

Digital Currencies in Cashless Societies

*Developments and Challenges Associated with Central Bank
Issued Digital Currencies – the Case of Sweden’s
Proposed e-Krona*

Hamburg, August 2019

ARKWRIGHT

This white paper reflects the key findings of a bachelor thesis on challenges facing central banks in cashless societies

Objective and contributors

Objective and Context



Swedish central bank
("Riksbank")

- Objective of this white paper: Determine the extent to which the implementation of a **Central Bank Issued Digital Currency (CBDC)** would address the **challenges facing central banks in a cashless society**
- The white paper **focuses on the Swedish Central bank ("Riksbank")**, as Sweden is close to becoming a cashless society and the Riksbank was extensively examining a possible CBDC resulting in different publications
- The paper is based on the **key findings of a bachelor's thesis** covering the aforementioned objective
- The findings are based on a literature review including a combination of insights from scholarly research, **reports from international organisations** and **central banks**

Contributors



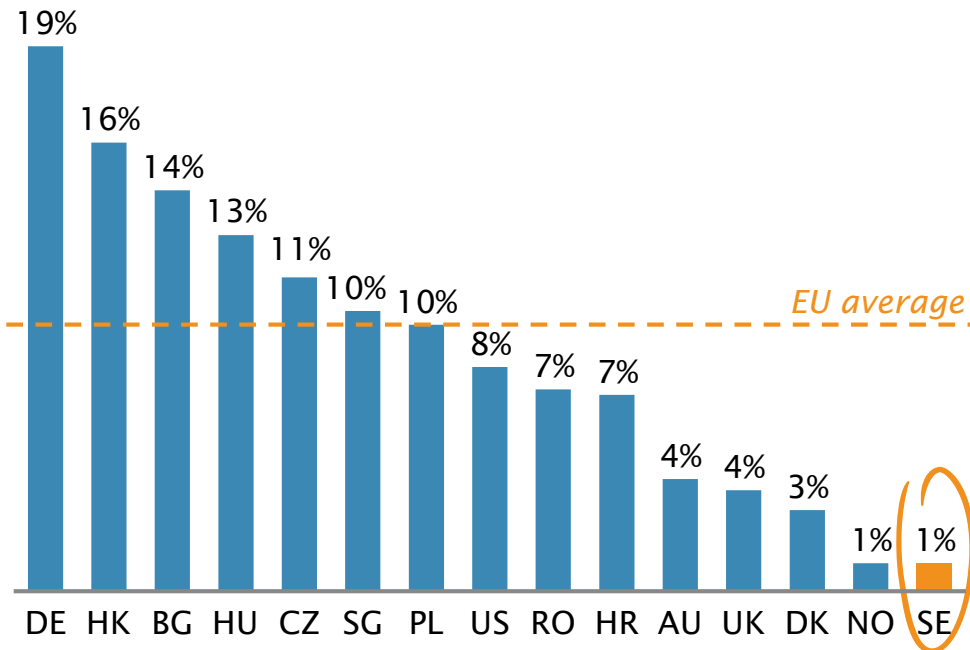
- Author: The bachelor thesis was written by Marit Holler. It was the final thesis for her **bachelor's degree in Foreign Trade and International Management** (Bachelor of Sciences) at the **Hamburg University of Applied Science**
- Supervision: The thesis was supervised by **Prof. Dr. Stephan Boll** at Hamburg University of Applied Science as well as **Steven Jacob**, Managing Director at Arkwright Consulting
- The thesis was **awarded a mark of 1.0**, which corresponds to the **highest possible grade ("very good")** according to the German grading system

Sweden has an exceptionally low cash-to-GDP ratio and is therefore close to becoming a cashless society

