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The rationale for issuing e-krona in the digital era

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This article describes the rationale for providing e-krona to the public through a partnership between the Riksbank and supervised private payments service providers. This arrangement can foster competition and innovation while ensuring the fundamental security and efficiency of the monetary system. These considerations are increasingly relevant as the use of paper cash falls because commercial institutions may not have sufficient profit incentives to provide an alternative means of payment that is universally accessible. Moreover, in a digitalized economy, Big Tech firms and other multinational enterprises are increasingly likely to issue their own private currencies to facilitate their collection of valuable information about consumer behavior. Therefore, launching an e-krona would help ensure that all Swedish individuals have access to an efficient, convenient, and secure means of payment.

1 Introduction

Digitalization is rapidly changing the payment market in many countries around the globe, as new technology interacts with demographic shifts and changing consumer behavior. These changes are particularly relevant to Sweden. The usage of cash has fallen rapidly, leading to a situation in which many retailers no longer accept cash and some Swedish households who have difficulties using digital payments are worried about how they will be able to pay for ordinary purchases if cash disappears altogether.¹ In the past, cash has also functioned as a back-up alternative if the private electronic systems fail. The systems needed for service payment providers to offer payment services to end users are concentrated among a few key players. This is not unique for Sweden but is a general characteristic of payment markets around the world. What is special about the Swedish situation is that market concentration, in combination with the marginalization of cash, raises concerns not only about robustness and resilience but also about competition on the payment market. This latter question arises because cash no longer poses a competitive threat to the payment services offered by incumbents. Lastly, the marginalization of cash as a means of payment leaves Swedish citizens without access to money issued by the central bank, the safest form of money.

This paper suggests that a well-functioning and trustworthy means of payment should be viewed as a public good that warrants the ongoing direct involvement of the public sector. Firstly, the government has an intrinsic responsibility to maintain a stable store of value and unit of account that facilitates the decisions and plans of households and businesses. This

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¹ The Riksbank has pointed to several possible negative consequences of an economy with no public access to central bank issued money. See Sveriges Riksbank (2017), (2018).

consideration provides the fundamental rationale for ensuring that the public has continuing access to money issued or fully backed by the government. Secondly, the government must ensure that the payment system is safe, efficient, and inclusive; that task is broadly similar to its responsibility for ensuring the effective provision of other basic utilities, such as clean water and reliable electric power. This will contribute towards protecting the role of the Swedish krona as a means of payment, store of value and unit of account in Sweden in the face of competition from private digital currency initiatives from Big Tech firms. Thirdly, as companies with a business strategy of commercializing user data emerge, individuals should have the possibility of paying using a public alternative that ensures that the data generated by their purchases is not stored and commercialized. It is the role of the government to protect personal integrity in a democratic society.

In this paper, we highlight the challenges facing the Swedish monetary system and we consider potential ways forward to ensure its efficiency in the future. Sweden is a small, open, and highly digitalized economy with its own national currency that is not commonly used in international trade. Consequently, the Swedish krona may be particularly vulnerable to the advent of currencies such as stablecoins issued by private multinational enterprises (as argued by, for instance, Brunnermeier et al., 2019). While the precise evolution of stablecoins and other forms of privately issued digital currencies remains uncertain, this development provides a compelling rationale for Sweden to minimize the risk to consumers and businesses choosing to switch from the Swedish krona to some other currency. The Riksbank can do so by ensuring that the Swedish monetary system continues to be efficient. We argue that this would be facilitated if the Riksbank were to adopt digital technology in the provision of money by introducing an e-krona. Ultimately, the decision to grant or refuse the Riksbank the mandate to do so will be taken by the Swedish Parliament.

The paper is organized as follows. Section 2 examines the characteristics of Sweden's current monetary system. Section 3 highlights the challenges posed by rapid digitalization. Section 4 considers alternative approaches to addressing those challenges. Section 5 concludes.

2 The current Swedish monetary system

The use of money is at the core of every market economy. Without money, people would have to revert to barter, that is, direct bilateral exchanges of goods or services. Barter relies on a double coincidence of wants in which person A wants to acquire what person B wants to sell and vice versa, and such coincidences are practically impossible in a complex and dynamic economy. By contrast, a form of money that is widely accepted can serve as a medium of exchange that facilitates efficient economic and financial transactions. We refer to the framework that ensures services of money to the public as a monetary system.

