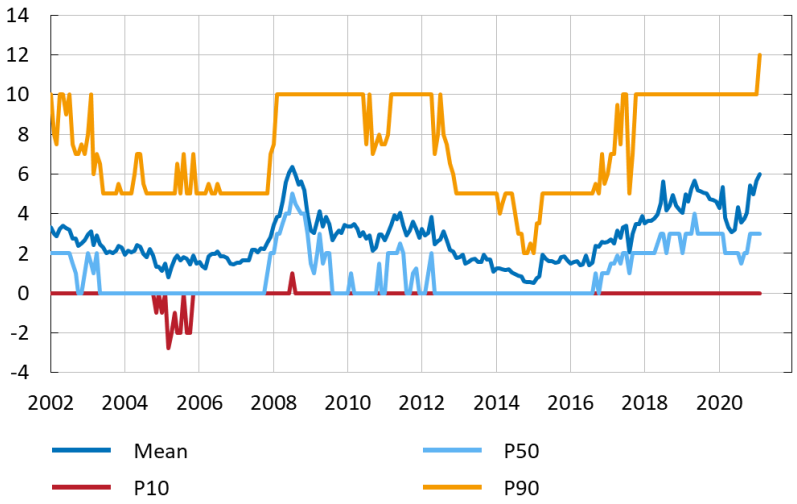
[8] The definition of "reasonable" is after all dependent on the environment that the respondent encounters. For example, consider the task of predicting the temperature tomorrow in Stockholm. The answer "−10 degrees Celsius" might be highly reasonable in January. However, a respondent giving such an answer in July is clearly not well-informed.

[9] The tendency of respondents in a survey to prefer "round" numbers – possibly as a sign of uncertainty – has been pointed out by, for example, Kleinjans and van Soest (2014) and Binder (2017).

[10] Extreme answers could be a matter of a respondent not taking the survey seriously (or wanting to "protest") rather than inflation illiteracy. However, we cannot distinguish between these cases and therefore treat all answers that are −5 per cent or less, or 10 per cent or more as a sign of illiteracy as it seems likely that respondents in general answer the survey with good intent.

Figure 3. Mean and selected percentiles over time – perceived inflation

Per cent

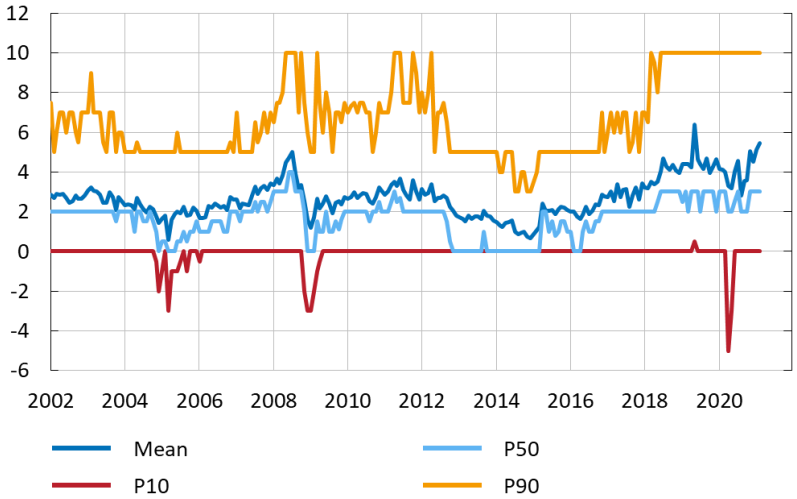


Note: P10 is the 10th percentile. P50 is the median. P90 is the 90th percentile.

Source: Authors' own calculations.