Sweden as a cashless society

Cash to GDP in cross-country comparison

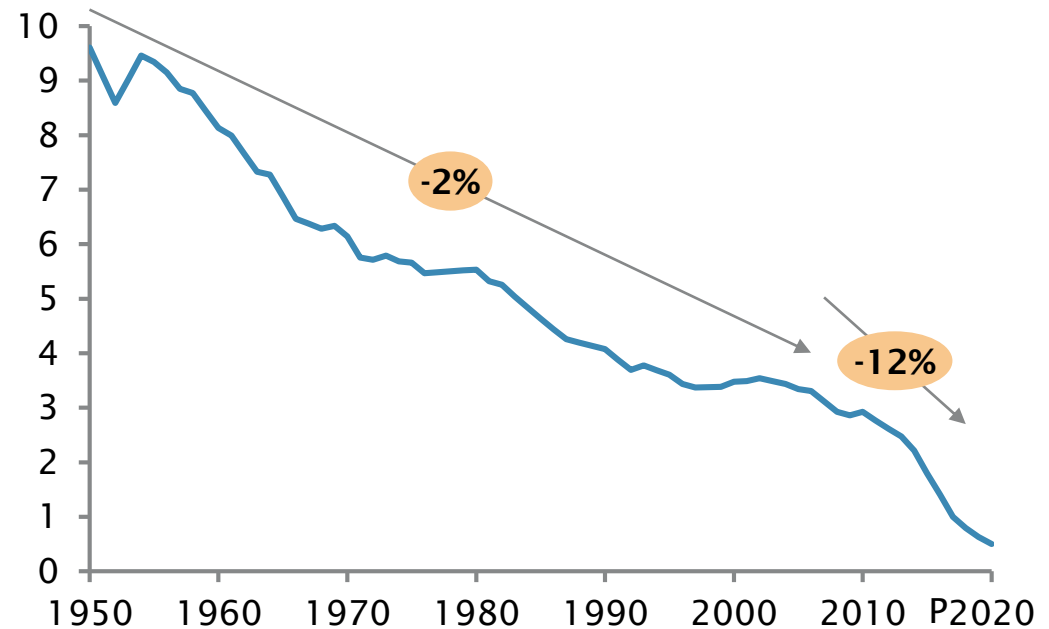
Cash share of GDP in %, 2017



- Cash transactions are not registered, therefore the circulation must be estimated by e.g. the ratio of currency in circulation to GDP
- Scandinavian countries have the lowest ratios, Germany has a very high ratio in comparison

Cash to GDP in Sweden

Cash share of GDP in %, 1950-2020



- The cash-to-GDP ratio in Sweden has been steadily decreasing since 1950
- Negative growth rates have been accelerating quickly since 2008, with a CAGR of -12%

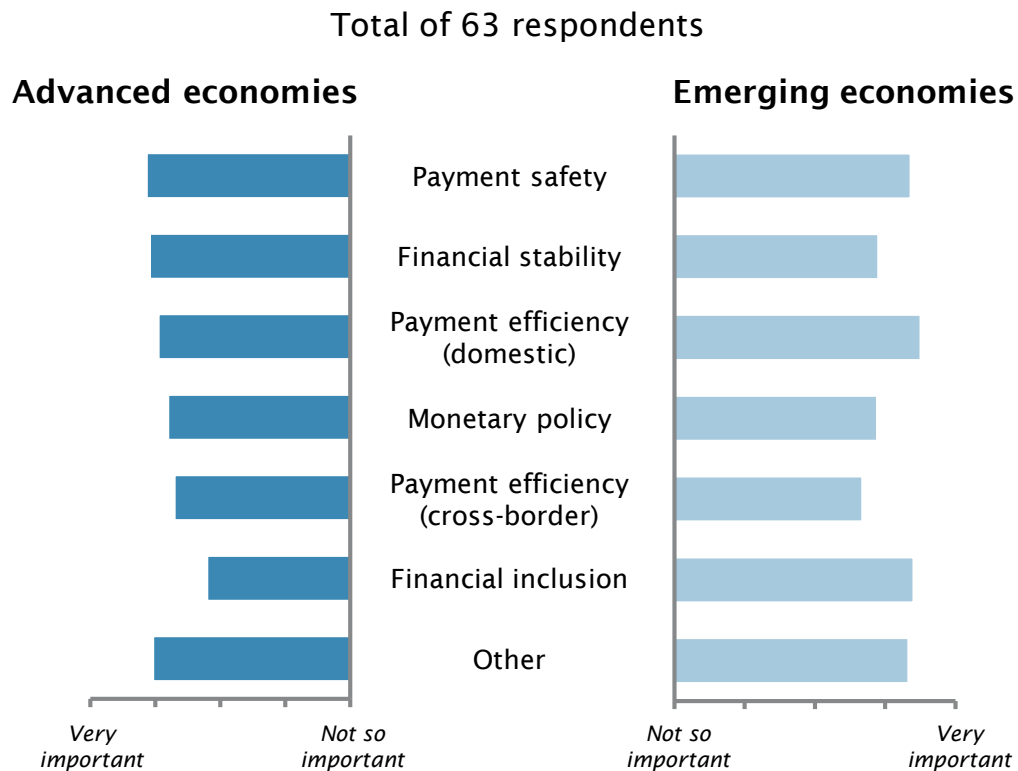
Central banks from advanced and emerging economies are investigating CBDCs – mainly as theoretical projects