This section considers the key characteristics of Sweden's current monetary system, reviews some of the factors that have contributed to its evolution over time, and highlights several fundamental reasons why money, as a public good, warrants the ongoing involvement of the public sector.²

2.1 Fostering a stable store of value and unit of account³

The most fundamental role of publicly issued money is to provide a stable store of value and unit of account that facilitates the economic and financial decisions of households

² Using formal economic terminology, public goods are defined as non-exclusive and non-rival, that is, the good is broadly accessible to individuals and businesses, each of whom can derive benefit from that good without reducing the benefits obtained by anyone else. Standard textbooks discuss national defense and radio broadcasting as examples of public goods.

³ Usually, the three functions of money are means of payment, store of value and unit of account. In the following we mainly focus on the two latter and simply assume that money can always function as a means of payment if the two latter functions are fulfilled.

and businesses. In particular, the prices that consumers pay for a representative basket of goods and services should be reasonably stable over time. Large and persistent swings in the value of money (that is, in the general price level) are particularly disruptive for ordinary households and small businesses. After all, wealthy individuals can simply hire a portfolio manager to help insulate their assets from inflation, whereas ordinary households cannot afford to hire a financial planner on an ongoing basis. Likewise, the chief financial officer of a large corporation can utilize sophisticated contracts and financial securities, whereas a small company may be overwhelmed in the face of high or volatile inflation. Price stability is therefore a public good that contributes to broad-based prosperity and efficiency in a market economy.

Thus, in a democratic society like Sweden, there is a strong rationale for assigning responsibility for price stability to a specific agency—namely, the central bank—that is transparent and accountable to elected officials and the general public. In particular, since appropriate monetary policy is essential for fostering price stability, the monetary policymaking process must be effective in serving the public interest rather than the special interests of any particular business or consortium or political interest group.

The framework for fostering price stability has changed over the past century or so. Prior to the modern era, the value of publicly issued money was typically defined in terms of a specific commodity (such as gold or silver), and hence its value could be established by a legal edict. In effect, the central bank would guarantee the value of its notes and coins in terms of a specific quantity of that commodity. The onset of the Great Depression in the 1930s clearly indicated that such a framework was too rigid and not adequate for ensuring a functioning modern economy.⁴ Sweden subsequently experimented with other monetary arrangements, each of which ultimately proved unsatisfactory. Since the 1990s, the Riksbank – like many other central banks – has maintained a framework of inflation targeting.⁵

2.2 The central bank's role as lender of last resort

Another important function provided by the public sector, most often through the central bank, is to serve as a lender of last resort (LOLR). In particular, the central bank can expand the supply of publicly issued money and extend short-term credit to commercial banks, enabling those banks to satisfy a temporary liquidity shortfall rather than being forced to liquidate loans or other assets. By fulfilling this role, the central bank can mitigate the economic impact of financial strains and foster the stability of the banking system as well as the broader economy.

The LOLR function was historically not a function of central banks, but the growing role of central banks in the emerging financial system of the 19th century meant that only they could guarantee liquidity in times of financial crisis. The Bank of England thus acted as LOLR as a direct emergency action in the 1866 Guernsey crisis, which led to a seminal analysis by Walter Bagehot, published in 1873, which formulated the classic doctrine of LOLR. Experiences of recurring financial crises in the United States, which did not at the time have a central bank, led directly to the establishment of the Federal Reserve in 1914 (Irwin, 2014). While the function of LOLR has retained its primary nature since Bagehot, and was carried out by central banks as late as during the recent global financial crisis of 2007-2008, central banks have been forced to apply it in new ways to fit new circumstances. Most notably,

⁴ For more on this, see, for instance, Eichengreen (1996).

⁵ After World War II, an international framework – the 'Bretton Woods system' – used a system of fixed exchange rates, in which national currencies were pegged against the US dollar. This was an attempt to manage the tradeoff between stability and flexibility. From the mid-1940s until the early 1970s, Sweden's monetary arrangements were thus determined by the Bretton Woods system and the value of the krona was pegged to the US dollar, but that system collapsed in the early 1970s. In the following decades, the value of the krona was pegged to a basket of foreign currencies, but with several devaluations. During the European exchange rate crisis in the early 1990s that arrangement also proved unsustainable, and the peg was abandoned in November 1992.

increased globalization meant that European banks had large exposures in dollars, which in turn meant that European central banks had to acquire dollars from the Federal Reserve in order to be able to carry out LOLR in Europe. Central banks also broadened the set of allowed collateral that could be used to borrow liquidity (see Molin, 2009, and Larsson and Söderberg, 2017).