Figure 4. Mean and selected percentiles over time – expected inflation

Per cent

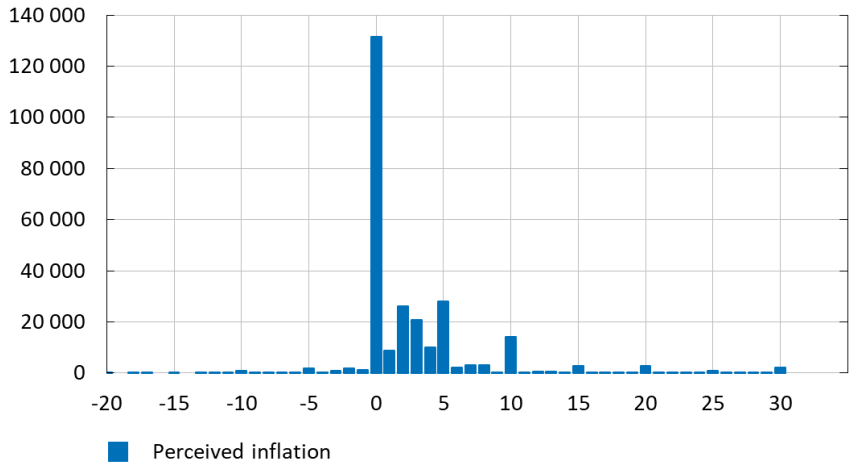


Note: P10 is the 10th percentile. P50 is the median. P90 is the 90th percentile.

Source: Authors' own calculations.

Figure 5. Distribution of answers for perceived present rate of inflation

Frequency on vertical axis. Per cent on horizontal axis.

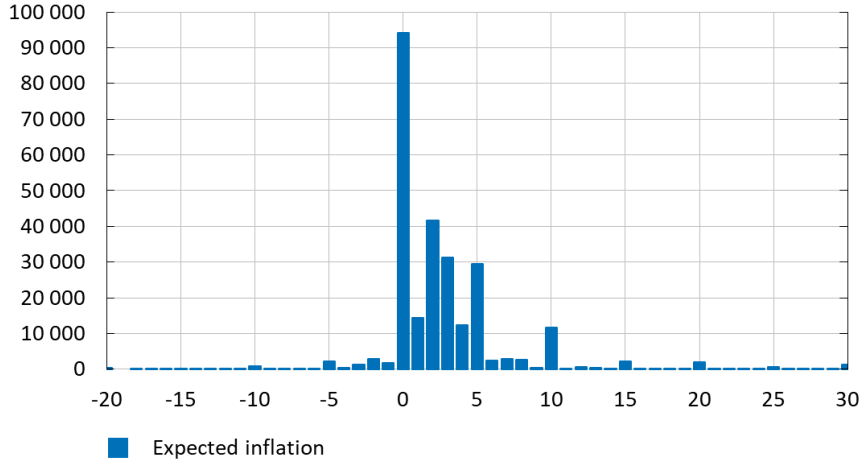


Note: Answers pooled across all surveys. Answers above 30% and below −20% are counted as equal to 30% and -20%, respectively, when creating the figure.

Source: Authors' own calculations

Figure 6. Distribution of answers for expected rate of inflation

Frequency on vertical axis. Per cent on horizontal axis.



Note: Answers pooled across all surveys. Answers above 30% and below −20% are counted as equal to 30% and -20%, respectively, when creating the figure.

Source: Authors' own calculations

3 Econometric analysis and results

To explore whether inflation illiteracy is related to the characteristics of the respondents, we generate two binary variables: y_t^p, which relates to perceived inflation, and y_t^e, which relates to inflation expectations. y_t^p takes on the value one if the respondent states that perceived inflation is *a)* −5 per cent or lower or *b)* 10 per cent or higher; for values of perceived inflation between −5 and 10, y_t^p takes on the value 0. y_t^e is generated according to the same principle – that is, it takes on the value

0 for values of expected inflation between −5 per cent and 10 per cent (and 1 otherwise). These variables constitute the dependent variables in the two probit models that we estimate. Explanatory variables in these regressions are dummy variables, which reflect different respondent characteristics; these have been created following Hjalmarsson and Österholm (2019). We present the explanatory variables in Table 1, where we also indicate which category has been excluded for each set of dummy variables. Also included in the estimations are time dummies to control for business cycle variations. Since not all respondents provide an answer to all questions regarding characteristics, the samples which we use for estimation of our models are smaller than those used to calculate the shares in Figure 2. Pooling the observations from all monthly surveys, we estimate probit models with y_t^p and y_t^e as dependent variables, respectively.

