

The implications of an e-krona for the Riksbank's operational framework for implementing monetary policy

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If the Riksbank introduces an e-krona, it will mean, to put it simply, that the Riksbank extends its counterparty circle to include households and companies that are not credit institutions. These groups will have the opportunity to have a direct claim on the Riksbank. The e-krona will be a further item on the Riksbank's balance sheet that can be both extensive and volatile. The volatility means that the current framework for implementing monetary policy may need to be adapted to reduce the risk of volatility in short market rates. The e-krona is an example of how the framework for implementing monetary policy needs to be reformed apace with the changes in the surrounding world to continue to function smoothly. If the e-krona is not an interest-bearing instrument, it is probably no longer possible to have negative interest rates on the monetary policy instruments, for instance a negative policy rate. However, if the e-krona is an interest-bearing instrument, it can be regarded as a monetary policy instrument and the interest rate on it set in a way that is compatible with the monetary policy conducted.

1 Introduction

This article analyses the possible consequences of the introduction of a digital e-krona for the Riksbank's framework for implementing monetary policy. By the latter we mean the regulations and the measures taken to put the Executive Board's decisions on the policy rate into practice on the financial markets. Will the practical implementation of monetary policy be the same as now or will it be necessary to make changes?

The Riksbank's ongoing project regarding a potential e-krona contains many questions – technical, legal, policy-related – and these questions are often very complex. As we will see, the effects of an e-krona on the Riksbank's framework for implementing monetary policy may not be so complicated to understand, at least in terms of principles. The reason for this is that the Riksbank already 'issues' digital money, although this is only accessible to the institutions participating in the Riksbank's RIX payment system. That the Riksbank is considering introducing an e-krona can therefore briefly be expressed as the Riksbank considering expanding the circle of those who can receive digital central bank money to include the general public.

But there are questions that are more complicated, and it is difficult to try to answer them in advance. One question is how great the demand for an e-krona will be. One decisive factor will probably be what counterparty circle is given access to an e-krona, as this will

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determine both the level and volatility in demand for the e-krona. In this article, we assume that the general public is allowed to own the e-krona with no limitations. This is an important assumption for our reasoning. Another question is whether or not the e-krona will be interest-bearing. We discuss both cases in the analysis below. Further, we assume that cash will continue to be supplied by the Riksbank as long as there is a demand from the general public.

We begin the article with a brief description of the RIX payment system and how the Riksbank's framework for implementing monetary policy looks now.¹ After that, we analyse the consequences for this framework of introducing an e-krona. The analysis is done in two stages. First, we look at an e-krona that is not interest-bearing and thereby comprises a close substitute for banknotes and coins. In stage two we analyse the consequences of introducing an e-krona that is interest-bearing, which also includes the possibility to have a negative interest rate. After that we discuss the special circumstances that can arise in a period of financial unease. We conclude with some main conclusions. In an appendix we use simplified balance sheets to illustrate what is meant by, for example, central bank money and commercial bank money.

2 The Riksbank's operational framework for the implementation of monetary policy

The Riksbank has chosen under normal circumstances to steer the shortest interest rate on loans from today to the next banking day, what is known as the *overnight rate*, and to rely on this indirectly affecting interest rates for longer maturities.² To steer the overnight rate, the Riksbank uses monetary policy instruments in the form of standing facilities and market operations. The standing facilities are linked to the banks' accounts in the RIX payment system.

RIX is the Riksbank's system for the transfer of funds in accounts and is one of the major hubs of the Swedish financial system.³ The Riksbank gives banks and several other market participants with the right to hold accounts in RIX the opportunity to make transfers to each other in a manner that does not entail credit or liquidity risks. Almost all of the payments in Swedish kronor that are not made internally within an individual bank are handled in the RIX system in some form. To increase the efficiency of the payment system, the Riksbank adds liquidity by granting credit during the day – *intraday credit* – against collateral.

The RIX payment system and the framework for implementing monetary policy interact in several ways. When intraday credit is repaid at the end of the day, the banks may have a surplus or a deficit on their accounts in RIX. To even out the balance, they may need to borrow money from the Riksbank or to deposit money there overnight. The Riksbank's possibilities to influence the overnight interest rate ultimately depends on the Riksbank being in a position to set the terms and the extent of overnight deposits and lending. Moreover, the requirements concerning collateral in RIX for intraday credit are partly the same as those for monetary policy instruments.

The rest of this section discusses the monetary policy instruments in greater detail, and how they have an impact on the Riksbank's balance sheet.