2.3 Providing a secure means of payment and settlement system

Central banks are involved in the payment market in several ways. Firstly, they produce notes and coins for the public. Historically, most central banks were given a monopoly on note-issuing during the 19th century.⁶ In general, the reason for the government becoming directly involved in the payment market has been to mitigate perceived problems in the monetary system (Söderberg, 2018). For instance, the private notes, issued by around 1,500 different banks, in circulation in the United States during the 19th century failed to provide a working unit of account for the country since the notes did not have the same value. This led to documented inefficiencies (Gorton, 2012).

When the American monetary system was overhauled in 1863-1864, during the Civil War, the government took the precaution of creating a public standard that ensured that all notes had the same value. Even so, note production was deemed too inflexible, and when the Federal Reserve was created in 1914, it gradually took over note production from private banks. Similarly, in Sweden, a long government process led to a decision to give the Riksbank a banknote monopoly in 1897. One important reason was that it was deemed that notes had to be completely risk-free and that their issuance should not depend on profit motives. There was no pressing problem that prompted the decision, but the committee delivering the proposal found it imperative that steps were taken to ensure a suitably efficient monetary system to meet the society that was emerging at that time (Söderberg, 2018).

Secondly, central banks facilitate payments between banks and are thus a hub for digital payments. To do this, they issue digital central bank money that is held by financial institutions in accounts in the central banks' Real Time Gross Settlement systems (RTGS systems). The origins of the RTGS systems can be traced back to the creation of the American Federal Reserve's FedWire in 1918, which was computerized in the early 1970s. Electronic RTGS systems then spread rapidly among central banks in the 1980s. The Swedish RTGS system, RIX, was created in 1986 (Bech and Hobijn, 2007). The purpose of these systems is to increase efficiency and safety for digital payments between banks and to facilitate the implementation of monetary policy used to safeguard a stable unit of account (CPMI/IOSCO, 2012). The main reason why central banks provide the central payment system is to help banks to settle payments using their accounts at the central bank, i.e. central bank money, thus abolishing the credit risks that could arise if they instead used commercial bank money. As the central bank system also offers intraday loans to the banks against collateral if they face temporary liquidity shortages, liquidity risks in settlement are also removed.

In line with the above, the Riksbank supplies the general public with money in the form of cash, and banks with money in the form of bank reserves held at the Riksbank, as well as the interbank payment settlement system RIX. Lately, the Riksbank has also supplied money to a designated account in a private settlement system for instant payments made using the mobile phone application Swish. Bank reserves are used to settle payments between the banks in the RIX system. Reserves are also a monetary policy tool, since the main policy rate, the repo rate, is the benchmark for the interest rate paid by the Riksbank on reserves.

Most money in the economy is, however, commercial bank money that is created when private banks extend loans. Only two per cent of the money used for payments in Sweden is cash, the only form of central bank money available to the general public today. The rest

⁶ There are a few exceptions, for instance Scottish private banks, which are allowed to issue their own notes but under strict restrictions.

consists of demand deposits at monetary financial institutions – typically commercial banks – and at the Swedish National Debt Office. We call these deposits commercial bank money. There is free convertibility between commercial bank money and cash.

In effect, this means that there are mainly three forms of money denominated in krona in the Swedish monetary system: central bank money in physical form (cash), central bank money in digital form (reserves), and private money in digital form (deposits). All three forms of money (cash, bank reserves and commercial bank money) always trade at par value. The Riksbank directly issues the two former, and facilitates payments in the third.

2.4 Tools for maintaining financial stability

As noted above, payments cannot be separated from the issuance of loans – most money in the economy is created through private banks issuing loans, and credit institutions are involved in payments and offer bank accounts to the public. This means that financial stability is a prerequisite for a well-functioning monetary system. Apart from the LOLR function carried out by central banks, governments also have a number of other mechanisms in place to increase financial stability. The two main forms are the various regulations governing the conduct of financial entities and deposit insurance guarantees, which mean that commercial bank money is guaranteed if the bank goes into bankruptcy. In Sweden, following the EU standard, the government promises to protect deposits in private financial institutions in an amount of up to SEK 950,000 per institution.