The regression results are shown in Table 2. To make them easily interpretable, we present them as average marginal effects. Thus, since all variables in the regression are dummy variables, each estimate can be interpreted as the average change in probability of an "illiterate" response when the corresponding variable changes from zero to one. For instance, looking at perceived present inflation, a low-income respondent is 5.5 percentage points more likely to exhibit illiteracy than a high-income respondent (the omitted category). The corresponding effect for expected inflation is 5.1 percentage points.

Overall, the results show that the estimated effects are mostly similar for perceived and expected inflation. Inflation illiteracy is strongly related to many of the characteristics of the respondents. In particular – and in line with the general results from the literature on economic and financial literacy – households with lower levels of income and education are more likely to provide an ill-informed answer; see, for example, Calvet et al. (2009) and Campbell et al. (2011).[11] Lower income or education each increases the probability of inflation illiteracy by about 4 to 5 percentage points. Other socioeconomic characteristics are also found to be significant, but the estimated effects are often relatively small.

Sex and age also tend to be significant explanatory variables, although the age effect is considerably weaker for perceived inflation. Women and younger households are more likely to be inflation illiterate, with marginal effects of around 3 percentage points for expected inflation.

[11] Households that have chosen not to state their income ("missing income" category) also have a higher probability. As pointed out by Hjalmarsson and Österholm (2020), these individuals tend to have lower education and are more likely not to be employed, compared to the respondents who state their income.

Table 1. Respondent characteristics

Variable	Division in survey	Regression label
Income	First quartile Second quartile Third quartile Fourth quartile	LOW_INCOME MED_LOW_INCOME MED_HIGH_INCOME *Excluded category* MISSING_INCOME
Education	Basic Upper secondary Tertiary	LOW_EDUCATION MED_EDUCATION *Excluded category*
Sex	Female Male	FEMALE *Excluded category*
Employment	Not employed Employed	NOT_EMPLOYED *Excluded category*
Age	16-24 25-34 35-49 50-64 65-	LOW_AGE MED_LOW_AGE MED_AGE MED_HIGH_AGE *Excluded category*
Type of housing	Owned apartment Owned house Rental apartment Other	*Combined to* OWN_HOUSE_APT *Combined to* OWN_HOUSE_APT *Combined to excluded category* *Combined to excluded category*
Family	Single without children Single with children Married/cohabiting with children Other Married/cohabiting without children	HH_SINGLE HH_SINGLE_CHILD HH_MARRIED_CHILD HH_OTHER *Excluded category*
Region	Big city county Forest county Other	BIG_CITY *Excluded category* LOCATION_OTHER

Note: The category "MISSING_INCOME" consists of the individuals who did not respond to the question regarding income.

Table 2. Results from probit regressions – average marginal effects

	Dependent variable: Perceived present inflation	Dependent variable: Expected inflation one year from now
MISSING_INCOME	0.046*** (0.002)	0.047*** (0.002)
LOW_INCOME	0.055*** (0.003)	0.051*** (0.002)
MED_LOW_INCOME	0.046*** (0.002)	0.043*** (0.002)
MED_HIGH_INCOME	0.024*** (0.002)	0.023*** (0.002)
LOW_EDUCATION	0.041*** (0.002)	0.043*** (0.002)
MED_EDUCATION	0.039*** (0.001)	0.037*** (0.001)
FEMALE	0.029*** (0.001)	0.031*** (0.001)
NOT_EMPLOYED	0.012*** (0.002)	0.006*** (0.001)
LOW_AGE	0.012*** (0.003)	0.035*** (0.003)
MED_LOW_AGE	0.003 (0.003)	0.021*** (0.002)
MED_AGE	0.007*** (0.003)	0.019*** (0.002)
MED_HIGH_AGE	0.008*** (0.002)	0.017*** (0.002)
OWN_HOUSE_APT	-0.017*** (0.002)	-0.018*** (0.001)
HH_SINGLE	-0.013*** (0.002)	-0.012*** (0.002)
HH_SINGLE_CHILD	0.023*** (0.003)	0.018*** (0.003)
HH_MARRIED_CHILD	0.017*** (0.002)	0.012*** (0.002)
HH_OTHER	0.015*** (0.002)	0.013*** (0.002)
BIG_CITY	0.006*** (0.002)	0.003** (0.002)
LOCATION_OTHER	0.002 (0.002)	0.001 (0.002)
Number of observations	264,725	260,903

Note: Average marginal effects are presented. Standard errors are clustered on time and given in parentheses (). ***, ** and * indicate significance at the 1, 5 and 10 per cent levels respectively. Time dummies are included in both regressions.