Relevance of Central Bank Issued Digital Currencies

Introduction

- Currently 38 central banks are (or soon will be) involved in work related to concepts of making Central Bank Issued Digital Currencies (CBDC) available to the public
- All of them are involved in **theoretical and concept-design research**; only a **minority is working on experiments and proof-of-concept projects**
- The **motivation** behind the research work, as well as opinions, differ among the central banks:
 - Central banks of **advanced economies** are mainly motivated by **payment safety and financial stability**
 - Central banks of **emerging market economies** are mainly motivated by **financial inclusion and payment efficiency**
 - Central banks need to balance technological change and changes in payment behaviour, which impacts their role and relevance as issuers of cash
- The Swedish Central Bank (Riksbank) is among the **most advanced in terms of its theoretical and concept-design work** and was therefore chosen as the main focus of the thesis
- Driving factors behind this research work are **the decreasing use of cash and upcoming opportunities through technical advances**, as well as the objective to learn about new concepts

Motivation for central banks to investigate CBDCs



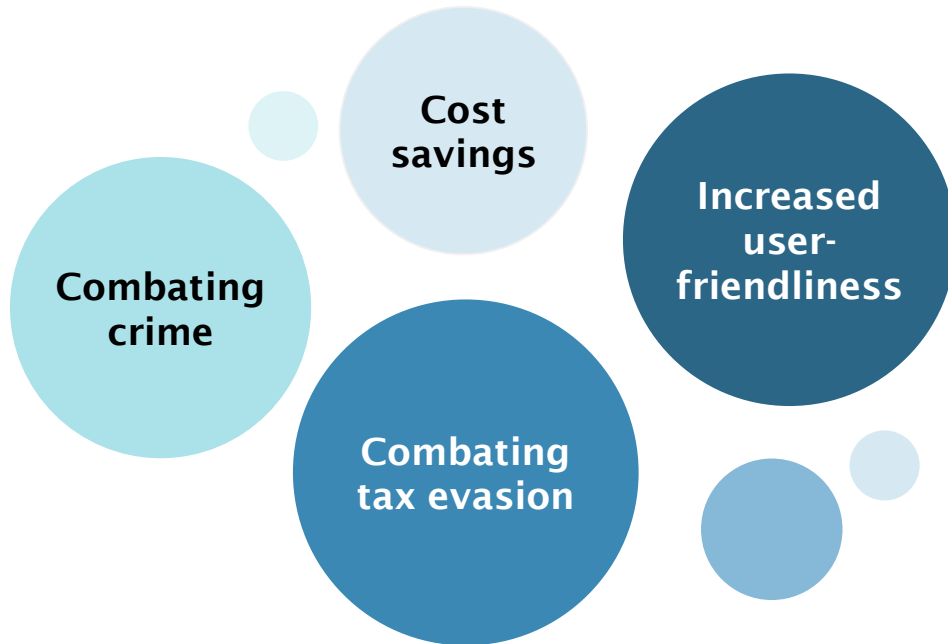
Extract of respondents






The Riksbank faces three challenges in a cashless society – financial inclusion, dependency on private parties and fragile cost efficiency

Benefits and challenges of a cashless society

Positive effects of a cashless society



Challenges for the Riksbank

-  **Financial inclusion**
How can accessibility be guaranteed for everyone?
-  **Increased dependency on private parties**
How can a technically robust payment system be provided?
-  **Fragile cost efficiency**
How can the total cost of transactions be kept at a low level in the long run?

