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Kontakt: info@mladaveda.sk, tel.: +421 908 546 716, www.mladaveda.sk

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Vydavateľstvo UNIVERSUM, spol. s r. o.

www.universum-eu.sk

Javorinská 26, 080 01 Prešov

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THE SENTIMENT FOR THE DIGITAL EURO: A EUROPEAN SURVEY

NÁZORY NA DIGITÁLNE EURO: EURÓPSKY PRIESKUM

Michael Pirgmann¹

After receiving his degree in economics from the University of Hamburg (Germany) in 1997, the author became a serial entrepreneur and founded various companies in the finance and real estate sectors. Since 2015 he has also dedicated his time to coaching other founders of startups, he invested in. He has been a doctoral student at the VSFS University of Finance and Administration, Prague, since 2020. His thesis researches the sentiment of European citizens towards Central Bank Digital Currencies (CBDCs), and the possible effects of issuing CBDCs on monetary policy, especially in times of negative interest rates.

Michael Pirgmann se stal po získání titulu v ekonomii na Univerzitě v Hamburku (Německo) v roce 1997 podnikatelem, kdy založil různé společnosti ve finančním a realitním sektoru. Od roku 2015 se také věnuje koučování jiných podnikatelů působících v startupech, do kterých investoval. Autor zároveň působí v Praze jako doktorand na Vysoké škole finanční a správní. Jeho disertační práce zkoumá názory evropských občanů na digitální měny centrálních bank (CBDC) a možné dopady CBDC na měnovou politiku, zejména v dobách negativních úrokových sazeb.

Abstract

Economic agents' sentiment about implementation of Central Bank Digital Currency (CBDC) and the Digital Euro (DE) was captured through two representative consumer surveys among groups of 525 and 1,050 European citizens which reflect the population distribution of the EU countries. The findings reveal broad resistance towards abandoning physical currency, highlighting concerns over security and privacy with the implementation of the Digital Euro. This resistance underscores the necessity for CBDC designs that prioritize these concerns to facilitate wider adoption. Recommendations include enhancing security and privacy features in the DE's design, maintaining cash as a payment option alongside CBDC to allow for gradual transition based on consumer preferences, and implementing a tiered non-remunerated CBDC system. The study contributes to existing literature by offering empirical evidence on consumer attitudes towards CBDCs and providing policy recommendations to address public concerns and promote acceptance of CBDC and the Digital Euro.

Keywords: Central Bank Digital Currency (CBDC), Digital Euro (DE), security, privacy, randomized online survey

Work address: Michael Pirgmann, Ballindamm 15, 20095 Hamburg, Germany
E-mail: mick1967private@gmail.com, <https://www.linkedin.com/in/mickpirgmann/>

Abstrakt

Text zkoumá postoj ekonomických subjektů k zavádění digitální měn centrálních bank (CBDC), zejména digitálního eura (DE) prostřednictvím dvou reprezentativních spotřebitelských průzkumů mezi skupinami 525 a 1,050 evropských občanů, které odrážejí rozložení populace v zemích EU. Výsledky ukazují, že respondenti nesouhlasí s případným zušením hotovostních peněz, což se rovněž projevuje obavami, ohledně bezpečnosti a možnosti ztráty soukromí při zavádění digitálního eura. Případný vznik CBDC a DE musí tyto návrhy vzít v potaz, jen tak může být zavedení úspěšné. Text formuluje několik doporučení, které se týkají designu DE, zachování hotovosti jako dalšího způsobu plateb vedle CBDC, postupného přechodu k CBDC na základě preferencí spotřebitelů, a implementaci víceúrovňového systému CBDC bez úročení. Studie přispívá k existující literatuře tím, že předkládá empirické důkazy o postojích evropských spotřebitelů k CBDC a poskytuje politická doporučení, jak řešit obavy občanů z přijetí CBDC a co je třeba udělat, aby si spotřebitelé na DE zvykli a začali je používat

Klíčové slova: digitálna mena centrálnej banky (CBDC), digitálne euro (DE), bezpečnosť, súkromie, randomizovaný online prieskum

JEL classification

E40, E50, C90

Introduction

CBDCs, such as the Digital Euro (DE) represent an emerging innovation in global finance and monetary policy (MP). As a new form of central bank (CB) liability, CBDCs are designed to complement traditional forms of money, such as physical cash and bank reserves. The concept of CBDCs is gaining traction, particularly in light of the declining use of cash, the growth of digital payments, and technological advancements that enable digital currencies (Engert and Fung, 2020; Torres, 2017).

The CB's motivations behind the proposal of CBDCs are diverse. They vary from offering a digital alternative for cash payments to strengthening the roles of CBs in a rapidly changing financial landscape. Additionally, CBDCs are seen to improve transaction efficiency and to promote financial inclusion, especially in areas where access to traditional banking is limited. However, several CB's simply want to be prepared in case the necessity arises to issue a CBDC (Nabilou, 2020; Polański and Szadkowski, 2020).

CBDCs are mainly being discussed in the context of three use cases. As a retail CBDC to be used as a means of payment or storage of value for the public, as a wholesale CBDC to be used by a restricted user group, or as a multi-CBDC (or cross-country-CBDC) to be used for transactions between countries.

Various design options are being contemplated for the architecture of CBDCs. For example, whether a CBDC should be interest-bearing or non-interest-bearing, or whether it should be token- or account based, the way they should be distributed, as well as the level of anonymity CBDCs should entail, is subject to an ongoing discussion (Bank for International Settlements, 2020; Klein et al., 2020a; Song Shin, 2022).

Despite these discussions and uncertainties, the development and implementation of CBDCs is on the rise. According to a survey from the Bank for International Settlements (BIS) in 2020, 86% of CBs are engaging in CBDC research or development and 14% have already reached the pilot stage (Boar and Wehrli, 2021). Still, as of February 2024, no major advanced economy has fully implemented a general purpose CBDC.

However, several smaller countries in the Caribbeans and Africa have already launched general purpose CBDCs. The Bahamas was the first country to launch a live CBDC in October 2020 with the “Sand Dollar” (Boar and Wehrli, 2021). Its objectives include expanding financial inclusion, streamlining service delivery costs, and enhancing payment efficiencies (Central Bank of the Bahamas, 2021). In contrast, e.g., G20 countries which represent approximately 80% of the global GDP, are still in the research or trial phase for wholesale, retail, and cross-country CBDC concepts. Countries like Argentina continue their analysis of potential CBDCs, while others like Canada, India, Indonesia, Saudi Arabia, and England are actively building prototypes and assessing design choices. Some nations, including Australia, Brazil, China, Japan, Russia, South Korea, and Turkey, have initiated operational trials on different scale. Additionally, cross-border collaborations are increasing, with projects involving multiple CBs internationally (Boar and Wehrli, 2021).

As shown in the chapter *Literature Review*, there is a controversial discussion in the about the demand of CBDC, it’s utility and whether CBDCs should be implemented as an addition to cash or whether CBDCs should replace cash. Research indicates that household demand for CBDC depends on interest rates, utility, legal tender status, and anonymity compared to other payment assets. Institutions on the other hand, may be more focused on the macroeconomic and policy implications. Findings overall suggest CBDC design considerations like interest-bearing features, quantity limits, and tiered access are critical to balance policy transmission, financial stability risks, and distributional impacts. No consensus exists in the literature on an optimal CBDC-design to harness benefits while containing risks. Also, the literature is scarce regarding the consumers sentiment regarding the implementation of CBDC, and specifically the DE.

Thus, this paper aims to shed light into the sentiment of the consumers opinion about the implementation of the Digital Euro as the European version of a CBDC. The goal is to answer the following questions:

Research question 1: What is the status of the familiarity level of private households in the EU about the DE and CBDC in general?

Research question 2: What are the main concerns of economic agents when they are confronted with the implementation of the DE?

Research question 3: Which design features should the DE have to enhance its adoption among private households?

To answer these questions, two surveys were conducted among EU citizens to gain a better understanding of the current sentiment about CBDC implementation and the relevance of

certain identified factors which influence the distribution of cash in relation to CBDC. The aggregated survey results will provide insights into individual decision-making processes regarding CBDC adoption.

This paper contributes to the growing body of literature in this field. The results will enhance the information available to decision-makers as well as researchers to facilitate better understanding of the motivation of private households when potentially adopting CBDC and the DE.

This paper is structured as follows: Following this *Introduction*, the *Literature Review* provides a basic idea about the current debate concerning CBDC, followed by an explanation of the *Baseline Design of the DE*. Afterwards, *Materials and Methods* outline the surveys' methodology, focusing on both, survey designs and assumptions. It also presents the results of Survey I and Survey II, providing insightful findings and analyses from the two distinct surveys. The results are critically debated in the fifth chapter, *Discussion*, before this paper ends with the *Conclusion*.