Both regulations and deposit guarantees have been developed incrementally, usually in the face of financial unrest. Financial regulations did exist in an early form in the 19th century, requiring, for instance, that a bank had a certain amount of capital. As the financial system grew there was increased pressure to increase regulation. In Sweden regulations were tightened in 1903 and 1911. A financial crisis following World War I increased pressure to strengthen regulations, but the momentum fizzled out and only marginal changes were made (Larsson and Söderberg, 2017). Instead, it was the financial crisis of 1929 and the subsequent Great Depression that provided the momentum for the large-scale introduction of regulation, beginning in the United States but also occurring in Sweden. In the United States, this led to the creation of the deposit insurance guarantee (Gorton, 2012).

Some of these regulations were removed in the 1980s and 1990s. In Sweden, a quickly deregulated financial market, together with other factors, led to the financial crisis of 1991. This crisis in turn led to the direct creation of a deposit insurance guarantee in Sweden. After the global financial crisis of 2007-2008, regulations were further tightened, both nationally in most countries (such as the Dodd-Frank Act in the United States) and internationally in the form of the global minimum standard known as Basel III. In the European Union, this also entailed a buildup of the deposit insurance guarantee, as the limit was raised to its present level of EUR 100,000 or SEK 950,000. In addition, a new framework of resolution was added, which means that the government can take over failing banks that are large enough to be deemed to have a systemic effect, to ensure that they can keep operating.⁷

To sum up, the present monetary system is the result of continuous attempts made to mitigate problems as they have arisen. The system has therefore evolved incrementally, and the approach has been one of using several different tools rather than relying on a single one to achieve the desired outcome.

7 For more information, see Swedish National Debt Office (2019).

3 Challenges in the digital era

Taken all together, the initiatives of the private market and the control and stability functions developed by the public sector have worked to maintain stability and efficiency of the Swedish monetary system. The question is whether stability and efficiency can be guaranteed in the digital era without additional measures. In this section, we will point to shortcomings that are already apparent and some other developments that could become problematic in the near future if action is not taken.

The digitalization of society in Sweden, through the low use of cash, has led to a lack of access to central bank money by the general public and in particular among certain groups that do not have digital access. Universal access to basic payment services needs to be fully guaranteed. Another risk that is becoming increasingly apparent is the concentration of a large share of payment services in a few large global companies that can create risks and vulnerabilities for countries and regions, create barriers to entry, and stifle innovation.⁸

There is also a risk that the Swedish payment system will become more vulnerable to disruptions. One such risk comes from the fact that the cross-border payment infrastructure has not kept pace with technological innovations present elsewhere and that services provided by the traditional systems have not been satisfactory. These shortcomings have left a gap that Big Tech companies, as indicated recently by Facebook's Libra initiative, can utilize and which could lead to potential risks to the international monetary system. If Big Tech companies will become dominant on the payment market there are a number of new potential risks. These risks were not explicitly analyzed in the e-krona reports published by the Riksbank (Sveriges Riksbank, 2017 and 2018). This section will therefore devote comparatively more space to these particular risks. Readers who want to know more about the other risks mentioned here are referred to the Riksbank's earlier publications.

3.1 Ensuring a competitive payment market

The payment market exhibits what economists call network effects: one individual's consumption of a good gives benefits not only to the person who is consuming but also to other individuals. There is no point in acquiring a card or a mobile application for payments if very few people are willing to accept this instrument as a means of payment. A merchant will not be willing to invest in the technology used to accept such a card or mobile application if the number of customers wanting to use it is not large enough. The existence of network effects in payment thus tends to create market concentration. Often, a few private firms dominate the domestic payment market and, in some instances, even the global payment market, e.g. Visa and MasterCard or Alipay and WeChat.⁹ This means that, in the future, the payment market might become very concentrated even at a global level, which could create two problems. The first is that incentives for further innovation are stifled. The already established firms have little incentive to improve their services since they already dominate the market. New firms, on the other hand, will suffer from high barriers of entry because of the network effects. Secondly, we cannot be certain that the dominant firms will not charge unjustifiably high fees for their payments service for both end users and merchants.

3.2 Resilience and crisis preparedness

The crucial role of payments in society means that the question of resilience in payments is important. If cash is no longer used, payments will be totally dependent on functioning electricity supplies, network connections, and software that handles payments. Disruptions to any of these can be expected in crisis situations, but also in normal times, for instance

⁸ See Bergman (2020) for an extensive discussion of the competitive aspects of the e-krona.