 **Possible Solution: Central Bank Issued Digital Currency (e-Krona)**

The e-Krona would **combine the characteristics of cash** with the benefits of digital money. It would **foster competition, innovation and technical resilience**. The implementation would **face legal and technical hurdles**. If the e-Krona were implemented it might have **negative effects on banks' profits and on financial stability**.

A CBDC poses three main challenges to the Swedish Central Bank in a cashless society

Challenges and potential solutions

Challenges

Possible solutions



Financial exclusion

Financial exclusion of certain social groups

- Elderly, children and people with low education levels could be excluded from the payment system
- The main driver is the decreasing acceptance of cash and the difficulty in accessing it
 - 53% of all Swedes had problems paying in cash in 2018
 - Negative CAGR (-4%) of ATMs from 2011 to 2017



Concentration risk

Dependency on a few private parties increases

- Tendency towards oligopoly intensified due to economies of scale and network effects
- Technical resilience of payment system is vulnerable (e.g. heavy dependence on back-end provider Bankgirot)
- Decreasing relevance of public authorities (central bank) relative to increasing relevance of private parties within the payment system



Cost efficiency

Decreasing competition might reduce cost efficiency

- The payment market is cost-efficient now because of the high degree of electronic payment usage
- However, the lack of competition might lead to steadily high prices even if payment providers' costs decline

Support availability of cash

Regulate private parties

Issue CBDC (e-Krona)

Focus of the thesis

In contrast to fiat money, there are two different models for the e-Krona that the Swedish Riksbank is currently investigating

Comparison of different money types

	Cash	Deposit	e-Krona <i>value-based</i>	e-Krona <i>account-based</i>
1 Risk-free	●	○ ¹⁾	●	●
2 Traceability	○	●	●	●
3 Anonymity	●	○	▨	○
4 Real-time payment	●	▨ ²⁾	●	●
5 Constant availability <i>(incl. offline)</i>	●	○	●	▨
6 Transaction clearing without private 3 rd party	●	○	○	○
7 Unlimited access	●	●	○	▨
8 User convenience	Works without technical assistance	Can be managed online/by app	Requires special hardware and token for storage	Can be managed online/by app

● Yes ○ No ▨ With limitations

The value-based CBDC design is in line with the Riksbank's mandate and more or less represents a digital version of cash

Possible designs of the e-Krona

Value-based



Storage

Decentralized storage in tokens, apps or on cards. If storage medium is lost, e-Krona is also lost (similar to cash); aims to support **offline payments**



Access

The end customer can be **granted access to the account via apps or cards**



Ownership

A database ensures that an e-Krona is **not spent more than once** and registers how many e-Krona are in circulation



Tracking

Anonymous option: e-Krona cards worth up to €250 can be bought with a simple buyer-identification procedure; can be passed on to others



Law

In line with the Riksbank's **current mandate**

Account-based



Storage

Account holder, account balance and transaction data are stored in a **central database** of the central bank (similar to a bank account)



Access

The end customer can be **granted access to the account via apps or cards**



Ownership

The system ensures that the parties exchanging the e-Krona are also **the lawful owners of it**



Tracking

Identification of the account holder is needed for account setup; the account holder **can track** their e-Krona spending