2.1 Standing facilities

The Riksbank offers banks that are monetary policy counterparties to the Riksbank the opportunity to borrow from or deposit money with the Riksbank from one day to the next, that is 'overnight' on predetermined conditions, what is known as *standing facilities*. Using these standing facilities the Riksbank can set limits – an *interest rate corridor* – for the

1 See Sveriges Riksbank (2012) for a description of the RIX payment system and Sellin and Åsberg Sommar (2012) for a detailed description of the framework for the implementation of monetary policy. See also Sellin (2018) for a description of the Riksbank's various operational frameworks since the end of the 19th century.

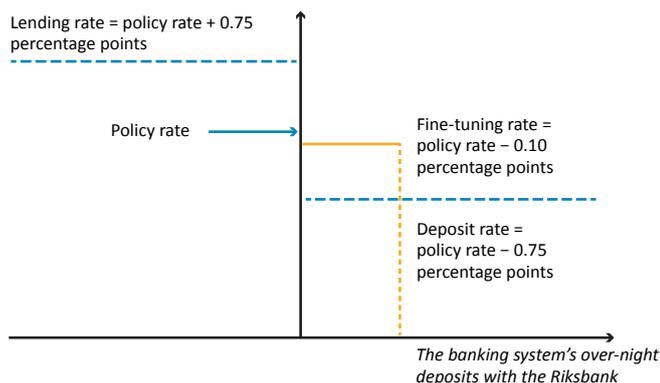
2 The market for balancing liquidity overnight – also known as *the overnight market* – is the market in which banks manage temporary surpluses or deficits in their liquidity in Swedish kronor.

3 The average daily turnover in the RIX system exceeded SEK 600 billion during the first four months of 2018.

overnight rate. The Riksbank's deposit rate comprises the floor and the lending rate comprises the ceiling in this corridor. The overnight interest rate will invariably lie inside the interest rate corridor because a bank in need of liquidity can always borrow from the Riksbank (against collateral) at the lending rate and a bank with surplus liquidity can always deposit the surplus in the Riksbank at the deposit rate. As there is a difference between the deposit and lending rates, the banks have an incentive with regard to overnight loans to agree on an interest rate that lies between the rates they would pay to or receive from the Riksbank. The Riksbank can thus ensure that the overnight rate falls within the interest rate corridor.

The interest rate on the deposit facility (the deposit rate) is currently equal to the Riksbank's policy rate (also known as the repo rate) minus 0.75 percentage points and the interest rate on the lending facility (the lending rate) is equal to the policy rate plus 0.75 percentage points, see Figure 1. If the balance of a bank's account with RIX shows a deficit when the payment system closes for the day, the bank has to pay the lending rate on the balance overnight (that is until the next bank day). If the balance of a bank's account shows a surplus when the payment system closes, the bank earns the deposit rate on the sum overnight. The sum that can be borrowed from the lending facility is limited by the adjusted value of the collateral provided by the bank.⁴ On the other hand, there is no limit on how much a bank may deposit in the deposit facility.

Figure 1. The monetary policy interest rates – the policy rate, the interest rate corridor and the fine-tuning rate



Source: Sveriges Riksbank

2.2 Market operations

However, the standing facilities are not sufficient in themselves to stabilise the overnight rate close to the policy rate. This is because the banking system as a whole may have a deficit or a surplus with regard to RIX and because the interest rate corridor is relatively wide. If the Riksbank did not have further measures to implement, the overnight rate would end up close to the lending rate if the banks in total had a deficit. And vice versa, it would fall close to the deposit rate if the banks in total had a surplus. The Riksbank therefore also carries out market operations to either provide liquidity (which was most often the case up to the year 2008), or to reduce a liquidity surplus.

The market operations can be divided into two categories. In the first, the Riksbank every week issues *Riksbank Certificates*, if the banking system has a liquidity surplus in relation to the Riksbank, or offers *monetary policy repos*, if the banking system has a liquidity deficit in relation to the Riksbank, in both cases with a one-week maturity to the policy rate.

⁴ A so-called haircut is made on all of the collateral the banks need to provide to be able to borrow from the Riksbank. This haircut varies between 0 and 40 per cent for price risk and between 4 and 9 per cent for exchange rate risk.