⁹ Beside its central role for card payments in Sweden, MasterCard has acquired parts of the Danish and Norwegian automated clearing houses.

because of cyber attacks. On the other hand, cash usage in modern economies is usually also dependent on electricity as cash registers and ATM machines run on electricity. The network effects mentioned above also tend to increase vulnerability as payments are increasingly carried out through a few large operators. This means that the social consequences can be large even if only one of these operators is affected by problems. Such vulnerabilities can be mitigated, for instance through ensuring that there is a larger variety of means of payments, ensuring a robust supply of electricity and electronic communications, and having extensive back-up functions in readiness, should the need for them arise. It is ultimately the role of the government to ensure that the payment market has sufficient resilience, which motivates a crucial role for the central bank in the payment market.

3.3 A payment system and money that work for all individuals in society

Paying with digital money requires access to technology and knowledge of how to use that technology. Even paying with a card usually requires the management of accounts through a computer or smartphone. Certain groups in society, such as the elderly but also groups with different forms of disability, find it hard to pay with digital forms of payment. These groups are already experiencing problems in making payments, since not all shops, restaurants and cafés accept cash, and their problems might increase in the future. A payment market dominated by private firms could theoretically also develop digital payment forms that are suitable for these groups, for instance solutions that are very easy and cheap to use. But the fundamental problem is that these groups have very different needs, and that it might not be profitable for private firms with a large market share to develop forms of payment for all of them. The digital era might therefore mean a form of financial exclusion for certain groups.¹⁰

3.4 Big Tech firms and stablecoins could change the landscape

A longer-term trend is the entrance of large IT companies, such as Google, Apple and Facebook, into the payment market. As a consequence of network effects, the market player that wins the critical mass of users often captures a very large share of the market. These companies already have large, well-established networks of customers, often on social media platforms, which can give them a competitive edge. There may also be a strong link between social media and the possibility of being able to pay friends in the network, which may lead to very rapid growth in IT company payment applications. This has happened in countries such as China with the Wechat and Alipay applications. Other examples include Apple Pay, Google Pay, Facebook Pay and Samsung Pay.

In June 2019, Facebook announced its plans to launch its own cryptocurrency called Libra in cooperation with a number of other companies.¹¹ The Libra is a so-called ‘stablecoin’ which means that its value should not fluctuate like it does for many cryptocurrencies such as Bitcoin. In order to achieve this the intention is to link the Libra to a basket of currencies such as the dollar, euro and yen. This means that Facebook and other companies would supply payment services that do not use Swedish kronor (SEK), which could have consequences for Sweden if Libra becomes popular.¹² It is already possible, in certain countries, to have a payment card that is linked to a cryptocurrency. When the card is used, the cryptocurrency is exchanged for the relevant national currency and the payment is made through the traditional card system. This is an example of how switching costs are lower

¹⁰ In Sweden, the County Administrative Boards and the Post and Telecommunications Authority have responsibility for the public’s access to general basic payment services.

¹¹ For more on Libra see Segendorf et al. (2019).

¹² The same reasoning applies also if some of the world’s leading central banks together decided to issue a global central bank currency, as suggested by Carney (2019). Although that currency might be better managed and would be backed by sovereign states, it could still threaten the monetary independence of Sweden.

in the digital world. Another example is that, for online shopping, changing prices into a different currency is a lot easier than in a physical store where goods are priced with stickers.

A successful penetration of Sweden by a multinational digital currency would pose a fundamental challenge to the Swedish monetary system. Consider a scenario in which the bulk of payments and financial transactions in Sweden are conducted using the digital currency of a multinational private enterprise. Such a currency might be referred to as a ‘stablecoin’, but its value would presumably be linked to major global currencies and not the Swedish krona. That means that Sweden would lose the ability to adjust monetary policy to domestic conditions. Historically, the exchange rate of the krona has helped serve as a cushion during times of negative macroeconomic shocks. In contrast, the stablecoin’s exchange rate would be adjusted to the prevailing conditions in the countries whose currencies are in the basket.

In effect, in such a scenario, Sweden would no longer have a stable unit of account. Swedish prices and wages would be denominated in terms of the privately issued stablecoin. The pitfalls of such a system are evident from Sweden’s historical experience as recounted above, and would, in effect, make the Riksbank lose control over monetary policy.