Literature review

There have been several studies touching public opinions about the implementation of the DE or CBDC. Bijlsma et al. (2021) examine public sentiment in the Netherlands towards CBDC and explore the conditions under which households and institutions would adopt an interest-bearing CBDC as an alternative or addition to cash. They find that both households and institutions are willing to adopt CBDC, but their willingness is conditional on various factors, including trust in the CB, CBDC design features, and especially the interest rate set by the CB (Bijlsma et al., 2021). Zegarra and Willeson (2021) analyze cash demand in Europe during times of negative interest rates using empirical data. They find an increased demand for cash when interest rates go negative. They suggest that a well-designed CBDC could counter this trend by providing an electronic alternative to cash. Their paper assumes that CBDC and cash would coexist, and their empirical analysis indicates that household demand for cash could decline if CBDC is introduced (Liñares-Zegarra and Willeson, 2021).

Li (2023) studies the demand for CBDC from a household perspective. The paper suggests that households weigh qualitative factors like security and privacy as well as interest rates when deciding whether to hold cash or CBDC. The author concludes that CBDC features would significantly affect its adoption rate (Li, 2023). Also, Son et al. (2022) research how the utility, stemming from CBDCs, influence the demand and decision-making from agents regarding their payment assets. They develop a utility maximization model to analyze an individual's choice of payment methods including cash, deposits, CBDCs. They also include cryptocurrencies in their examination. They show that interest rates, legal tender status, and anonymity are key properties driving payment choice. Their model demonstrates that higher CBDC interest rates lead to greater CBDC demand, crowding out deposits and cash, while higher deposit rates have the opposite effect. Their simulations also show that setting the same interest rates on CBDCs and deposits leads deposit demand to disappear due to CBDCs' legal tender status (Son et al., 2022). In his 2022 study, Williamson develops a banking and payment model to explore the implications of introducing a CBDC. Williamson does not see an interest-bearing CBDC as a replacement for cash would be beneficial to

physical currency per se. Still, his analysis suggests that CBDC can potentially enhance welfare by providing competition to private payment methods and reallocating safe assets from the private banking sector to the CB, which he considers a more efficient narrow banking facility. Thus, Williamson considers disintermediation as beneficial. The study underscores the nuanced role CBDC could play in optimizing welfare and addressing inefficiencies within the current financial system (Williamson, 2022).

A paper by Keister and Sanches (2019) develops a model to analyze the macroeconomic effects of introducing CBDC. The authors build on a New Monetarist framework and incorporate credit frictions that lead to underinvestment by financially constrained bankers. In the model, both cash and bank deposits are used as media of exchange in decentralized trades. The introduction of a CBDC can promote exchange efficiency but may also crowd out bank deposits, raise interest rates, and further tighten bankers' borrowing constraints. Keister and Sanches consider three types of CBDC designs: one that competes with cash (cash-like), one that competes with deposits (deposit-like), and one that competes with both (universal). Although introducing a CBDC can negatively impact intermediation and investment, the authors show that choosing the optimal design and interest rate raises welfare relative to not having a CBDC (Keister and Sanches, 2019).

Furthermore, there is an ongoing debate on whether CBDCs should complement or replace cash. Researchers supporting CBDC as an addition argue for consumer choice for cash, and that it would ensure economic stability (Bijlsma *et al.*, 2021; Bindseil, 2019; Xin and Jiang, 2023). Supporters of fully replacing cash argue that this enhances the tool kit for monetary policy (Berriel and Guardado, 2019; Torres, 2017). Grasselli and Lipton (2018) contemplate that the removal of cash would open up “exciting possibilities”. They state that only with the recent development of CBDC is it possible to replace cash with another form of central bank money and set the interest rate as negative as the current economic situation demands (Grasselli and Lipton, 2019). While completely replacing cash with CBDC is not an absolute necessity for CBDC to function efficiently, Bordo and Levin (2017) suggest an interest-bearing and account-based CBDC. They argue that phasing out paper currency would enhance the effectiveness of CBDC and MP in several respects. They propose a gradual phasing out of cash via transfer fees rather than an abrupt abolition. This would discourage disintermediation into cash when CBDC interest rates turn negative.

The Baseline Design for the Digital Euro

The European Commission's proposal for the baseline design of the DE (European Commission, 2023) focuses on integrating it as a key element in the financial ecosystem. The DE will coexist with commercial bank money; thus, it will not be planned as a replacement for cash in the foreseeable future. It is designed to have legal tender status, and to align with diverse consumer preferences across the EU. The legal structure of the DE defines it as a direct liability of EU Central Banks to users, with the operational aspects of DE transactions managed by Payment Service Providers (PSP). PSPs will be pivotal in distributing the DE because they have pre-existing established client relationships.

A key design feature is the provision of basic DE services free of charge to natural persons within the EU, highlighting its non-remunerated nature as a public good. To balance

the interests of users, PSPs, and merchants, the ECB emphasizes a compensation model that avoids excessive charges while ensuring wide accessibility and high-quality services. Furthermore, limits on individual holdings of the DE are planned to mitigate potential impacts on MP and financial stability, though setting these limits should be at the sole discretion of the ECB. Also, it has been indicated that the DE will not bear interest. Hence, it will be treated equally to physical banknotes, though future scenarios might lead to a reevaluation of this stance.

Initially, the digital euro's distribution will be limited to residents within the EU, with plans to gradually extend its availability to visitors and entities in selected regions outside the EU. Cross-currency payment functionalities with other CBDCs will be supported, subject to agreements with relevant CBs outside of the EU. Finally, it is aimed to make the DE online and offline accessible. The offline capabilities are particularly noteworthy for their resemblance to physical cash ensuring utility in situations where digital connectivity is compromised (European Commission, 2023).

Materials and Methods

To get a better understanding of the sentiment regarding the implementation of the Digital Euro two surveys have been conducted. It aims to explore the extent to which individuals would be willing to adopt the DE in their daily financial transactions and what concerns they may have about this form of digital currency. The results seek to offer valuable insights that could guide policymakers, financial institutions, and other stakeholders in their decisions regarding the future of CBDC and the DE.

Survey design and assumptions

The research was divided into two surveys to avoid a bias due to fatigue of the participants when participating in lengthy surveys. The first survey (Survey I) mainly aims to research the current sentiment about a potential implementation of CBDC in the EU while the second – much shorter survey (Survey II) – concentrates on specifically evaluating the qualities of the two payment forms cash and CBDC².

Notably, certain assumptions were made prior to conducting the surveys. For the succeeding consideration and the questionnaire, a baseline-scenario according to the former chapter was assumed. So, a widely available non-remunerated DE which is implemented as a true alternative to cash, and which has a dual use effect. It can be used by the households as a cash-like means of payment in day-to-day activities as well as a convenient storage of value and therefore have some of the advantages of a bank deposit (without the bank services). Also, when designing the questionnaires (see Appendix A and B for the full questionnaires), one of the initial assumptions that were made was that the respondents do not need any prior knowledge about CBDC or the DE. Hence, it can be assumed that the respondents have different interpretations of the questions based on their prior knowledge. Furthermore, the surveys were designed with the Euro as the reference currency, so it presumes that the

² Also, the intention was to approach a second research topic, the effective lower bound (ELB) - which is not part of the research in this paper - in two different settings. In both surveys, the questions about the ELB were asked after the questions analyzed in this paper to avoid influence on the answers analyzed here.

respondents can transfer their financial situation in terms of the Euro, even in case when it is not their national currency. Another assumption underlying the study is that respondents act rationally when considering the trade-offs between different financial instruments, such as cash, CBDCs, and other digital payment methods or assets. This assumption is based on the rational choice theory, which assumes that individuals make decisions by weighing the costs and benefits of alternative options (Arlehamn *et al.*, 2017).

The participants for the surveys were acquired from a diverse pool of EU citizens. The questionnaires were designed to capture the perspectives of individuals with varying levels of familiarity with CBDCs and different financial circumstances.

Prior to distributing the surveys, a number of pre-tests were conducted with smaller groups of participants to assess the clarity and comprehensibility of the questions, as well as to identify any potential issues related to the survey structure or the topic (accessible at https://docs.google.com/forms/d/1_MBzUfiYntWH-xgae7Ct_kCeNZBunmPIPnCismU9N8/edit). The pre-tests for Survey I were conducted between March 20th and March 28th, 2023, with groups of 25, 30 and 50 participants while the pre-test for the smaller Survey II was conducted between January 11 to 13th, 2024 with a group of 20 participants.

For the first survey, multiple iterations with the test groups were performed and the questionnaire was altered multiple times to ensure, that the participants understand the novel topic as well as possible. For example, it became clear in the test for Survey I that a large group of participants confused CBDC with cryptocurrencies. Thus, an explanatory part about CBDC and the differences to cryptocurrencies resulted in a completely different outcome of the test runs. These learnings were also applied when later designing the second survey. Participants were diverse in terms of age, gender, education level, employment status, and household income, to ensure that a comprehensive representation of different population segments. The test surveys showed that a survey without targeting specific population groups in the EU would lead to a heavily skewed distribution towards male German and Italian citizen (more than 60% were male German or Italian participants), thus the survey results could not be seen as representative. Consequently, Survey I was split up into 54 separate surveys to exactly match the population distribution regarding the number of citizen and the percentage of female and male residents for each of the 27 countries. According to the Eurostat 2022 numbers (<https://ec.europa.eu/>), the following distribution was used to cluster the participants into country-related groups, separated by male and female.