The Riksbank's monetary policy counterparties are thus given the opportunity to invest in securities with a short maturity (one week) issued by the Riksbank or alternatively to borrow money for one week. The volumes offered correspond to the banking system's liquidity surplus or liquidity deficit.⁵

The second category is the *fine-tuning transactions* the Riksbank implements at the end of every banking day to stabilise the overnight rate close to the policy rate. In the fine-tuning transactions, the Riksbank offers credit against collateral or overnight deposits at an interest rate equal to the policy rate plus/minus 0.10 percentage points. If the banking system as a whole has a liquidity deficit at the end of the day, the Riksbank lends funds, although not to an amount that exceeds the banking system's total deficit. A similar procedure applies if the banking system as a whole has a liquidity surplus at the end of the day. In this case, the Riksbank receives funds, but not to an amount that exceeds the banking system's total surplus. Allocation takes place on a 'first come, first served' basis, as long as there are funds left to lend or deposit. Figure 1 summarises the interest rates in the standing facilities and fine tuning and how they relate to the policy rate.

2.3 The banks' liquidity position, the framework for implementing monetary policy and the Riksbank's balance sheet

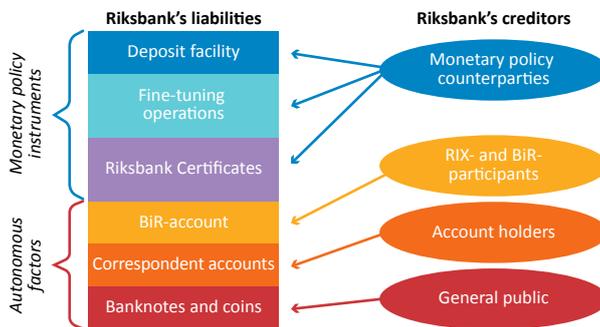
To conclude the description of the operational framework for implementing monetary policy we also need an explanation of how it manages the banking system's liquidity in concrete terms and how the Riksbank's balance sheet is affected. We illustrate here the case where the banking system as a whole has a liquidity surplus against the Riksbank, which is the situation that has prevailed since 2008.

Figure 2 is a schematic description of the liability side of the Riksbank's balance sheet. According to this description, the liability side of the Riksbank's balance sheet can be divided into two parts: the monetary policy instruments and the so-called *autonomous factors*, that is, claims on the Riksbank governed by the creditors' demand and which the Riksbank cannot control. The monetary policy instruments all have the property that they withdraw liquidity – Figure 2 illustrates the situation with a surplus in the banking system – partly in the form of the standing deposit facility and partly in the form of market operations (fine tuning and issuing of certificates). The autonomous factors currently comprise the general public's demand for banknotes and coins, allocations made to the Bankgirot client funds account in RIX to back up real-time payments overnight (BiR account) and deposits and withdrawals from the correspondent accounts with the Riksbank.⁶

⁵ The banking system has had a liquidity surplus since 2008, which has thus meant that the Riksbank has issued Riksbank Certificates every week since then. Prior to 2008, the banking system had a liquidity deficit, which meant that the Riksbank supplied liquidity through repos. See further Nessén et al. (2011).

⁶ Those who have correspondent accounts with the Riksbank are foreign central banks and international financial institutions that need to implement transactions in Swedish krona. Banks that are RIX participants and participants in Bankgirot's BiR system can make provisions in a special account in RIX (the BiR account). These provisions back up the payments made between the banks on Bankgirot's BiR platform overnight when RIX is closed. At present, the BiR platform is only used by the Swish payment service. The banks' total provisions in the BiR account may amount to a maximum of SEK 10 billion with effect from October 2018.

Figure 2. The liability side of the Riksbank's balance sheet and the Riksbank's creditors, in a situation with a liquidity surplus in the banking system



Source: Sveriges Riksbank

In connection with the weekly issues of Riksbank Certificates, the Riksbank forecasts how large the liquidity surpluses will be in the coming week. Firstly, the Riksbank Certificates that mature need to be replaced with new ones. But then claims in the autonomous factors also need to be taken into account. For example, an increased demand for banknotes, new provisions to the BiR account or new deposits in a correspondent account in the Riksbank will lead to the Riksbank's debt to the monetary policy counterparties declining to a corresponding degree, and the amount of new Riksbank Certificates that needs to be issued will be lower.⁷ And the reverse, if the demand for banknotes is expected to decline, the volume of Riksbank Certificates issued needs to be greater. The part of the surplus that is not withdrawn by issuing Riksbank Certificates – either because the banks do not buy all of the certificates issued or because there are unexpected changes in autonomous factors – is then managed by means of the daily fine-tuning transactions.

3 The implications of an e-krona

As we wrote in the introduction, the implications of the e-krona for the operational framework for implementing monetary policy are relatively easy to understand, at least in terms of principle. In this section we begin by first looking at how the balance sheet is affected on an overall level, and then we discuss the effects on the lower bound for the repo rate.

