ARTICLE – Financial infrastructure undergoing technological changes

The Swedish financial infrastructure, that is, the technical systems that enable financial transactions, is undergoing a technological shift.[61] This is due to new opportunities arising through technological advances, and also to changes in the behaviour and expectations of the population, as well as regulations that force financial agents to develop new functions, which in turn require the introduction of new technology. As the infrastructure forms the basis for the financial system these changes raise a number of important questions about the future of the financial system. The purpose of this article is to provide an overview of the changes in the Swedish infrastructure and describe the issues of principle that ensue.

Changes in the financial infrastructure enable increased digitalisation, speed and accessibility

The financial infrastructure consists of the systems that manage payments and transactions with financial instruments. For this reason, the financial infrastructure forms the base for the financial system. The technical changes that have occurred in the financial infrastructure in the last decades have enabled several clear trends in the financial system.

Firstly, the financial system is becoming ever more digital and fast-paced than before. Secondly, it is becoming accessible for a larger share of the day than before. One example is that a bank customer now primarily interacts with his/her bank via a computer or mobile phone. Another example is that instant payments, such as Swish, are being used to an increasing extent. Thirdly, the financial system is becoming increasingly cross-border. To ensure the financial system becomes more efficient and safe in the future, it is therefore assumed that the financial infrastructure will need to continue to develop in an appropriate and sustainable manner.

The driving forces behind the changes include technical innovations. Faster computers and more advanced means of communication have made it possible to rapidly transfer large volumes of information. These technical innovations have also changed the users' expectations of how long time a financial transaction should take. Transfer of an e-mail, for instance, is instant and can be done at any time of the day. This leads the general public to expect the same type of service from its financial services. Technological progress is enabling new companies, as well as public sector agents, to begin offering new solutions. The new fintech companies are an example of the former and the European Central Bank's (ECB) creation of several new common European infrastructures is an example of the latter.

Another driving force is new regulation, which leads to agents in the financial infrastructure needing to introduce new functions that require technical solutions. These regulations are aimed at making the financial infrastructure safer and more efficient. For Sweden's part it is mostly a question of adapting to the EU regulations. For instance, the EU's Central Security Depositories Regulation (CSDR) requires that so-called securities depositories must introduce partial delivery to reduce the risks and increase efficiency.[62] Another initiative within the EU that has a driving effect on technological developments is the Capital Markets Union, CMU.[63] The CMU aims to create a more uniform European financial system and to achieve this new regulations have been introduced with the aim of increasing competition between agents in different parts of Europe.

These changes raise several important questions regarding the future functioning of the financial system.

The relationship between the state's overall responsibility and private agents needs to be reviewed

Private and public sectors complement one another

The state has an overall responsibility to ensure there are robust and safe infrastructure systems and as part of this operates financial infrastructure. Operation of the financial infrastructure is thus based on a division of labour between public and private sector agents. For instance, the central bank in Sweden supplies a central

[61] New technology and new business models, so called fintech, can in the long run entail further changes, see Fintech – interaction between financial operations and technological innovation. *Financial Stability Report* 2017:1. Sveriges Riksbank.

[62] For more information on CSDR, see *Regulation on settlement and central securities depositories* (CSDR), https://ec.europa.eu/info/publications/regulation-settlement-and-central-securities-depositories-csdr_en.

[63] For further information on the CMU, see *Capital Markets Union – A plan to unlock funding for Europe's growth*, https://ec.europa.eu/info/business-economy-euro/growth-and-investment/capital-markets-union_en.

payments system for the banks, RIX, which complements those parts of the payments system that are managed privately by the banks and by Bankgirot. Other parts of the financial infrastructure, such as clearing and settlement of securities, are operated by private agents. This division of labour is based on a consensus that private and public sector operation both have advantages and disadvantages and complement one another. As private companies are sensitive to losses, they tend to be very willing to make their operations efficient. This efficiency advantage indicates that the financial infrastructure should to some extent be run privately. At the same time, there are disadvantages with private, profit-making operations, which means that this is not suitable from the perspective of society. When it comes to financial infrastructure it may be difficult, for instance, for a profit-making company to consider the total cost to society of a disruption. There is thus a risk that a company would invest too little in its operational resilience, from the point of view of society. Another risk of privately-run infrastructure concerns entrance barriers as existing structures which benefit established agents but hinder entrance for new agents. An operation run by the public sector, on the other hand, can take into consideration more factors and thus potentially make decisions that are better for society.