Survey II was conducted with exactly half of the number of respondents compared to Survey I, because it was assessed from the Survey I learnings that a smaller group would still lead to representative results. Thus, the second survey included 525 participants reflecting the corresponding EU population distribution. Survey II was conducted with fewer groups, because according to the population distribution of the EU, further dividing the participants into group sizes according to the population would have led to groups which would have been too small to be representative.



EU EUR	Currency	Total	Male	% Male	Female	% Female
Austria	EUR	8.964.889	4.416.886	0,9914%	4.548.003	1,0209%
Belgium	EUR	11.554.767	5.700.474	1,2795%	5.854.293	1,3141%
Croatia	EUR	3.871.833	1.865.129	0,4187%	2.006.704	0,4504%
Cyprus	EUR	920.987	449.553	0,1009%	471.434	0,1058%
Estonia	EUR	1.331.824	633.426	0,1422%	698.398	0,1568%
Finland	EUR	5.533.793	2.733.808	0,6136%	2.799.985	0,6285%
France	EUR	67.871.925	32.835.985	7,3705%	35.035.940	7,8643%
Germany	EUR	83.237.124	41.066.785	9,2180%	42.170.339	9,4657%
Greece	EUR	10.482.487	5.125.977	1,1506%	5.356.510	1,2023%
Ireland	EUR	4.964.307	2.484.658	0,5577%	2.479.649	0,5566%
Italy	EUR	59.030.133	28.818.956	6,4688%	30.211.177	6,7813%
Latvia	EUR	1.893.223	875.225	0,1965%	1.017.998	0,2285%
Lithuania	EUR	2.810.761	1.304.965	0,2929%	1.505.796	0,3380%
Luxembourg	EUR	643.941	324.355	0,0728%	319.586	0,0717%
Malta	EUR	519.562	270.021	0,0606%	249.541	0,0560%
Netherlands	EUR	17.475.415	8.686.536	1,9498%	8.788.879	1,9728%
Portugal	EUR	10.343.066	4.920.220	1,1044%	5.422.846	1,2172%
Slovakia	EUR	5.449.270	2.665.376	0,5983%	2.783.894	0,6249%
Slovenia	EUR	2.108.977	1.059.938	0,2379%	1.049.039	0,2355%
Spain	EUR	47.400.798	23.248.611	5,2185%	24.152.187	5,4213%
	Totals:	346.409.082	169.486.884	38,0435%	176.922.198	39,7125%
Non-EUR EU						
Bulgaria	LEW	6.519.789	3.136.262	0,7040%	3.383.527	0,7595%
Czech Republic	CZK	10.524.167	5.186.548	1,1642%	5.337.619	1,1981%
Denmark	DKK	5.840.045	2.904.857	0,6520%	2.935.188	0,6588%
Hungary	HUF	9.689.010	4.644.875	1,0426%	5.044.135	1,1322%
Poland	PLN	37.019.327	17.913.014	4,0208%	19.106.313	4,2887%
Romania	RON	19.053.815	9.245.544	2,0753%	9.808.271	2,2016%
Sweden	SEK	10.452.326	5.260.707	1,1808%	5.191.619	1,1653%

Table 1 - EU population distribution in Survey I

Source: author

While the first survey consisted of 54 different single surveys, the second survey consisted of 20 groups with the distribution shown in table 2.

Survey II participants were asked to rate the importance of certain factors (costs, security, privacy, and overall preferences) and to also score these factors on a scale of 1 to 10 for cash and the DE. They were also asked basic demographic questions. After the pretests, the survey content was revised, structurally changed, and verbally amended, and the surveys data was collected using Google Forms (<https://www.google.com/forms/about/>). Responses for Survey I were gathered over a period of 6 weeks between July 1st and August 15th, 2023, while responses for Survey II were accepted from January 14 to January 18th, 2024.

Country	Male	Female
Germany	46	51
France	35	38
Italy	33	36
Spain	27	29
Poland	22	25
Romania	11	12
Netherlands	9	11
Belgium	6	7
Greece	5	7
Rest of EU	55	60
Participants	249	276

Table 2 - Group distribution in Survey II

Source: author

For both surveys, existing private and business contacts were used as well as LinkedIn contacts (www.linkedin.com) and the platform www.clickworker.com. IP tracking was employed to prevent multiple responses from the same participant. Also, regarding participants from the clickworker platform, respondents were asked to provide their unique clickworker number and - once they had participated - were put on a blacklist, to prevent participation in surveys for another country or gender. The participants' privacy was strictly upheld with the surveys being anonymous and not asking for personally identifiable information.

The results were analyzed with Python (v2024.0.0) using MS Visual Studio Code (Ver.1.86) with the packages Pandas, Matplotlib, NumPy and SeaBorn.

Results for Survey I and Survey II

In the following two sections the results of two independent surveys are described.

Descriptive results for Survey I

A total of **1,050 respondents** participated in this survey. The geographic distribution of the participants matches exactly the proportions of populations and male to female distribution of all 27 countries (<https://www.statista.com/statistics/755225/population-of-europe-by-gender/>). Key demographic indicators such as age, gender, employment status, education level, and household income are briefly analyzed to provide a comprehensive overview. For strategic reasons, these questions were asked in the last part of the survey (Part 3, questions 3.1 to 3.7). To get a better understanding of the results, here the demographics are analyzed first.

This survey has a robust geographic distribution matching the EU countries. The largest number of respondents are from Germany, accounting for 196 (or approximately 18.7%) of the total survey participants. France and Italy follow closely with 160 (15.2%) and 139 (13.2%) respondents, respectively. The gender distribution is quite balanced with 540 (51.4%) female, and 510 (48.6%) male participants, thus matches the gender distribution in the EU.

The age of the participants ranges from 18 to 72 years, with an average age 36.45 years, thus it does not exactly match the EU average of 43.7

(<https://de.statista.com/statistik/daten/studie/248994/umfrage/durchschnittsalter-der-bevoelkerung-in-den-eu-laendern/>).

The standard deviation of approximately 10.74 years indicates a moderate dispersion of ages around the mean. Thus, while there is a concentration of respondents in their mid-30s, the sample also includes a variety of other age groups.

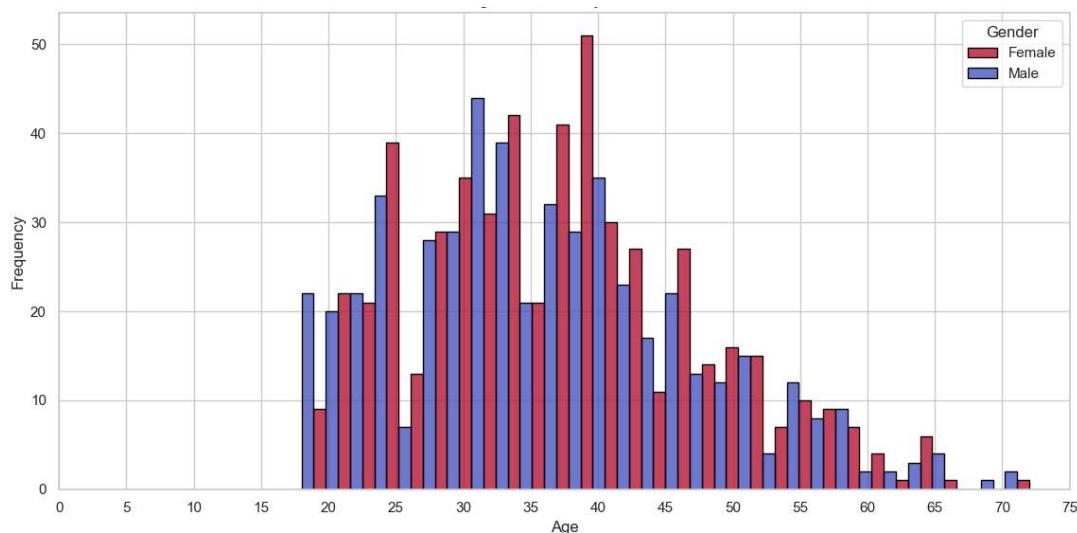


Figure 1. - Age distribution by gender (questions 3.1 and 3.2)
Source: own

The results show that the middle 50% of the data falls within the age range of the late twenties to mid-forties. The median age for both groups is in the mid-thirties. The median age being close to the mean suggests a fairly symmetrical age distribution. The 75th percentile age is 43, indicating that about 75% of the respondents are 43 years old or younger. Overall, the age distribution is skewed slightly towards the younger ages but does include a reasonable representation from older age groups as well. Still, the distribution shows that the survey successfully captured opinions from a broad spectrum of age groups, from young adults to seniors.