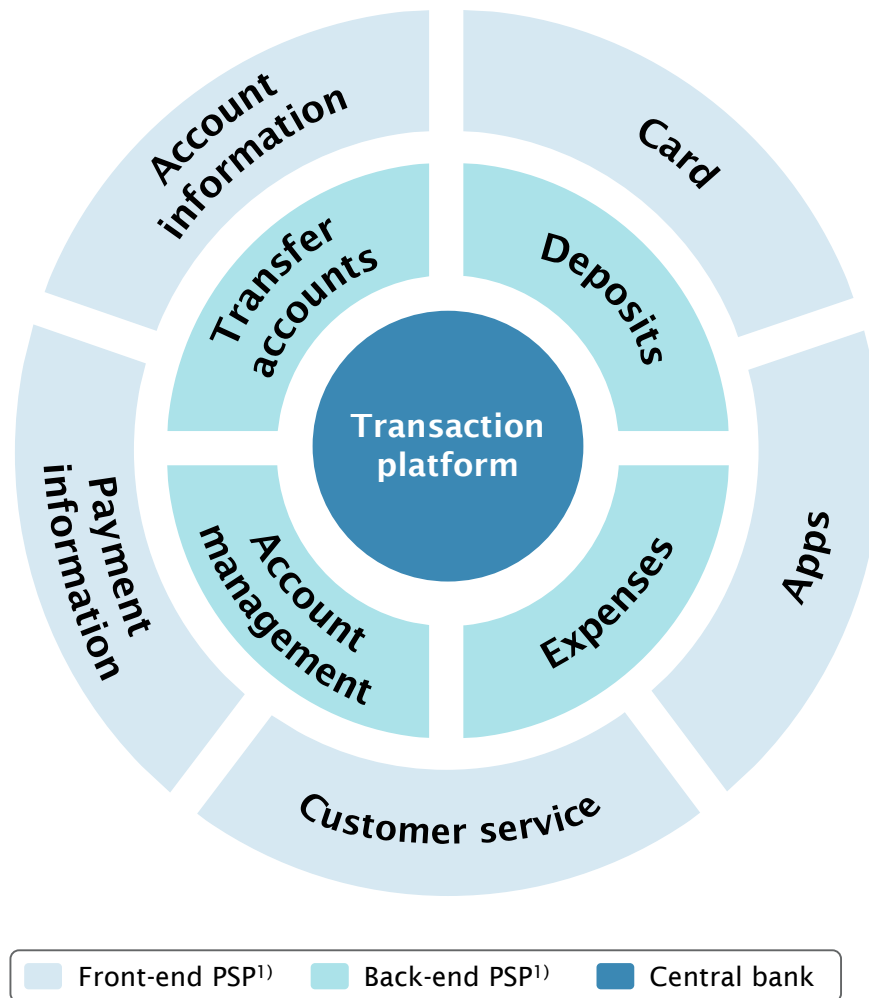
Law

Not in line with the Riksbank's **current mandate**, but members of the e-Krona project group are discussing possible law changes with the Riksdag

The Riksbank suggests an operating model whereby it provides the platform and PSPs offer suitable services

Proposed operating model

Structure



Division of responsibilities

- New technologies reduce the workload entailed by consumer services, but the Riksbank is still **not aiming to establish direct customer relations** due to the burden of IT infrastructure and customer service
- Financial service providers would work as agents for the central bank

Fragmented approach: The Riksbank provides a platform on which private PSPs can join to establish customer services

The issuance of e-Krona would give users only small benefits and put banks under increasing pressure

Impact on users and banks

Users



Extra security in exceptional situations (without access to telecommunications network); the e-Krona system would provide a back-up system



Small or no interest return on e-Krona in order to avoid e-Krona being seen as an investment product; high interest is unlikely



Limited degree of extra **anonymity**; it cannot be guaranteed that data will not be monetised



High cost related to implementation, in particular for merchants where additional hardware might be required

The e-Krona would face the risk of not being accepted as a means of payment and hence face **difficulties reaching critical mass**

Banks



Banks would face a loss of retail deposits as e-Krona would be a **direct substitute** for them. If the e-Krona were implemented, deposits would be partially shifted to it



Loss of retail deposits **reduces funding volumes** available to banks and alternative funding options entail **higher expenses**









Banks would face a **competitive payment market environment**

Banks would **need to adjust their funding model** and would face **more competition** in the payment market

Issuing e-Krona would only partially address the challenges the Riksbank faces in a cashless society