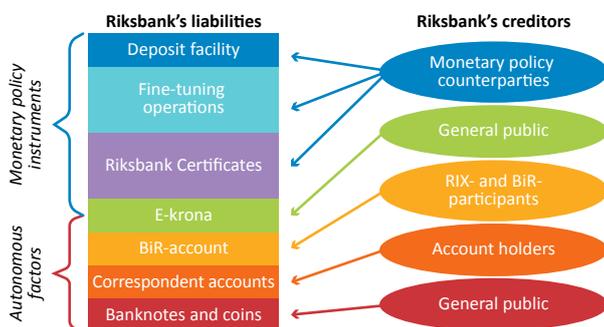
3.1 Effects on the balance sheet

We begin by looking at how the balance sheet is affected. As previously mentioned, the e-krona means that the circle of those who can hold digital central bank money will be extended to include the general public. This entails a new liability item on the Riksbank's balance sheet, with the general public as a counterparty, see Figure 3.⁸ How large this item can become depends on a number of factors and is discussed in two separate articles, see Segendorf (2018) and Juks (2018). In brief, this is a question of how demand for the e-krona would affect, for instance, the demand for banknotes or for normal bank deposits and how the banks would react to it.

⁷ One can also express this as a decline in the banking system's liquidity surplus towards the Riksbank. The Riksbank's total debt is unchanged, but there has been a reallocation from monetary policy liability to autonomous factors.

⁸ This representation applies regardless of the technical design of the e-krona.

Figure 3. The e-krona and the liability side of the Riksbank's balance sheet and the Riksbank's creditors, in a situation with a liquidity surplus in the banking system



Source: Sveriges Riksbank

Whether the e-krona is to be regarded as an autonomous factor or counted as one of the monetary policy instruments depends on whether or not it is interest-bearing.

3.2 An e-krona without interest

If the e-krona is not an interest-bearing instrument, it can be regarded as a further autonomous factor, that is, a claim on the Riksbank that is governed by demand from the general public and which the Riksbank cannot control. As in the case with an increased demand for banknotes and coins, an unexpected increase in the amount of e-krona will lead to the banking system's liquidity surplus declining (or the deficit increasing). An unexpected decline in the amount of e-krona will correspondingly lead to the liquidity surplus increasing. If the banking system has a liquidity deficit to start with, this will of course instead decline. What this means for the practical implementation of monetary policy is that the Riksbank needs to be able to forecast how many e-krona will be demanded in the following week in order to supply or withdraw an appropriate volume of liquidity via market operations. Described in this way, the e-krona would not entail anything significantly new and the current operational framework should be able to deal with it adequately.

However, it appears likely that it will be more difficult to forecast the volume of e-krona than the volume of cash, as it will be easier to move money between a bank account and an account for e-krona than it is to move money between a bank account and cash. Handling cash is more complicated. This means that the demand for e-krona will probably vary more over time than the demand for cash. And in a low interest-rate environment like the one we have now the e-krona can become even more attractive, even if it is not interest-bearing. Particularly for participants in the RIX payment system, who do not have access to the standing facilities, the e-krona will comprise an attractive investment alternative if the deposit rate is negative. We will return to this in later sections.

The increased volatility in the liquidity surplus and the potentially large amounts that may be involved risk leading, if no other changes are made to the operational framework, to increased volatility in interest-rate setting on the overnight market, with potential consequences for other interest rates at longer maturities.⁹ This would indicate that the operational framework needs to be reviewed.

⁹ The increased variation also risks leading to the system 'tipping over', that is, going from a surplus to a deficit, in an unplanned manner. If the banks have invested all the liquidity surplus in Riksbank Certificates and the demand for e-krona suddenly increases, the banking system will 'tip over' to a deficit in relation to the Riksbank. The banks will then need to borrow money overnight in the Riksbank's fine-tuning operations. Another alternative for the banks would be to sell back some of their certificates to cover the liquidity deficits, but then the payment would not be available until the following day. The probability that the Riksbank will from day to day alternately lend and borrow in the fine-tuning transactions will likely increase if the e-krona is introduced.

3.3 An interest-bearing e-krona

With the current legislation, it may not be possible for the Riksbank to pay interest on an e-krona. However, the legislation might be amended in the future and it is therefore also worth analysing the consequences for the operational framework if an interest-bearing e-krona is introduced.