In question 3.4, the survey asked participants about their education level, which were categorized as "High School or lower," "Some college or vocational training," "Bachelor's degree," "Master's degree," "Doctorate or higher," and "Prefer not to say." As can be seen in Figure 2, education levels among participants are diverse, with the majority holding a bachelor's degree or above. Those with some college education or vocational training made up 18.3% of the sample, while respondents with a high school education or lower constitute the smallest group with a share of 13.6%.

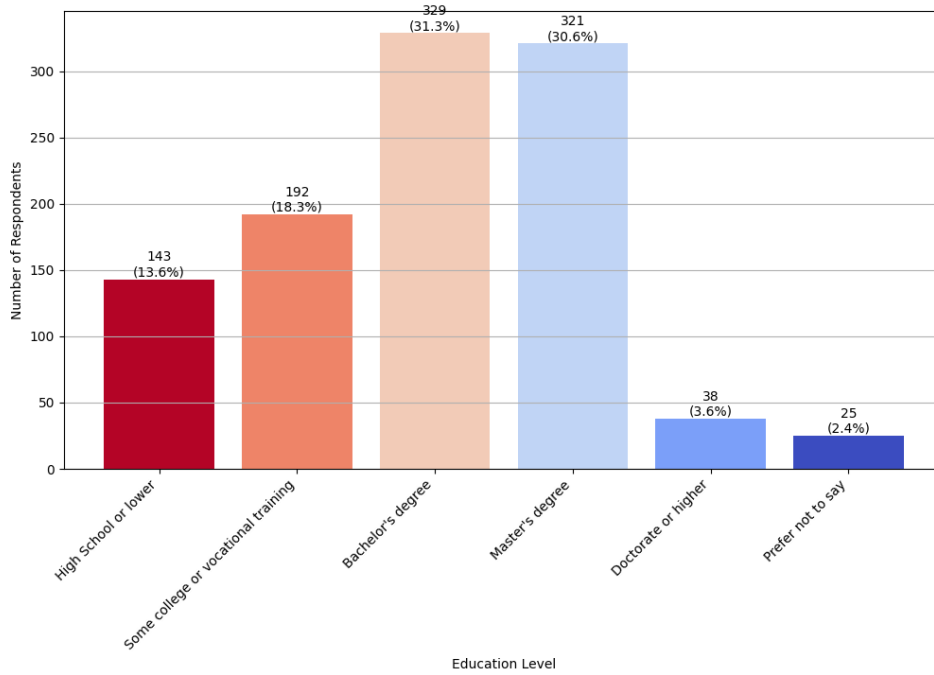


Figure 2.- Education level (question 3.4)
Source: own

The participants were asked about their employment status in question 3.5. The most common status being full-time employees, represented by 475 respondents. This reflects the employment landscape and can be indicative of the economic conditions and attitudes toward CBDC within the working-age population.

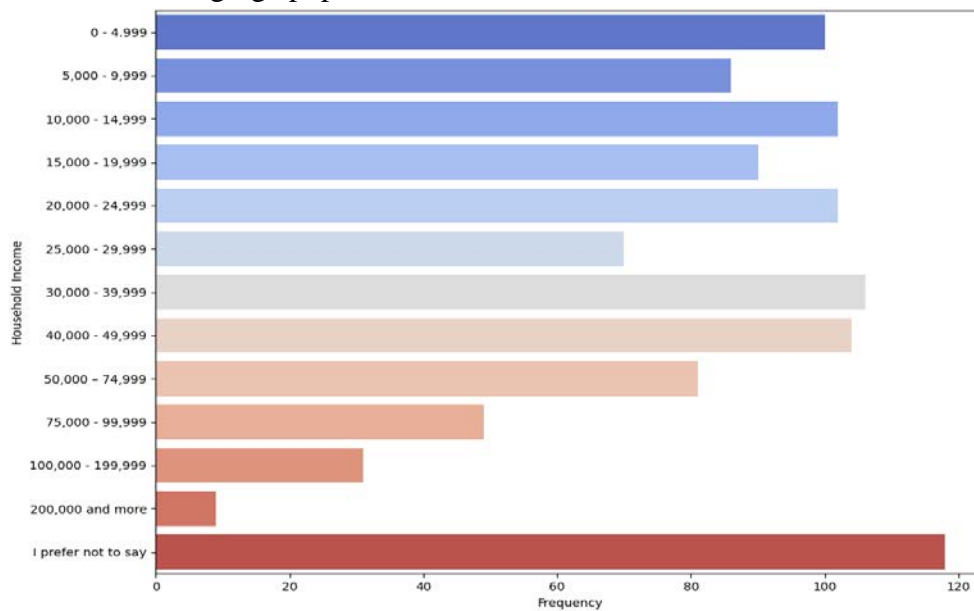


Figure 3. - Household income distribution (question 3.6)
Source: own

The household income depicted in Figure 3 varies significantly among the 12 income brackets which the participants could choose. The smallest income group, earning EUR 0 - 4,999, made up 9.52% of the respondents. This was closely followed by the EUR 5,000 - 9,999

bracket, which made up around 8.19% of the sample. The EUR 10,000 - 14,999 and EUR 15,000 - 19,999 categories included around 9.71% and 8.57% of respondents. The EUR 30,000 - 39,999 bracket accounted for about 10.10% of the total sample while the other middle-income brackets of EUR 20,000 - 24,999 and EUR 40,000 - 49,999 each represented around 9.71% and 9.90% of the survey participants. As could be expected, fewer respondents were in the higher income categories. The EUR 50,000 – 74,999 brackets included approximately 7.71% of the sample, while the EUR 75,000 - 99,999 and EUR 100,000 - 199,999 brackets made up 4.67% and 2.95%, respectively. The least common income level was EUR 200,000 or more. Only 0.86% of respondents are falling into this category. However, 11.24% of respondents chose the "I prefer not to say" option.

The following analysis will delve deeper into the knowledge of the respondents about CBDC and their willingness to adopt and use CBDC in different situations. In the first question (1.1) in part 1 of the survey, participants were asked about their familiarity with the discussion surrounding the introduction of CBDCs, specifically the Digital Euro.

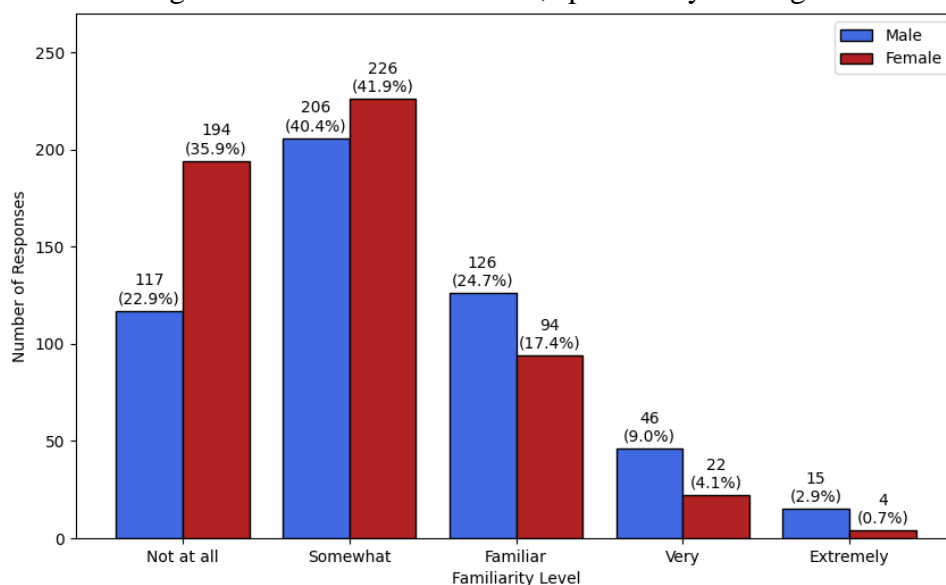


Figure 4. - Distribution of familiarity by gender (question 1.1) with the introduction of CBDC/DE
Source: own

The participants had the options to express their familiarity with CBDC according to Likert values 1-5 with 1 being the least familiar and 5 being the most familiar. A gender-specific analysis, presented in the histogram in Figure 4, showed each group's frequency of responses across the familiarity levels. Notably, a higher percentage of male respondents reported greater familiarity compared to their female counterparts, especially in the low familiarity levels. This trend suggests that males in this sample might have a higher degree of exposure or engagement with the topic of CBDCs than females. Sill, overall, the results show only a modest awareness about the DE and CBDCs in general.

To see whether there are regional differences in familiarity across the countries, they were analyzed with an ANOVA test (Analysis of Variances). For the ANOVA test, the data was grouped by country, and then, for each country the mean, median, and standard deviation

of the familiarity scores were analyzed. Then the means across the different countries were compared.