Effectiveness of the e-Krona

Challenges	Predicted effectiveness	Explanation
 Financial exclusion		Financial inclusion could be promoted <ul style="list-style-type: none">■ The e-Krona would have an intuitive design, but it is questionable whether people would actually experience substantial improvements compared to existing services■ Services for special needs (e.g. for blind people) could be substituted by the Riksbank
 Concentration risk		The e-Krona could provide a back-up system <ul style="list-style-type: none">■ The e-Krona aims to add technical resilience to the payment market independently of telecommunication networks, enabling commerce to continue in exceptional situations■ The technical implementation remains unclear so far
 Cost efficiency		Cost efficiency could be guaranteed by fostering competition <ul style="list-style-type: none">■ The cost associated with an e-Krona transaction is likely to be the same as that for deposit transactions■ The competitive payment market and the resulting cost pressure would depress the prices■ The issuance of e-Krona would destroy economies of scale effects, and costs related to acceptance infrastructure would arise

Sweden and emerging market economies are positive towards CBDCs, larger currency areas and other cashless societies remain sceptical

International outlook

Sweden

- The Riksbank sees the e-Krona as a **chance to improve and maintain payment efficiency and security**
- It is confident that **possible risks related to financial stability can be tackled**
- The theoretical and concept-design work is already well advanced
- The **Riksbank is taking actions** to clarify the legal situation. It put the technical development of the e-Krona out to tender in June 2019
- A decision on the issuance of e-Krona has not been made yet



POSITIVE

Other cashless societies

- Other Nordic central banks also face a decline in cash's relevance; a CBDC could be a supplement to cash
- However, the **central banks of Norway and Denmark do not see significant potential for improving payment efficiency and security**, but only a risk of damaging existing commercial banks
- The Central Bank of Denmark also sees a potential risk to its fixed exchange rate



SKEPTICAL

Larger currency areas

- Cashless payments are popular in larger currency areas, but the demand for cash is not declining as significantly as in Nordic countries
- The **ECB and the Fed do not see the need to develop a CBDC concept because of the existing payment system's efficiency and security**
- According to the Fed, the available technology is immature and risky to existing banks and PSPs
- The euro and dollar are of international importance; a CBDC issuance would have additional impact on third-currency areas



SKEPTICAL

Emerging market economies

- Central banks in emerging markets **see more benefits** in a CBDC
- A **CBDC could support digitalisation, bank the unbanked cost efficiently, and tackle shadow economy and financial crime**
- In April 2018 Uruguay's central bank completed a pilot for the e-Peso as part of a financial inclusion programme. Participants were able to transact e-Peso on an online platform; all e-Pesos were voided after the pilot and the project is currently under evaluation



POSITIVE

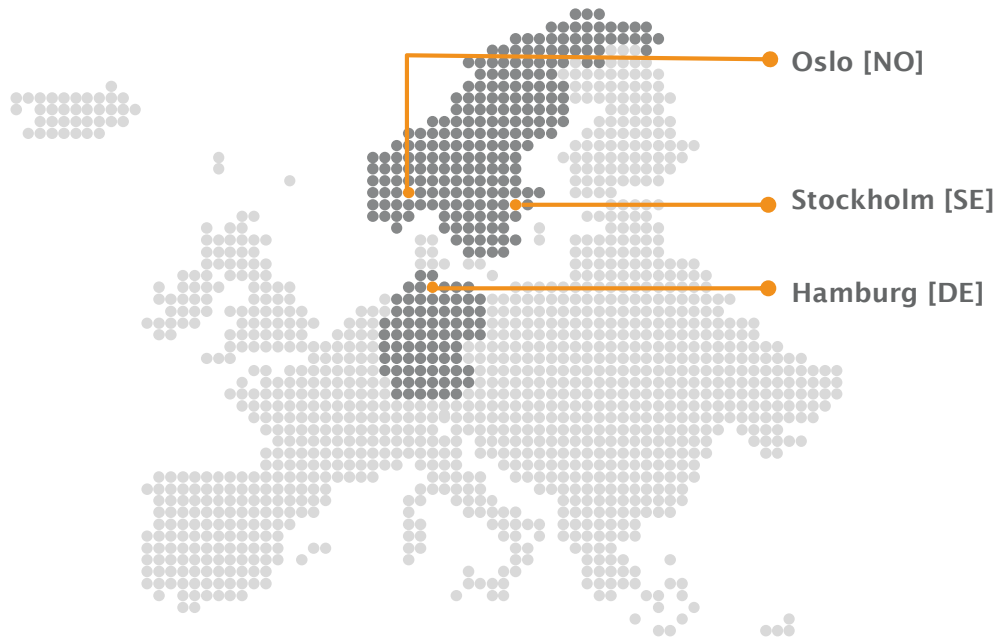
Sources (selection for this white paper)