Given such adverse consequences, one might wonder why Swedish residents would ever concede to using a privately issued stablecoin instead of the krona. To address that question, we need to return to the issue raised above: namely, the fact that payment systems exhibit strong network externalities. In particular, the benefits of joining a network are magnified by the extent to which other consumers and businesses also participate in that network. And the term ‘externality’ means that each individual’s decisions reflect the direct benefits which accrue to that individual but not the indirect consequences that could transpire if a large number of individuals were to make that same decision. Moreover, the benefits of the decision might be fairly immediate, whereas the consequences might not be apparent for some time. Furthermore, private payment companies may decide to offer services that are cheap or even subsidized since they also benefit from gaining access to consumer data, in addition to their payment services. This could give them a competitive advantage.

The relevance for Sweden’s monetary system is quite clear. If the existing payment network is not very convenient or efficient, there could be a window of opportunity for some multinational enterprise to establish a more convenient and efficient network using its own privately issued stablecoin. That enterprise could offer various forms of discounts and coupons to incentivize the participation of Swedish consumers and retailers. As the size of the network expanded, other consumers and retailers would have increasingly strong incentives to join it, and hence the network could become ubiquitous quite rapidly. With prices and wages being specified in terms of the stablecoin, consumers and retailers would also shift their financial holdings into stablecoin-denominated assets, and banking institutions would hold reserves denominated in stablecoin.

Stablecoins could also challenge the role of the central bank as a lender of last resort (LOLR). This role hinges on the central bank’s ability to issue the same currency as the liquidity needs of the commercial banks. If commercial banks were to have large liabilities denominated in privately issued stablecoins, then the Riksbank could not create currency to lend to them in times of illiquidity.¹³ Thus, if a privately issued stablecoin came into general use in Sweden, Sveriges Riksbank would no longer be able to serve as LOLR; rather, the multinational enterprise would need to serve that function, and any failure to do so could become a major threat to Sweden’s economic and financial stability.¹⁴

¹³ A stablecoin is both ‘money’ and a financial infrastructure/payment system. The latter implies that the account structure, or register, on which stablecoin transactions are settled is outside of the central bank.

¹⁴ There is an interesting historical antecedent in the experiences of the Bank of Amsterdam (1609-1820). As explained by Frost et al. (2020), modern stablecoins would have difficulties fulfilling some important functions such as supplying liquidity for settlement and LOLR.

3.5 Loss of privacy

Apart from the possibility of losing the national unit of account, the rapid entrance of Big Tech firms onto the payment market also entails other possible problems. Since these companies have a business model that consists of collecting and selling consumer data, consumer privacy and integrity could potentially suffer. In countries like China, it has become evident that these types of companies can gain a large market share very rapidly. The interconnectedness between social media usage and payments opens up opportunities to use payment data for marketing purposes. And since marketing is generally more lucrative for these firms than payment service provision, there are strong incentives for firms to subsidize payment services to gain access to valuable data. We already see a few global Big Tech firms with a business model of collecting data dominating completely in other realms in our personal life. It is the role of the public sector to ensure that consumers in the future still have other options available to them when it comes to personal payments.

4 Potential approaches

The risks highlighted in this paper have their roots in changes in technology. It is likely that attempts to mitigate the risks will entail some form of changes to the monetary system – in other words the monetary system needs to be updated in the face of new challenges. We can think of two main alternatives:

- A regulatory update that takes into account the specific risks raised by the ongoing changes.
- Provision of central bank issued digital money accessible to all, i.e. an e-krona.

We would like to stress that these measures can be seen as complements rather than substitutes. According to economic theory, it can be optimal, in the face of uncertainty, to use many tools to achieve one target (see for instance Brainard, 1967). In the following, we will briefly discuss the advantages and disadvantages of these two approaches.

4.1 A modernized regulatory system

As described in section 2, regulations have been and continue to be a vital part of the financial and monetary system. Regulations have been updated intermittently. Most often, these intermittent changes have been motivated by financial turmoil, and in order to reduce risks in the financial system. The most recent example are the regulations enacted in many countries, including Sweden, after the financial crisis in 2007-2008. Though there are national differences in the resulting regulations, an international minimum standard for banking regulations under the name of Basel III was also created.

Regulatory changes can also be a way to reduce the risks associated with the ongoing changes in the monetary system. For instance, in November 2019, new legislation was passed in Sweden that makes it mandatory for larger banks to supply a minimum of cash services across the country. It is theoretically possible that regulations could address at least some of the problems that have been identified in this paper. For instance, in order to increase the robustness of the system, regulations could make it mandatory for actors on the payment market to devote more resources to building back-up functions. Similarly, each of the problems identified in this paper could hypothetically be addressed by regulations. There are, however, a number of challenges to this approach.