Global changes, for instance, technological advances, can lead to new analysis being required with regard to the future division of labour between public and private sector. One example is the decline in cash handling in Sweden, which is linked to the factors mentioned above. A cashless society with the means of payment that exist today would mean that the payment system offered to the general public would be in entirely private hands. The Riksbank has therefore begun to investigate the possibility of a state digital currency, a so-called e-krona, which would ensure that the krona continues to be issued by the public sector. An e-krona would either require a new financial infrastructure or that the existing infrastructure is expanded.

Trend towards more instant payments

In Sweden and internationally, there is also a trend towards more instant payments. As mentioned earlier, the most well-known example in Sweden is Swish. Instant payments mean that the payment is made instantaneously between payer and recipient and that it is possible to make payments around the clock, even at weekends and bank holidays. This can be compared with traditional payments, which put simply can only be completed during office hours when RIX is open.

As the volume of instant payments increases, the consequences of disruptions to the flow of payments become more serious for society. The infrastructure that manages the payments therefore becomes very important and needs to be designed to be as safe as possible. One question is thus whether Sweden may in the future need an infrastructure with greater elements of public sector management to ensure secure access to instant payments. The Riksbank is therefore looking into how instant payments will be supplied in the future. One possible solution is a private infrastructure that is linked to and overseen by the Riksbank. Another is for the Riksbank itself to offer instant payments around the clock to the general public. A further alternative would be for the Swedish krona to be linked to the ECB's infrastructure for instant payments, Target Instant Payments System (TIPS). This would enable instant payments in Swedish krona directly via a central bank. The Riksbank has begun a prestudy of a possible Swedish connection to TIPS. TIPS is also an example of another trend: the development of larger cross-border infrastructures that offer economies of scale and facilitate cross-border financial flows.

Cross-border infrastructures offer economies of scale but can make oversight and supervision more difficult

By building large, cross-border infrastructures a large number of agents can pool their resources. The potential gains of this from an efficiency point of view are economies of scale and an increased financial integration between countries. Large joint systems with uniform rules make it easier and cheaper to carry out cross-border financial transactions and operations.

Something that would promote the attainment of the ambitions of the Capital Market Union (CMU) is common European financial infrastructures. TIPS has been created to enable instant payments in Europe at a lower cost and with common rules and technical standards. The ECB has also, for the same reasons, launched T2S (Target 2 Securities), which is a common system for settling securities at a European level.[64] In 2011, the Riksbank and the Swedish financial market investigated whether Sweden should join T2S. As the market was then doubtful, the Riksbank refrained from joining. It is, however, possible that potential economies of scale in the future will make it appropriate for Sweden to join and the Riksbank has opened a dialogue with the Swedish financial market on the development of securities settlement in Sweden.

The economic advantages of harmonisation and larger infrastructures mean that private initiatives have also been started up. In the Nordic region, the banks have

[64] *What is TARGET2-Securities (T2S)?*, https://www.ecb.europa.eu/paym/target/t2s/html/index.en.html.

launched a project entitled P27, which aims to establish a pan-Nordic payment infrastructure for payments in Nordic currencies.[65] The purpose of the initiative is to harmonise the payment market, which looks different in different parts of the Nordic region, and thereby create economies of scale that can reduce the costs of making payments.