The analysis revealed a variation in the mean familiarity scores across different countries, indicating that regional differences exist in understanding of the DE. For instance, certain countries exhibited higher average familiarity levels, suggesting a greater exposure or interest in CBDCs among their residents. This suggests that while a moderate level of familiarity exists among the participants that there is room for improvement in public awareness and education regarding CBDCs. Despite the limitations that some countries like Malta or Luxembourg have insufficient data for the ANOVA test, figure 5 can show that the level of knowledge about CBDC is low across the board. This might have a larger influence on the answers of the rest of the survey.

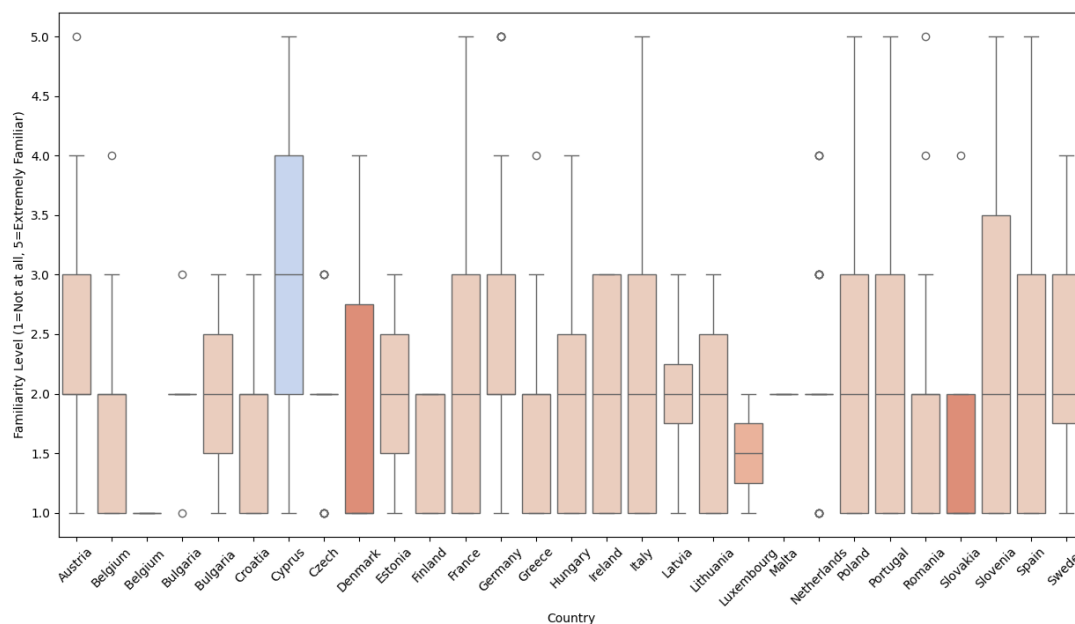


Figure 5. - Familiarity (question 1.1) with CBDC/DE by country
Source: own

In question 1.2 the participants were asked - considering the pros and cons of CBDC - whether they would use CBDC instead of other forms of payment (such as cash or credit cards). The respondents could choose answers according to the Likert scale. More than half of the respondents answered that they would either strictly avoid (130 or 12%) or probably would not use (408 or 39%) CBDC, while 25% (251) remained neutral.

Notably, only approximately a quarter of the participants showed a positive inclination towards CBDC with 18% (188) tending to use it and only 7% (73) strongly supporting its usage as an alternative to current payment options for daily transactions.

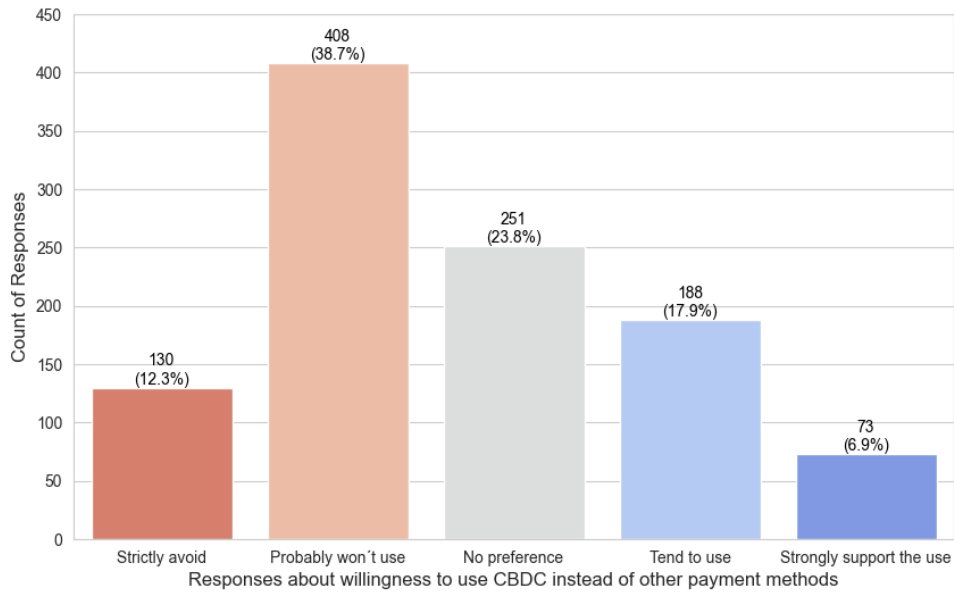


Figure 6. - Willingness to use CBDC instead of other payment options (question 1.2)

Source: own

Overall, the mean of the responses is approximately 2.68, with a standard deviation of 1.11, indicating a slight bias against the adoption of CBDC for daily payments. This outcome highlights potential concerns or reluctance to move away from established payment methods. Also, as can be seen from the count distribution of the answers to questions 1.1 and 1.2 regarding the likelihood to use CBDC, there is a strong correlation between knowledge and likelihood to use CBDC.

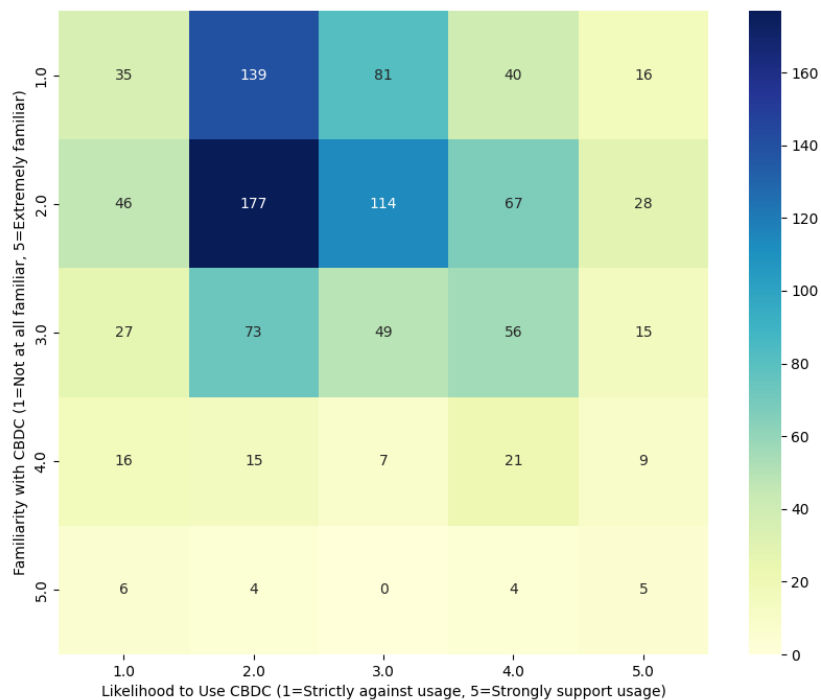


Figure 7. - Heatmap of response combinations for CBDC familiarity and likelihood to use (questions 1.1 and 1.2)

Source: own

In the heatmap in figure 7, each cell represents a count combination of survey participants who selected a particular combination of familiarity and likelihood levels according to the Likert scale. The color intensity indicates the frequencies, with darker shades representing higher frequencies. The results confirm the intuitive assumption that the likelihood of willingness to use CBDC is low when there is low knowledge about it.

To find out what respondents think about the concept of a tiered CBDC (Bindseil, 2021), respondents were asked in question 1.3 to suggest a fair and appropriate amount of CBDC which would be free-of-charge, with any excessive amount subject to fees. The average suggested limit was approximately EUR 40,465, with a notably high standard deviation of around EUR 142,321, underscoring the wide range of views.

The median response was EUR 5,000, indicating that half of the respondents favored a limit at or below this amount, which is surprisingly close to the EUR 3,000 limit for non-remunerated CBDC holdings suggested by Bindseil (Bindseil, 2021). The interquartile range spanned from EUR 2,000 (25th percentile) to EUR 10,000 (75th percentile), suggesting that the majority of respondents preferred a lower limit. However, the responses varied greatly, ranging from as low as EUR 0 to as high as EUR 1,000,000. Intuitively, one could think that the reason for participants not choosing higher amounts might be related to their household income. To investigate this assumption, the Spearman's rank correlation was applied - denoted by (ρ) - which seems appropriate to analyze the correlation of the categorical income intervals as well as the suggested fair limits which are also in a categorical form (Sedgwick, 2014). To do so, all respondents which opted not to answer the question about their household income were excluded. The analysis revealed a coefficient of approximately $\rho = 0.1725$ (with -1 or +1 as one variable's perfect monotone function of the other one). This result indicates a weak but positive monotonic relationship between the two variables. Hence, it suggests that respondents with higher household incomes tend to propose slightly higher limits for free-of-charge CBDC usage, although the strength of this association is relatively modest. The presence of a weak positive correlation aligns with the intuitive expectation that income levels might influence what respondents consider a fair non-remunerated tier for CBDC.