The first challenge when it comes to regulation is the *design issue*. Once the problems that the regulations are intended to mitigate have been identified, the regulations must be designed in a way that achieve the goal as efficiently as possible. However, there is a fundamental information problem here, which makes it difficult to design regulations perfectly. One issue has to do with *unintended consequences of regulation* that are difficult to predict when regulation is designed. For instance, higher regulatory demands on firms,

which entail higher costs of compliance, might lead to barriers of entrance to new firms on the market. In this example, reduced competition is not the intention, but it is a side-effect of the means chosen to achieve another goal. Additionally, it cannot be guaranteed that the regulations will achieve the goals they are intended to achieve. The G20 countries' joint Financial Stability Board has therefore initiated a continual monitoring on the effectiveness of the post-crisis regulations and of any unintended consequences (FSB, 2019).

The second challenge is that all regulation entails some form of *monitoring* to ensure that the regulated firms comply with the requirements. Such monitoring is costly, for instance in terms of work spent by supervisors. However, the regulated firms also have to spend person-hours on ensuring that they comply with regulations – on top of other potential costs of the regulation. Increased regulation therefore shifts resources away from more productive activities to monitoring.

The third challenge is inherent in the process of creating regulation. It is a slow political process, not least in order to make a satisfactory analysis of the possible consequences of regulation. Regulatory change, in other words, can and should not be carried out often – if it is being changed too often, it also undermines confidence in its consistency which confuses market actors. This means that regulations are *inflexible* when circumstances change. Sometimes this inflexibility itself has consequences for the effectiveness of the regulations. Market actors can, for instance, find ways of circumventing regulations, reducing their effectiveness further. A key example here is the emergence of 'shadow banking', i.e. innovative financial practices that could circumvent existing financial regulation. It was in that sector that many of the problems behind the global financial crisis of 2007–2008 were created. As market players change their behavior, regulations tend to lag and updating them takes considerable time and analytical effort.

In sum, regulations are important but they are slow to adapt to change, and they have problems in the form of potential unintended consequences and costs of monitoring.

4.2 Implementation of an e-krona

The second main alternative is to ensure that the public has access to central bank issued digital money, i.e. an e-krona. As mentioned above, central bank money already exists in digital form in Sweden in the form of bank reserves. It was previously also possible for the Swedish public to have electronic government deposits with the National Debt Office, and the public can at least temporarily, pending payment to their bank accounts, hold government money in digital form in their tax accounts. But an e-krona would not only entail the possibility to hold government digital money but also to pay with it. An e-krona would thus be a new feature of the monetary system.

Just like in the case of regulation, the *design* issue is crucial in minimizing the risk of *unintended consequences*. Design is also about efficiency: how do we ensure that the goals that we want to attain are reached as efficiently as possible? An e-krona, just like regulation, would then need to have specific goals followed by a deep analysis on how to design the e-krona to attain these goals. For instance, if increased resilience is the main goal, it might become necessary to design the e-krona as a separate infrastructure from today's digital payments infrastructure. Likewise, if it is available for all, then it will have to be designed to be easy to use. The desired level of anonymity, which in effect would be a tradeoff between integrity and the risk of malicious use, would also have to be decided on, and then brought about with a suitable design.¹⁵

In contemplating these design issues, a key consideration is that digital technology is evolving rapidly, posing the risk that the payment system will reach a 'tipping point' that becomes practically irreversible. One implication is that a protracted process for perfecting

¹⁵ For more on the question of design see Armelius et al. (2020).

the e-krona prior to launch could turn out to be futile, and hence it might be sensible to develop and launch the e-krona on a more expedited time frame, followed by an ongoing process of improvements and refinements thereafter. As mentioned above, the ultimate decision to give the Riksbank permission to do so rests with the Swedish Parliament.

The rapidly evolving digital world is also highly relevant for the process of regulating private forms of money. Such regulations necessarily involve tradeoffs between specificity and flexibility. Specific regulations can help protect the public interest but may require frequent revision to reflect changes in technology, facilitate transparency and efficiency, and ensure broad compliance by regulated firms. Indeed, these issues are likely to be acute in the context of overseeing huge multinational enterprises and global payment networks. Such revision takes considerable time and, by the time the revisions are ready to be implemented, there is considerable risk that they will no longer be adequate for the situation for which they were devised. A direct government presence in the payment market in the future, through an e-krona, could therefore potentially be a *more adaptable* instrument than regulation, or a good complement to regulation, to handle ongoing changes.