There are thus several advantages in cross-border infrastructure. But there may also be potential problems if significant parts of infrastructure are relocated beyond Sweden's borders. To some extent this has already happened in that private infrastructure companies have in some cases chosen to locate their IT operations abroad. The most evident and dramatic reason is from an emergency preparedness point of view that in a war Sweden could be cut off from financial functions important to society. But the financial infrastructure also needs to be under supervision and oversight during normal circumstances, to minimise the risks. In Sweden it is Finansinspektionen and the Riksbank who have responsibility for this.[66] In a future where there is a cross-border infrastructure several countries would therefore need to coordinate their supervision and oversight. This sets higher demands on cross-border cooperation between different national authorities and private agents. Nor is it possible to rule out the risk of Swedish influence declining in this case.

Old technology needs to be adapted, which entails risks

New technology also needs to interact with older, existing technology. In the financial sector, both in Sweden and abroad, IT operations are still reliant on so-called mainframe computers. These were developed in their current form in the 1950s, although they are now much more advanced.[67] Around 70 per cent of all of the financial transactions in the world are still processed by mainframe computers.[68]

Mainframe computers in themselves are considered stable, but problems can arise when new technology, such as mobile applications, are to interact with the older technology. The new regulations also entail new functions being built on already existing systems. The results can become a patchwork where it is difficult to assess the consequences of changes in certain parts of the system. Problems can then arise when updates are made in connection with the introduction of new functions. The British bank TBS experienced major disruptions in April 2018 because of this. The problems continued for more than a month and at worst almost two million customers were denied access to their accounts. In autumn 2018 two other British banks suffered similar problems.

From the Riksbank's perspective it is important that financial institutions and infrastructure companies maintain their role in the economy even when new technological functions are added. This means that they need to take an overall perspective of their IT systems and either replace certain technical systems or ensure that the older and newer technology is compatible. In Sweden the Riksbank has particularly drawn attention to the central securities depository Euroclear Sweden, where Swedish securities are settled and stored. This concerned in particular incorporating the functions required in the above CSDR regulation without causing disruptions.

The Riksbank's role in developing the future financial infrastructure

Technological advances entail new opportunities and challenges. For the Riksbank's part, this means that the central bank functions in the financial system must be updated to keep up with developments. It also means that the Riksbank must act to ensure the different parts of the infrastructure keep up with developments so that some parts do not lag behind. This is a question of reducing direct vulnerabilities and risks in the system, as well as seeing the opportunities offered by the new technology that can lead to a safer and more efficient financial system. It is therefore important that the central bank help to ensure that the development work proceeds smoothly. At the same time, the agents in the financial system must take an overall perspective of their technical systems and implement modernisation in a way that does not deteriorate the functionality of their systems.

This article has mentioned several initiatives the Riksbank has taken to bring about a safe and efficient future financial infrastructure. Firstly, the Riksbank is reviewing the relationship between public and private sector operation of the future financial infrastructure. The most high profile question here is a possible future state-issued digital currency, the e-krona. But there are also other questions, such as whether the infrastructure for instant payments should be operated by the public or private sector. Secondly, the Riksbank is analysing the advantages and disadvantages for Sweden of joining cross-border infrastructures. At present, this concerns whether to join TIPS and T2S. Finally, the Riksbank also

[65] *Sweden's future payment infrastructure*, https://www.swedishbankers.se/en-us/the-swedish-bankers-association-in-english/payment-infrastructure/sweden-s-future-payment-infrastructure/

[66] The difference between supervision, which is conducted by Finansinspektionen, and oversight, which is conducted by the Riksbank, can largely be expressed as the supervision being more formal. Among other things, supervision checks that specific regulations are observed and that there is a possibility to decide on sanctions against a company that does not meet the requirements. Oversight does not entail any possibility for sanctions but can take a broader perspective of operations and identify risks that are not yet covered by existing regulations.

[67] See Ceruzzi, P. (2003), *A History of Modern Computing*. MIT Press.

[68] See, for example, Ismael, N. (2017), https://www.information-age.com/legacy-systems-next-financial-crisis-123465888/

acts to ensure that systemically important infrastructures renew their technical systems at the right time and with maintained functionality, for instance through its requests to Euroclear Sweden.