- Barontini, C., & Holden, H. (2019). *Proceeding with caution – a survey on central bank digital currency*.
- BIS. (2012). *Innovations in retail payments*.
- BIS. (2014). *Non-banks in retail payments*.
- BIS. (2017). *Statistics on payment, clearing and settlement systems in the CPSS countries*.
- BIS. (2018). *Central bank digital currencies*.
- Brainard, L. (2018). *Cryptocurrencies, Digital Currencies, and Distributed Ledger Technologies: What Are We Learning?*
- Danmarks Nationalbank. (2017). *Central bank digital currency in Denmark?*
- Danmarks Nationalbank. (2018). *Banknotes and coins in Figures*.
- Deutsche Bundesbank. (2018). *Zahlen & Fakten rund ums Bargeld*.
- Draghi, M. (2018). Public letter to Jonás Fernández.
- ECB (2018). *Payment statistics*
- FED. (2018). *How much U.S. currency is in circulation?*
- HKMA. (2018). *Hong Kong Monetary Authority Statistics*
- Juvs, R. (2018). *When a central bank digital currency meets private money: effects of an e-Krona on banks*. In Riksbank, Sveriges Riksbank Economic Review (p. 79-98)
- Judson, R. (2017). *The Death of Cash? Not So Fast: Demand for U.S. Currency Home and Abroad*
- Mancini-Griffoli, T., Soledad Martinez Peria, M., Agur, I., Anil, A., Kiff, J., Popescu, A., & Celine, R. (2018, 11). *Casting Light on Central Bank Digital Currency*.
- MAS. (2018). *Monetary Authority of Singapore Statistics*
- Norges Bank. (2018). *Central bank digital currencies*.
- Reserve Bank of Australia. (2018). Reserve Bank of Australia. Retrieved from *Statistics - Banknotes and coins issued*
- Riksbank. (2017). *The Riksbank's e-Krona project - Report 1*.
- Riksbank. (2018). *Payment patterns in Sweden 2018*.
- Riksbank. (2018). *The tasks of the Riksbank*.
- Riksbank. (2018). *All banks should be obliged to handle cash*.
- Riksbank. (2018). *The Riksbank's e-Krona project - Report 2*.
- Riksbankskommittén. (2018). *Tryggad tillgång till kontanter*. Stockholm : Statens Offentliga Utredningar.
- SCB. (2019). *Financial market statistics - money supply January 2019*
- Segendorf, B. (2018). How many e-Krona are needed for payments? In Riksbank Sveriges Riksbank Economic Review (pp. 66-78)
- Segendorf, B., & Jansson, T. (2012). *The Cost of Consumer Payments in Sweden*.
- Segendorf, B., & Wretman, A.-L. (2015). *The Swedish payment market*
- Skingsley, C. (2016, 11). Should the Riksbank issue e-Krona? *Speech at FinTech Stockholm*
- World Bank. (2018). *The Global Findex Database 2017*. World Bank.
- World Bank. (2018). *GDP in LCU*. World Bank.

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Arkwright payment profile

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OVERVIEW ARKWRIGHT

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- Profound industry expertise – especially in **media, energy, financial services and payments**
- Building **long-term** relationships with clients through a **fact-based and result-oriented** approach

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- **Over 20 years of payments industry** experience
- Comprehensive understanding of **business and operating models** along the **entire value chain**
- Based in the **world's first cashless societies**, Arkwright is a driving force defining the future of the payments industry
- **5 partners** focused on the payments industry, **supported by a high-performance team**

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