If it is possible to have an interest-bearing e-krona, the interest rate on it would need to be set so that the monetary policy counterparties cannot use the e-krona to circumvent the Riksbank's monetary policy interest rates. For instance, the Riksbank would in the case of a liquidity surplus not be able to set the interest rate on the e-krona higher than the Riksbank's policy rate, as the monetary policy counterparties would then probably prefer the e-krona to bidding in the weekly issues of Riksbank Certificates (at the policy rate) or to investing in the daily fine-tuning transactions (at the policy rate minus 0.10 percentage points). Correspondingly, it would in the case of a liquidity deficit in the banking system be a problem for the Riksbank to supply liquidity to the banking system via monetary policy repos at the policy rate if this money could be immediately invested at an interest rate on e-krona that was higher than the policy rate. Such interest-rate setting could risk undermining the Riksbank's possibility to steer the overnight rate to keep it close to the policy rate. The interest rate on the e-krona would thus have to be set so that it harmonised with pricing of the monetary policy instruments, which means that the e-krona itself needs to be fitted in with the monetary policy instruments.

If it becomes easy to move funds between deposit accounts in the banks and e-krona, the Riksbank could use the interest rate on the e-krona to influence the banks' deposit rates in a more direct way than is currently possible. If the interest rate on the e-krona was raised (at the same time as the policy rate is raised) the banks could be forced to raise their deposit rates by the same amount if they wished to avoid depositors moving their money from the banks' deposit accounts to e-krona. Correspondingly, cutting the interest rate on the e-krona could make it possible for the banks to reduce the interest rates on their deposits without risk of depositors moving their money over to the e-krona. The operational target for monetary policy would then need to shift focus from solely ensuring that the overnight rate is close to the Riksbank's policy rate. It would then be interesting to also evaluate how changes in the interest rate on the e-krona have an impact on the banks' deposit rates.

We note that in the system we have outlined here, it would be fully possible for the Riksbank to cut the interest rate on the e-krona without at the same time cutting the policy rate. The only restriction is that the interest rate on the e-krona cannot be higher than the Riksbank's policy rate.¹⁰ But is there any situation in which the Riksbank would consider cutting the interest rate on the e-krona without this being justified by a cut in the policy rate? Yes, possibly if the banking system were affected by a bank run against deposits in accounts. If such a confidence crisis were to occur, the Riksbank would want to make the e-krona less attractive. See Armelius et al. (2018) for further discussions on how the e-krona can be used as a monetary policy tool.

Finally, the conclusion is that an e-krona that is interest-bearing should be included as a further monetary policy tool in the Riksbank's toolbox. Moreover, the operational target for monetary policy – for the overnight rate to be close to the Riksbank's policy rate – needs to be supplemented if one wants to make use of the new opportunities offered by an interest-bearing e-krona when implementing monetary policy.

¹⁰ It is more correct to say that the interest on the e-krona cannot be higher than on any of the monetary policy interest rates, even for example the deposit rate. In this context, it is interesting to note that as of 1 November 2018, the Riksbank is offering central counterparties that are RIX participants and clear in Swedish krona the opportunity to apply for access to a new deposit facility, intended to counteract disruptions in central counterparties' managing of liquidity in Swedish krona spreading throughout the financial system. The deposit facility means that central counterparties have the opportunity to deposit money with the Riksbank overnight at the Riksbank's deposit rate, that is, the interest rate on the Riksbank's standing deposit facility to which the Riksbank's monetary policy counterparties have access.

3.4 On the e-krona and the effects on the lower bound for monetary policy interest rates (including the policy rate)

So far, the main focus has been on how the interest rate on the e-krona, if it were to be interest-bearing, should be set. Another way of looking at this is whether the e-krona can determine how low the monetary policy rates can become. As in the case with cash, the e-krona will determine a floor for the interest rates on the monetary policy instruments. This follows from the e-krona, like cash, being perceived as a risk-free investment, available to all and determined by demand. If the monetary policy interest rates are set too low, banks, companies and households will prefer cash or e-krona.

Previously, one considered that the existence of cash, which does not give any return, set a floor for nominal interest rates at zero per cent, what was known as the zero lower bound. But several central banks have had negative policy rates in recent years. In the case of the Riksbank, the policy rate has been negative since February 2015.¹¹ This has been possible because of the costs of storage, insurance, transport and so on that are linked to holding cash as an alternative to the monetary policy instruments. The concept 'zero lower bound' has thus been replaced by the 'effective lower bound' (ELB), which is below zero per cent. See Table 1 below. However, it is difficult to know this lower bound in advance in that it is difficult to quantify the different costs exactly. Moreover, they can change over time.¹²

Holding an e-krona is not linked to corresponding costs. How the lower bound is affected in more detail will depend, however, on whether or not the e-krona is interest-bearing.