4 Implications and conclusion

The data from the NIER's *Economic Tendency Survey* clearly suggest that a large share of the respondents is what can be defined as inflation illiterate. We find that inflation illiteracy is robustly related to several characteristics of the respondents, including education, income and sex.

Since the level of education matters, our results indicate that the degree of understanding of economic concepts is relevant for inflation illiteracy. However, since sex and age are also significant explanatory variables, other channels are also likely to be part of the story. Differences in experiences, consumption baskets, willingness to collect and process information, or time available for processing information may all be of relevance when explaining this heterogeneity, in line with suggestions by, for example, Jonung (1981), Malmendier and Nagel (2016) and Cavallo et al. (2017).

Establishing the presence of inflation illiteracy and how this property is related to respondent characteristics are important issues of general interest. In addition, we want to highlight two practical implications from our analysis.

First, the fact that a considerable share of Swedish households might be inflation illiterate should be relevant both when modelling the economy and conducting economic policy since it is not unlikely that these households take poorly founded economic decisions.

Second, when it comes to household surveys, extreme-value answers risk influencing aggregated time series (such as the mean inflation expectation) in an unwanted way and could mislead policy makers who analyse them. Household surveys should therefore be adjusted for outliers using a reliable method before aggregated time series are calculated.

The NIER does have a procedure for outlier adjustment, in which observations that are judged as outliers according to an algorithm based on the quartiles of the data are removed.[12] Together with a level adjustment of parts of the time series, the outlier-adjusted data are then used to calculate the official time series for perceived and expected inflation that the NIER publishes in the *Economic Tendency Survey*;[13] these series are shown in Figures 7 and 8, where they are denoted "NIER, official".[14]

[12] More specifically, outliers are treated as follows in a given cross section. The first (Q1) and third (Q3) quartiles of the responses are calculated, as well as the inter-quartile range, QR=Q3−Q1. Responses greater than Q3+3QR or smaller than Q1−3QR are omitted. See National Institute of Economic Research (2022a, p 15) for details.

[13] The method for gathering the data of the *Economic Tendency Survey* was changed in November 2019. Historically, the survey used to be conducted purely by telephone but nowadays some respondents give their answers on the telephone whereas others do it through an online form. Between October 2019 and January 2020, the two methods were used in parallel and could accordingly be compared. The differences observed during this period are used to adjust historical data to make them more comparable to those gathered by the present method; see National Institute of Economic Research (2020) for details. For perceived and expected inflation, this means that the historical (that is, prior to November 2019) cross-sectional means are shifted up by 1.65 and 0.67 percentage points respectively.

[14] An EU harmonisation of the survey meant that the questions concerning inflation in the *Economic Tendency Survey* were changed in April 2015. At the same time, the NIER also changed its method for