These considerations underscore the rationale for a two-pronged strategy of regulating private payments and launching the e-krona. By issuing a public form of digital money, the central bank will maintain a direct presence in the payments system and facilitate the effectiveness of its regulatory framework for private payments.

4.2.1 An e-krona does not necessarily exclude the private sector

It is important to note that public provisioning of an e-krona can still entail the participation of the private sector. An e-krona could, for instance be supplied through a public-private partnership, so that the government supplies the critical infrastructure while the private market can compete at the customer level. This would be one way of achieving the best of both worlds. The government would retain control and ownership over a critical infrastructure, while innovation and competition would be stimulated through free access to the platform. It would be similar to the model for supplying physical cash to the public that has worked well before – where the public accesses cash indirectly through the banking system.

There are potential precedents for such an arrangement. Since the 1990s, there has been a general tendency towards privatization in society, whereas government monopolies were more common prior to that. In Sweden, rail tracks and high-voltage transmissions are, for example, still owned by the government, while many of the electricity distribution networks, as well as critical parts of the telecom network, are privately owned (Bergman, 2020). In the latter case, the public sector is still very much involved with detailed regulation of price as well as quality.

Public-private partnerships, like the one in the Swedish electricity distribution, combine government ownership in one part of the distribution chain with private ownership in another.¹⁶ Indeed this is the solution chosen for cash handling and distribution in Sweden and many other countries where the central bank has the wholesale responsibility while the private sector handles the retail side.

4.2.2 International cooperation for improved cross-currency payments

Some Big Tech initiatives in the payment market have had cross-border payments as one of their main objectives, in particular Facebook's Libra initiative. This has increased focus on current deficiencies in the traditional systems. Central banks around the world have initiated different work streams on so-called Central Bank Issued Digital Currencies (CBDC), of which an e-krona would be an example, to try to address those deficiencies in collaboration with each other. One example is the CBDC coalition created by the Bank of Canada, the Bank of

¹⁶ See Bergman (2020) for a more elaborate discussion.

England, the Bank of Japan, the European Central Bank, Sveriges Riksbank and the Swiss National Bank, together with the Bank for International Settlements (BIS).¹⁷ The group will assess potential areas where a CBDC could make a useful contribution economic, functional and technical design choices, including cross-border interoperability; and the sharing of knowledge on emerging technologies.

If CBDCs can contribute to making international payments more efficient and affordable, that would contribute to minimizing the risk that some form of private cryptocurrency or stablecoin would gain a large share of the domestic payment market. It is therefore important that central banks cooperate in setting standards and so on, so that cross-currency payments are facilitated by the introduction of CBDC.

5 Conclusions

In this paper, we have argued that a well-functioning and trustworthy means of payment should be viewed as a public good that warrants the ongoing direct involvement of the public sector. We have stressed that the current monetary system is the result of incremental change, as policymakers in the past have acted to fulfill the fundamental government responsibility of ensuring an efficient monetary system. Currently, there are a number of potential risks facing the Swedish monetary system. As before, it is the role of the government to ensure that the system is sufficiently safe, inclusive and efficient and, ultimately, that trust in the monetary system is maintained. This will contribute towards protecting the role of the Swedish krona as the store of value and unit of account in the face of competition from private digital currency initiatives from Big Tech firms. Furthermore, it will give individuals the possibility to pay using a public alternative that ensures that the data generated by their purchases is not stored and commercialized.

We have also discussed the main potential policies through which the government can continue to fulfill the role of maintaining an efficient and robust monetary system that is accessible to all in the face of changing technology: regulatory updates and continued public money provision to the public, i.e. issuing an e-krona. Both have advantages and disadvantages, and the question of design is crucial to both.

Given the analysis of the current monetary system, our conclusion is that an important explanation for its durability is that it has relied on several different policies rather than just one. This would suggest that the best course of action is, again, to rely on more than one policy. Our main conclusion is that a suitably designed e-krona, provided to the public through a partnership between the central bank and supervised private payments service providers, could be an important tool, in combination with updated regulation, for the Swedish government to ensure an efficient Swedish monetary system in the future.

¹⁷ The Federal Reserve has now also joined the coalition.

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