Let us begin with the case of *an e-krona that is not interest-bearing*. If the Riksbank's deposit rate, policy rate and/or fine-tuning interest rate on deposits were negative in this situation, interest in investing in the corresponding interest-bearing monetary policy instrument would be minimal, as it would be more beneficial to invest money in e-krona at zero per cent interest. This means that the lower bound in the case of a non-interest-bearing e-krona would probably be much closer to zero than the bound that applies without an e-krona. It may be the case that negative monetary policy interest rates are on the whole no longer possible. See Table 1 below.

This in turn has implications for the width of the interest rate corridor, in that it will determine the lower bound for all interest rates on monetary policy instruments. The indications are that the interest rate corridor would need to become much narrower if one wants to continue with an interest rate corridor that is symmetrical around the policy rate. The broader the corridor, the higher the lower bound for the policy rate will be. One alternative in such a situation would be to change over to a floor system where the policy rate comprises the lower bound in the corridor instead of lying in the middle of the corridor. This is attained by the central bank ensuring that the banking system has so much liquidity that all banks have to deposit with the central bank, which would lead to the overnight rate being pushed down to the floor of the corridor. Such a system is currently applied by the central banks in the United Kingdom, Norway and New Zealand.

If, on the other hand, the e-krona is interest-bearing, the interest rate can be set at both positive and negative levels. The lower bound for the policy rate is then determined by the level that is highest of either the lower bound in the case of cash (that is, the level where it is more profitable to hold cash than to have money in an account) or the interest rate on the e-krona.¹³ If the interest rate on the e-krona is positive, for instance, the policy rate cannot be set lower than this. See Table 1 below.

¹¹ During 2009, when the policy rate was 0.25 per cent, the deposit rate was negative for a period of time. However, this had no effect on interest-rate setting in general, in that the amounts deposited at a negative interest rate were very small.

¹² See Alsterlind et al. (2015) for a discussion of the lower bound for the repo rate.

¹³ If the interest rate on the e-krona is lower than ELB, however, the demand for e-krona will probably be low as long as cash exists.

Table 1. Lower bound for monetary policy interest rates

Without an e-krona	Non-interest-bearing e-krona	Interest-bearing e-krona
ELB < 0	ELB ~ 0	ELB = the highest of ELB without an e-krona and interest on an e-krona

Note. ELB stands for Effective Lower Bound. See the text for further explanations.

Finally we can draw the conclusion that an e-krona that is not interest-bearing comprises a further autonomous factor in the Riksbank's balance sheet that the operational framework for the implementation of monetary policy needs to manage. This new autonomous factor may be strongly volatile, which could lead to increased interest rate volatility if no changes are made to the operational system. A further consequence is that it will probably not be possible for the Riksbank to use negative interest rates on its monetary policy instruments. If the e-krona is instead interest-bearing, the interest rate on it would have to be set in a way that was compatible with interest-rate setting on monetary policy instruments.

4 Variations in the demand for e-krona, under normal circumstances and times of financial unease

In times of unrest on the financial markets, an e-krona could be an attractive, risk-free investment regardless of whether or not it is interest-bearing. At such times the general public could therefore prefer to invest its money in e-krona accounts with the Riksbank where it is immediately accessible and almost risk-free, instead of having deposits with a commercial bank that might suffer problems. Although the general public's deposits in accounts in commercial banks are covered by the deposit guarantee, funds from the deposit guarantee are not immediately accessible for the bank's depositors when a bank has been declared bankrupt.¹⁴

The general public's demand for e-krona can therefore vary substantially, depending on the financial situation. In normal times, when the risks are low, the general public may prefer to have deposits in commercial banks as this gives a higher return. In times of financial unease with increased risks, the general public may instead prefer safer investment alternatives. This could mean that in times of financial unease the commercial banks may be subjected to substantial withdrawals and the general public could prefer to deposit money in the Riksbank, where e-krona would be immediately accessible. Appendix A explains these sequences of events with the aid of some very simplified balance sheets.

With the assumptions we have made in this article – that an e-krona is accessible to all and to an unlimited extent – such a scenario with large withdrawals could lead to the commercial banks losing a large share of their funding in a short time. If this were to happen, the banking system could have a significant liquidity deficit in relation to the Riksbank instead of the liquidity surplus it has now (see Appendix A). In this situation, the Riksbank would need to supply liquidity to the banking system through credit against collateral. One question which would then arise is whether the banks have sufficient collateral to cover the acute funding need with credit from the Riksbank. In such a situation the Riksbank may be forced to consider quantitative limits to alleviate undesired effects of an increased demand in e-krona from the general public, particularly in times of financial unease. See Juks (2018) for more detailed analyses of these issues.

¹⁴ The deposit guarantee replaces capital and accrued interest up to SEK 950,000 per person and institution. The compensation amount in SEK applies to depositors in Sweden, see information on the deposit guarantee on the Swedish National Debt Office's website. 'General public' also covers companies whose cash reserves prior to supplier and wage payments are often above what is covered by the deposit guarantee.