In follow-up to question 1.3, participants were asked in question 1.4 - under the assumption that CBDC payments were easy, widely accepted, and safe - if they would use CBDC for daily expenses and if so, what amount they would keep as a balance in their account (respondents could choose between EUR 500 and EUR 10,000).

Out of the 1,050 respondents, 26.6% (279) answered that they would not use CBDC at all and that they would rather use other payment forms. When excluding these responses, the mean balance maintained in CBDC accounts is approximately €2,214.66, with a median of €1,000 and a standard deviation of about €2,605.25. The median value suggests that half of the potential CBDC users prefer to keep a balance of €1,000 or less.

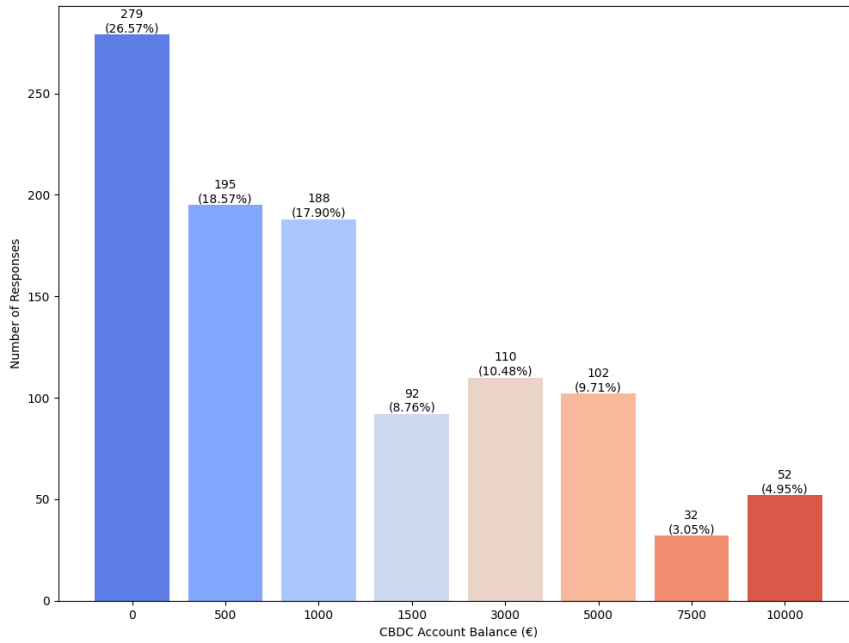


Figure 8. - Preferences for CBDC deposit balances (question 1.4)
Source: own

When asked in question 1.5 whether the participants would support the removal of cash the responses showed a clear picture in adversity of the idea to only use digital forms of payment. As is pictured in Figure 9, out of the 1050 participants 30.41% (319) and 31.27% (328) were strictly against the removal of cash or tend to be against it, respectively. A total of 173 or 16.49% were neutral while 15.92% (167) would somewhat support the removal of cash. Only 5,91% (62) would strongly support the removal of cash.

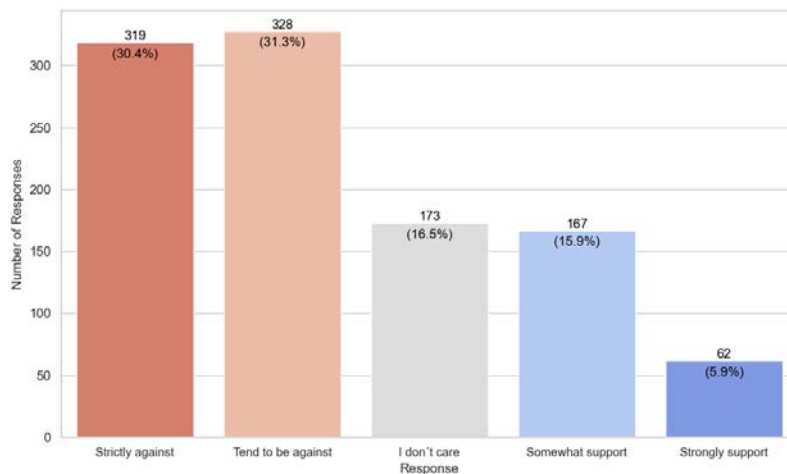


Figure 9. - Support for the removal of cash (question 1.5)
Source: own

Furthermore, a crucial question for researching the sentiment about CBDC as well as evaluating the premium according to chapter 3.3, is question 1.6 where the question was asked about various concerns when CBDC would be implemented. Following Robbins et al.

to visualize data for this situation a diverging stacked bar chart is suggested (Robbins and Heiberger, 2011).

As it is visualized in Figure 10, the dominant concerns highlighted by the survey are related to government control of finances and the transparency of payments, suggesting a significant aversion to the potential oversight and surveillance capabilities that CBDCs might enable. When choosing between “not at all concerned”, “slightly concerned”, “moderately concerned”, “very concerned” or “extremely concerned”, almost half of the participants were either extremely or very concerned about government control (26.8% or 22.1% respectively) or privacy of the payments (24.1% or 21.1% respectively).

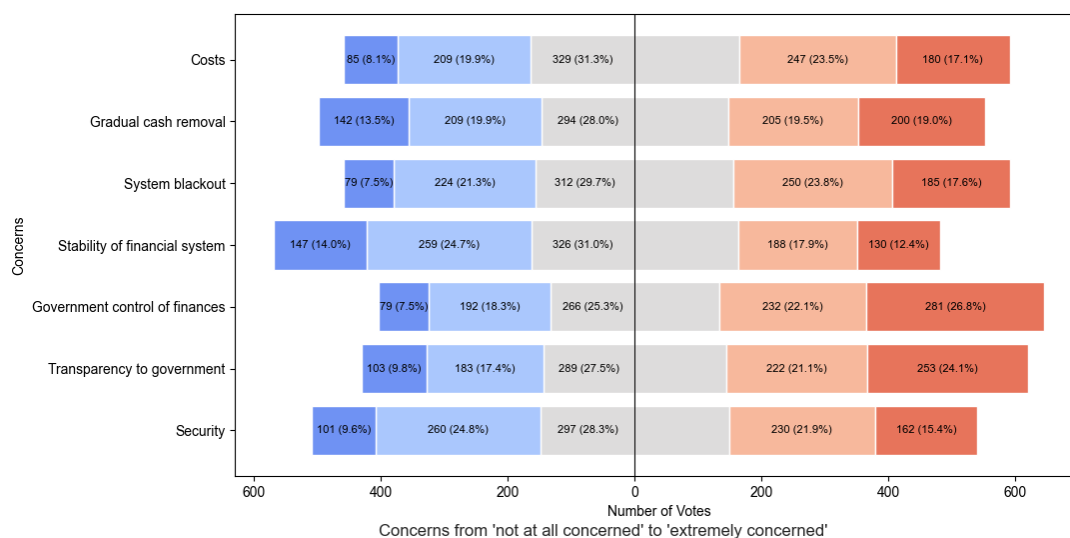


Figure 10. - Diverged bar chart of concerns of CBDC implementation (question 1.6).

Source: own

It is important to note that the scale regarding concerns is already skewed negatively. Concerns about security or blackouts also scored high, underscoring the participants awareness of risks, such as cyberattacks and data breaches. Interestingly, there were fewer concerns about the stability of the financial system but roughly 40% of the participants were either extremely or very concerned about the removal of cash which is in line with the responses for question 1.5. Additionally, costs applied to CBDC accounts were also areas of concern, though they registered lower on the scale.

Descriptive results for Survey II

The second survey specifically targeted factor weights and factor scores for cash and CBDC which will be explained and portrayed in this section. Survey II was conducted among 525 participants among 20 groups (10 male and 10 female). The group sizes in proportion to each other were – just like in Survey I – proportionally selected according to the EU population distribution, with the first 9 groups for each gender matching the 9 most populated countries and the 10th group representing the remaining participants according to their percentage of the rest of the population. Since the population distribution is the same as in Survey I, the repeating descriptive statistics will not be discussed any further.