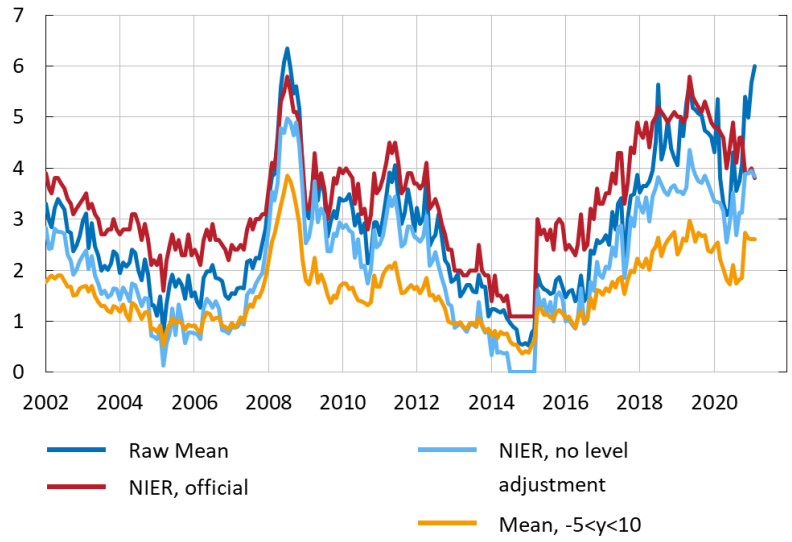
However, aggregated time series may differ substantially depending on the choice of methodology when it comes to outlier adjustment. We illustrate this in Figures 7 and 8 by showing different measures of perceived and expected inflation, using various ways of controlling for outliers. The "raw mean" series are simply the cross-sectional averages across all respondents that provide an answer to the survey question and thus provide the unadjusted aggregate benchmark. The "NIER, no level adjustment" series represent our calculations of what the aggregated series looks like after following NIER's documentation on how outliers are controlled for but where no level adjustment is made. Finally, the series "mean, –5<y<10" are cross-sectional means taken after having removed all responses that we classify as inflation illiterate. It should be noted that removing observations based on our illiteracy measure is not a method that we suggest should be implemented in practice; while we believe that it is a reasonable definition for the sample in question, it is too rigid to be used in general. This is exemplified by the simple fact that we pointed out above: Under present conditions – with very high actual inflation numbers – stating that perceived and/or expected inflation is 10 per cent (or more) is obviously not unreasonable. Using the illiteracy measure as a criterion for removing observations serves here only as an illustration.

Two observations are immediately evident from studying Figures 7 and 8: 1) adjusting for outliers can have a substantial effect on the aggregate numbers and 2) different approaches may lead to quite different time series. In most periods, the removal of observations based on our illiteracy classification results in the largest effect, and often reduces the aggregate measures by a full percentage point or more. The NIER's official series and our own proxy differ markedly, but they both show that the NIER's method generates a less aggressive adjustment to the raw mean than when observations are removed based on our illiteracy measure. This shows that the choice of outlier control mechanism can have first-order effects when creating aggregated means.

calculating perceived and expected inflation; see National Institute of Economic Research (2022b) for details. The time series using this new method begin in April 2015. "NIER, official" is therefore given by the time series which the NIER denotes as based on the "old method" between January 2002 and March 2015, and the time series using the present method between April 2015 and February 2021.

Figure 7. Perceived inflation

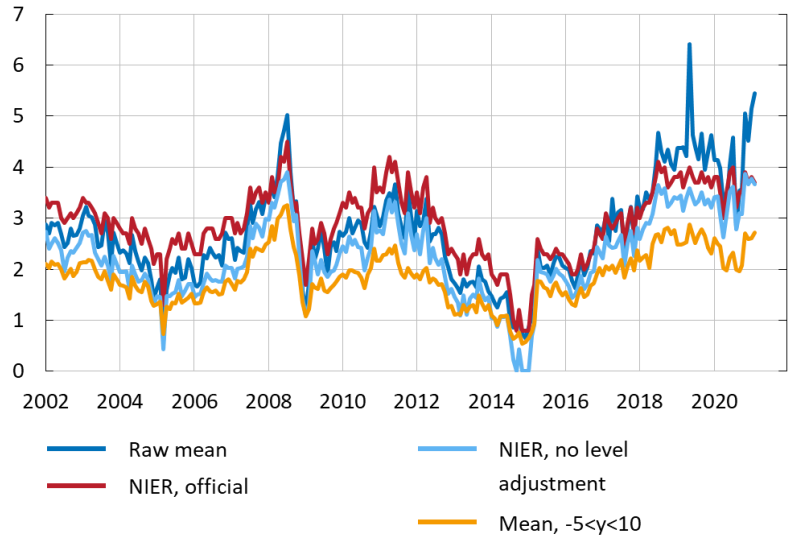
Per cent



Source: National Institute of Economic Research and authors' own calculations.

Figure 8. Expected inflation

Per cent



Source: National Institute of Economic Research and authors' own calculations.

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