5 E-krona affects the operational framework for implementing monetary policy

To summarise, the introduction of an e-krona means, put simply, that the Riksbank extends its circle of counterparties from the current relatively narrow circle to a very broad one that also includes companies and households.

An e-krona that is not interest-bearing would be a further autonomous factor that the operational framework for implementing monetary policy needs to manage. Moreover, the demand for e-krona could vary substantially over time and be difficult to forecast, which could make it more difficult to determine the volumes in the Riksbank's weekly market operations. If no changes are made to the current operational framework, this may in turn lead to increased volatility in short market rates. However, there needs to be closer study of what changes need to be made.

An e-krona that is interest-bearing must be priced in a way that is compatible with the monetary policy instruments and will thereby itself become a further monetary policy instrument for the Riksbank.

The existence of an e-krona that is accessible to all and to an unlimited extent could increase the risk of major withdrawals from the banks in times of financial unease, as it would be simple to transfer means from an account in a commercial bank to an e-krona account with the Riksbank. The Riksbank would then be acting in an environment where the banking system once again had a liquidity deficit in relation to the Riksbank and would therefore need to supply the system with liquidity. These fluctuations in demand for the e-krona, especially in times of financial unease, would likely raise the question of whether it might be justifiable to consider quantitative limits to the supply of e-krona. However, this would entail a new element in the operational framework for implementing monetary policy, with the Riksbank offering a volume of liquidity that is demanded given the level of the policy rate determined by the Executive Board of the Riksbank. Such measures would require further investigation.

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Appendix A – What is money? An illustration using simple balance sheets

What is money, and how is it created? In this section we use a very simple approach to describe in a purely schematic way how money is created, what is meant by central bank money and commercial bank money, and how an e-krona could cause financial flows between the general public, the commercial banks, the central bank and abroad.

To illustrate these concepts in the simplest manner possible, we begin with an economy with only three sectors – the general public (households and companies), commercial banks (which receive deposits from the general public and lend to households and companies) and a central bank that lends money to and receives deposits from the commercial banks.¹⁵ See Figure A1.

Figure A1. Balance sheets, closed economy with only three sectors

Central bank		Commercial banks		Households and firms	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
R ⁻	S	R ⁺	R ⁻	S	L
	R ⁺	L	D	D	

In more concrete terms, we imagine that the general public has banknotes S and deposits D on the assets side of their balance sheet, and bank loans L on the liabilities side. The commercial banks have bank loans L and potential loans to the central bank R⁺ ('reserves') as assets, and bank deposits D and loans from the central bank R⁻ as liabilities. Finally, we have the central bank that has the banks' deposits with the central bank R⁺ ('reserves') and banknotes S on the liabilities side, and potential lending to the banks R⁻ on the assets side of the balance sheet. Note that all items have a counterpart item on another balance sheet, which follows on from our assumption that only these three sectors exist.

Section 2 of this article contains a description of the operational framework for the implementation of monetary policy and how this relates to the Riksbank's balance sheet. It describes banknotes as a so-called autonomous factor, which means that the Riksbank is not able to directly affect its size. The size of S is governed entirely by the general public's demand for cash. R⁺ and R⁻ represent the central bank's operational framework for the implementation of monetary policy, in real terms the Riksbank's monetary policy instruments. The Riksbank determines which quantities shall be offered and at what price, that is, interest rate.

With the aid of these balance sheets we can now briefly discuss some concepts.

Money. The sum of R⁺, S and D. That S is money is easy to understand. But also deposits D are counted as money, or a means of payment, since they in modern financial systems are usually very liquid. The fact that D is counted as money illustrates the fact that banks 'create' money when they grant credit, which gives rise to new deposits. R⁺ also counts as money. When central banks buy assets they pay using reserves.

Central bank money. The sum of S and R⁺. In the older macroeconomic literature this is also called 'outside money', see the definitions in Lagos (2006). This money is created outside of the private sector and thus comprises a net asset for the private sector.

¹⁵ This is a very simplified view of, for instance, how banks fund their lending. Here we disregard wholesale funding, as the banks are assumed to fund their operations solely through deposits.

Commercial bank money. D on the commercial banks' liabilities side. Also known as 'inside money', see Lagos (2006). This money is created inside the private sector and does not constitute a net asset as one private agent's liability is another agent's asset.

What happens if the demand for cash increases?