After the explanatory introduction, the participants were asked in question 1.1 how important the product attributes *cost*, *security (risk perception)*, *privacy (transparency)*, and *overall preferences (consist of knowledge, familiarity, reputation, and other factors which are not included in the other three factors)* of cash and CBDC are for them, when considering a form of payment or storage of value. They were asked to rate each quality on a scale from 1 to 10. Importantly, it is assumed that an agent has the same value of the weight for each factor, independent of which asset they apply. For example, if an agent weighs the factors *costs* with 20%, *risk* with 30%, *transparency* with 25% and *overall preferences* with 25% then these values of weights stay the same, no matter if she/he calculates the premium for cash or CBDC. The same is true for the other factors portrayed here. The weights represent the importance of each factor; therefore, it must be the same, regardless of the assets. But the score for each factor might be different, e. g. due to different costs for transactions for CBDC or cash, or due to different levels of security for either asset holdings. To mention some examples; advances in digital security technology could decrease the perceived risk for the DE or CBDC, leading to a higher risk (the higher the better) score.

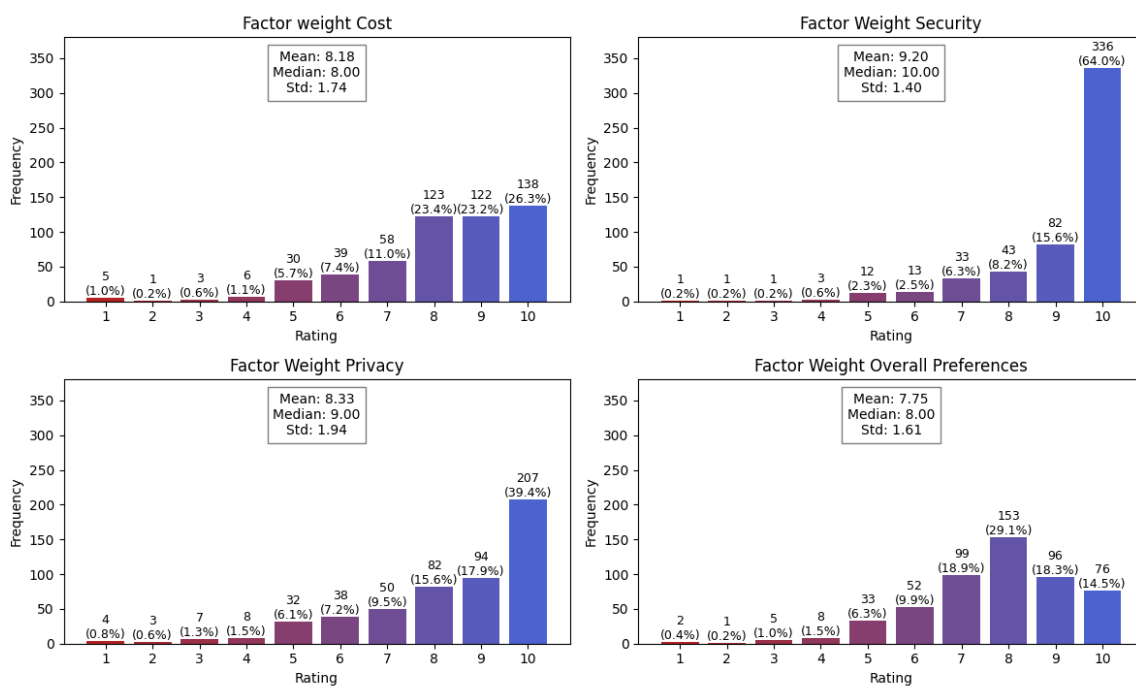


Figure 11. - Factor weights for *cost*, *security*, *privacy* and *overall preferences* (question 1.1)

Source: own

For cash, e.g., increased incidents of theft or loss could lower the according score for the respective weight factor. Or the introduction of more efficient digital transaction methods could reduce the costs associated with CBDC, increasing its score. Furthermore, for cash, increased costs of handling and storage could decrease its score accordingly.

As seen from Figure 11, all factors received rather strong ratings. The rating for *cost* indicates a strong consideration of cost in payment preferences. The mean score was 8.18, with a standard deviation of 1.74, suggesting a consensus among participants on the importance of cost. The factor *security* was the most highly rated factor with a mean of 9.20

and a standard deviation of 1.40. This highlights the importance of security for either payment form.

Privacy (transparency) was also held to be important, with a mean score of 8.33 and a standard deviation of 1.94. The distribution showed a slight skew towards higher ratings, indicating a strong preference for privacy in financial transactions.

The factor “*overall preference*” has a mean of 7.75 and a standard deviation of 1.61. While still important, it shows a wider spread of opinions compared to other factors. In conclusion, it can be stated that *security* is the most critical factor, followed closely by *privacy* and *cost*, while *overall preferences* are less important for the respondents.

In question 1.2, the participants were asked to score the qualities of cash and the CBDC regarding *cost* efficiency, perceived *security*, *privacy* aspects and the *overall preference*, resulting from convenience of payments and knowledge about the payment form. The scores for the factors *cost* and *security* showed comparable results, depicting no strong preference of one payment form over the other. Participants rated cash and CBDC similarly in terms of cost, with cash scoring a mean of 5.48 and CBDC scoring 5.47. This similarity suggests a neutral perception of both forms regarding cost-effectiveness. Also, the scores for *security* were close, with cash scoring a mean of 6.23 and CBDC scoring 6.23. These ratings indicate a comparable level of confidence in the security aspects of both Cash and CBDC. Privacy showed as a factor where cash significantly outperformed CBDC. The histogram in Figure 15 clearly showed that cash scored consistently higher than CBDC, reflecting a strong preference for the privacy attributes of cash.

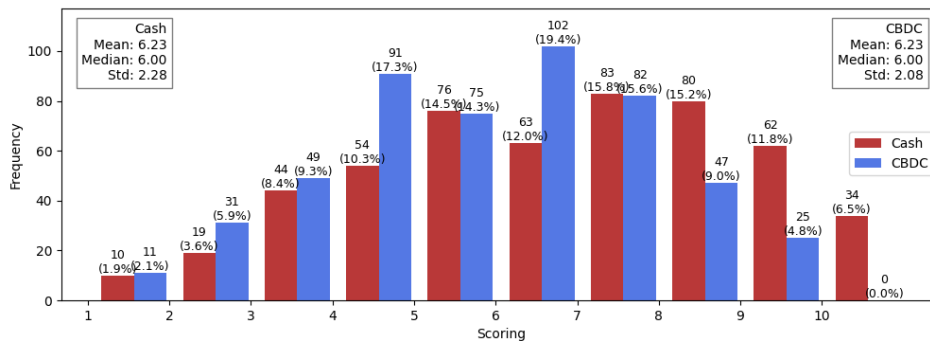
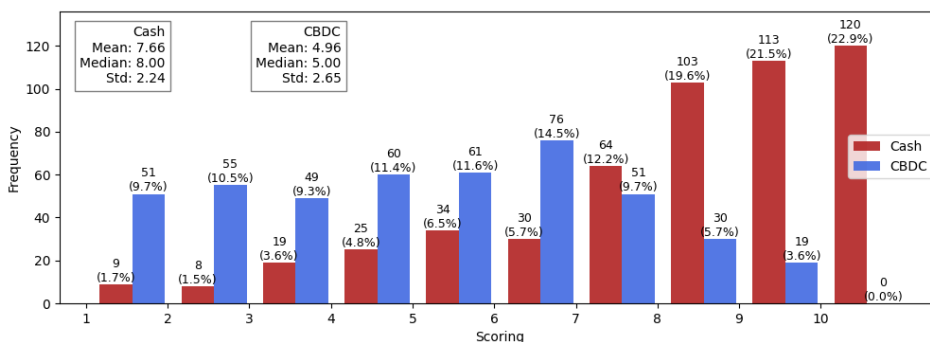


Figure 12. Factor score for *privacy* (question 1.2)

Source: own



Source: own

The mean score for cash with a value of 7.66 was significantly higher than that of CBDC with a value of 4.96, suggesting strong concerns about CBDC regarding transparency.

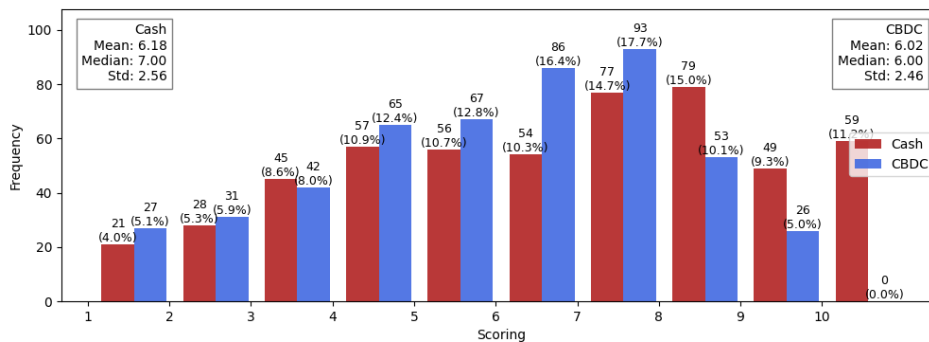


Figure 13. Factor score for overall preference (question 1.2)

Source: own

Overall preferences showed a slight leaning towards cash, with a mean score of 6.18 for cash and 6.02 for CBDC. This indicates a marginal preference for cash when considering all factors not evaluated by cost, privacy or security.