If the general public demand more cash, this is in practice via the commercial banks (that is to say, the general public does not turn directly to the central bank). The commercial banks buy cash from the central bank, and pay by reducing their loans R^+ to the central bank (alternatively by increasing their borrowing R^-). See Figure A2. The banks sell this cash to the general public, who pay by reducing their bank deposits D (or by borrowing). The central bank's balance sheet total is unchanged as S increases as much as R^+ declines (or R^- increases). It is not generally possible to say what else happens to the banks' balance sheets, this depends on a number of circumstances and on what has caused the increased demand for cash.

Figure A2. An increased demand for cash

Central bank		Commercial banks		Households and firms	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
R^+	S	R^+	R^-	S	L
	R^+	L	D	D	
	↑	↓	↓	↑	
	↓			↓	

What happens if the central bank introduces an e-krona?

Now we imagine that the central bank begins to issue a digital central bank currency. As we explained in the main text, the e-krona entails a new item, E, on the liabilities side of the central bank's balance sheet. In Figure A3 we assume, for the sake of simplicity, that all e-kronas are held by the general public, and none by the commercial banks. The assets side of their balance sheet thus gains a new item.

Figure A3. An e-krona is introduced

Central bank		Commercial banks		Households and firms	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
R^+	S	R^+	R^-	S	L
	R^+	L	D	D	
	E			E	

What happens to bank deposits if an e-krona is introduced?

One question that often arises when the e-krona is discussed is to what extent it can replace traditional bank deposits. There is no general answer to this question, as a number of circumstances are involved.¹⁶ An extreme scenario is shown in Figure A4, where the general public replace bank deposits with the e-krona. Bank deposits D decline and E rises to a corresponding degree. But when bank deposits D fall, the banks lose some of their funding, and lending L must fall unless other measures are taken. One such measure would be for the central bank to lend more to the commercial banks (R^- rises as much as D has fallen). In Figure A4 we assume that L is ultimately not affected. It may be worth noting that the central bank needs collateral when lending to the commercial banks. In this example we have implicitly assumed that L can be used as collateral for the loans from the central bank.

¹⁶ See Juks (2018) for an analysis of how Swedish banks could be affected.

Figure A4. The central bank counteracts the fall in bank deposits by lending to the commercial banks

Central bank				Commercial banks				Households and firms			
Assets		Liabilities		Assets		Liabilities		Assets		Liabilities	
R ⁻	↑	S		R ⁺		R ⁻	↑	S		L	
		R ⁺		L		D	↓	D	↓		
		E						E			

In reality, the commercial banks have other funding sources, as they can issue securities on the financial markets. See Juks (2018) for a detailed analysis.

We now add a further balance sheet in Figure A5 for 'abroad' to the above system to be able to illustrate international capital flows, for instance. Once again, we make strongly simplified assumptions and study a situation where only the central bank has foreign claims (B^F), as the focus is on what is happening to the central bank's balance sheet and not on the private capital flows. Further we assume that agents abroad can hold e-krona. Therefore we have the items E^F , and $E = E^P + E^F$.

Figure A5. Small open economy

Central bank				Commercial banks				Households and firms				Abroad	
Assets		Liabilities		Assets		Liabilities		Assets		Liabilities		Assets	Liabilities
R ⁻		S		R ⁺		R ⁻		S		L		E ^F	B ^F
B ^F		R ⁺		L		D		D					
		E						E ^P					

What happens if the demand for e-krona abroad rises?

Figure A2 above showed in purely schematic terms what happens if the demand for cash rises. This description reminds us of what happens if the demand for the e-krona rises, but with certain changes. One difference is that the general public will not need to go via the commercial banks in the same way, but can more directly exchange banknotes for the e-krona. Alternatively, they can reduce their bank deposits and in this way increase their holdings of the e-krona.

Now, however, the question is what happens if the increased demand for e-krona comes from abroad. We can imagine, for instance, a situation where the e-krona has come to be regarded as an attractive form of saving, even among foreign investors. The foreign investor has an account for e-krona with the central bank and wants to increase their holding of e-krona. The investor pays for these e-krona with assets in foreign currency, which means that the assets side of the central bank's balance sheet increases. Figure A6 illustrates in this overall manner that the central bank's balance sheet is affected by international demand for e-krona. The exchange rate will be affected, probably appreciating, because the demand for Swedish krona has increased.

Figure A6. Increased international demand for the e-krona

Central bank				Commercial banks				Households and firms				Abroad			
Assets		Liabilities		Assets		Liabilities		Assets		Liabilities		Assets	Liabilities		
R ⁻		S		R ⁺		R ⁻		S		L		E ^F	↑	B ^F	↑
B ^F	↑	R ⁺		L		D		D							
		E	↑					E ^P							