Survey II concluded with demographic questions about the gender, age, and the origin of the participants. The results match the results from Survey I, except for grouping the 18 least populated countries of the EU (by number of residents) into one group which consisted of approximately 20% of the total number of participants. The average age of the participants was also comparable with 37.6 versus 36.5 in Survey I.

Limitations of the Surveys results

First, intentions expressed by the survey participants when asked about hypothetical situations often diverge from actual behavior when being in the situation. Also, while the surveys aimed to achieve a representative sample of EU citizens, the use of online platforms like LinkedIn and Clickworker may have introduced a sampling bias. Distributing the surveys in country and gender buckets according to Eurostat population data, while helpful, does not guarantee a representative sample (Couper *et al.*, 2007). Moreover, important stakeholder groups like businesses, merchants, and policymakers were excluded, which limits the generalizability of findings to a retail consumer perspective. Their opinions likely differ, so complementing the surveys with in-depth interviews of, for example, corporate treasurers or regulators could have provided more insights (Lewis and Ritchie, 2003)

Also, following Bethlehem, though the number of participants and the gender distribution across the 54 survey groups for Survey I and 20 for Survey II, respectively, matches the EU distribution, certain demographics like the elderly, those without internet access, and those less active on social media platforms are likely underrepresented (Bethlehem, 2010). The impact of sampling bias is difficult to estimate without benchmark surveys or population-level data on attitudes and opinions about CBDCs. Other unobserved factors and concerns in general may have affected the results as well.

Discussion of the Research Findings

In this section, the results of this paper are discussed and put into perspective with other research. There are some notable parallels and differences which will be highlighted in the following chapters.

The CBDC and the DE demand and adoption

To contribute to the answers to research questions RQ1-RQ3, two surveys were performed to get a better understanding of the sentiment among economic agents (here limited to private households) and narrow down the important factors which influence the demand for cash versus CBDC, and how individuals score these factors. There is only limited third party research which could be put in perspective with the results from Survey I and II, though.

The surveys were conducted according to the distribution of genders and population in the 27 EU countries among 1,050 and 525 participants, respectively. Thus, as expected, no abnormalities could be found regarding the demographics. Analyzing the results of Survey I, which aimed to get a better understanding of the sentiment about CBDC and the DE, it became apparent that there is currently a low level of knowledge about CBDC. Comparing the EU countries, there were not many differences regarding familiarity with CBDC. This could be confirmed by a recent study by BearingPoint among 8,114 people in Germany (2,040), Finland (1,004), France (1,056), Netherlands (1,006), Ireland (1,002) Austria (1,005) and Switzerland (1,001) which concluded that a third of the participants had not heard of the DE yet at all. Outstanding was France, where 43% of the respondents had not heard of the DE yet (Bearing Point, 2023). The Survey I result also indicated a correlation between knowledge about the DE and the willingness to use it. This could be confirmed by Bijlsma et al. when researching Netherlands potential for an adoption of the DE. Their results also show that the knowledge about CBDC is positively related to the intended adoption. Interestingly, trust in banks in general is negatively related with intended CBDC account usage (Bijlsma *et al.*, 2021). Still, 18% of the Survey I participants indicated, that they tend to use the DE when available, while only 7% would strongly support its use. This corresponds to the results from the BearingPoint survey, where between 15% and 21% of all EU countries would use the DE even several times per week. Also, the analysis by Bijlsma suggests a clear potential demand for CBDC in the Netherlands based on about half of the respondents indicating an intention to open accounts for the DE. 49 % of participants confirmed that they would be interested in opening a CBDC account (Bijlsma *et al.*, 2021). Son et al. also confirmed a demand for CBDC, though they highlight that the demand might be negatively correlated with the interest rate in case of an interest-bearing CBDC. The demand for CBDC would obviously increase as the interest rate on CBDC holdings increases (Son *et al.*, 2022). But according to the baseline design for the DE and other CBDC, an interest-bearing retail CBDC is highly unlikely as the DE is planned as an addition to cash with similar properties (Jaremba, 2023). Furthermore, demand for non-interest-bearing CBDC was also suggested by Huynh et al. when researching demand for CBDC in Canada. They concluded that CBDC could be adopted when it was introduced as an addition to current payment choices. Their simulation estimated that CBDC could be used in up to 25% of transactions (Huynh *et al.*, 2020). This was also confirmed by Survey I and II.

Removal of Cash, Preference for Cash

The participants of Survey I were asked about their preference for cash versus the DE and whether they would support the removal of cash. The results showed clearly that only approximately 22% would somehow support the removal of cash and would consider using only digital payment forms instead. This is in alignment with the results from BearingPoint showing that cash is still the most popular payment method in Europe, though participants also endorse other digital payment forms. A strong majority of the respondents stated that they would not turn away from cash within the next 5 years (Bearing Point, 2023). This sentiment strongly contradicts the contemplations from researchers who argue that the complete removal of cash would enhance the effectiveness of CBDC and MP in several aspects (Berriel and Guardado, 2019; Grasselli and Lipton, 2019; Torres, 2017).

Concerns about CBDC

In Survey I, a significant portion of participants expressed considerable concerns regarding government control and privacy in the context of using CBDC or the DE. Specifically, 26.8% of respondents were "extremely concerned" and 22.1% were "very concerned" about government control, while 24.1% were "extremely concerned" and 21.1% were "very concerned" about the privacy of payments. This highlights that almost half of the respondents are significantly concerned about these aspects. When compared to the findings from Survey II, where participants rated the importance of the factors *costs*, *security*, *privacy* and *overall preferences* on a scale from 1 to 10, a clear correlation can be seen. In Survey II, the mean score for *privacy* (also referred to as *transparency*) was 8.33, with a standard deviation of 1.94, indicating that privacy is highly valued by participants. This aligns with the concerns about privacy of payments in Survey I, where a significant percentage of participants were either extremely or very concerned. As emphasized by other researchers, it is crucial to address privacy concerns and data protection to enable public adoption of CBDC (Bilotta and Botti, 2021; Schianchi and Mantovi, 2023).

Security is also a top priority among economic agents as highlighted by various researchers (Aysan and Kayani, 2021; Bilotta and Botti, 2021; Kiff *et al.*, 2020). Similarly, it was a top priority in Survey II, with the highest mean score of 9.20 and a standard deviation of 1.40. This focus on security correlates with concerns in Survey I about risks such as cyberattacks and data breaches, which were significant enough to be highlighted by participants.

When asked about concerns regarding costs in Survey I, the respondents did not express an increased concern about the cost for CBDC or DE payments. The *cost* factor in Survey II, on the other hand, received a stronger rating, with a mean score of 8.18 and a standard deviation of 1.74, suggesting that participants place considerable importance on the cost implications of payment methods and storage of value in general. Only a few sources such as Keister and Sanchez mention concerns about costs for accessing payment networks and argue that these costs are a reason people use cash (Keister and Sanches, 2019). Thus, the costs for CBDC should be comparable to cash to facilitate adoption.

Overall, both surveys express high levels of concern about government control, privacy, and security, as well as a moderate consideration for costs.

Policy Recommendations

Building upon the insights provided through Survey I and II in previous chapters, some recommendations can be offered when implementing the DE. These recommendations consider the complex interplay between the preferences for cash, DE, as well as the factors influencing these preferences.

DE baseline design recommendations

The DE should be designed with a focus on privacy and security considerations. The surveys reveal that nearly half of respondents have significant concerns about privacy and government oversight associated with CBDC payments. This aligns with the findings of other researchers, who emphasize addressing privacy in CBDC designs to enable public adoption (Bijlsma et al., 2021; Bilotta & Botti, 2021a; Huynh et al., 2020; Li, 2021). It can be recommended that CBs should closely evaluate the appropriate anonymity thresholds when architecting a retail DE. Options include transaction value limits below which transfers are unrecorded, combining online and offline capabilities, or utilizing privacy-enhancing technologies. Any limits or reductions in anonymity for the DE relative to physical cash should balance public concerns with related Anti-Money Laundering (AML) policy objectives. Getting this balance right would require extensive consumer research along with coordination with relevant authorities to understand trade-offs.

Also, more than 70% of the respondents in Survey I indicated that they are either against removing cash as a payment option or are uncertain about going completely cashless. This reluctance is reinforced by research such as a recent study from BearingPoint (2023) showing that most EU consumers still strongly prefer cash for transactions and would not switch within the next 5 years (Bearing Point, 2023). Thus, it can be emphasized that it is important that implementing the DE as an addition to cash should be maintained as a part of the CBDC design concepts which were researched here. This allows the possibility of a gradual transition by letting consumer preferences dictate the use of cash versus CBDC organically.

Furthermore, policymakers should carefully consider the implications of introducing interest-bearing CBDC on the demand for cash and the broader monetary system. This includes assessing the potential impact on savings behavior, payment preferences, and financial stability. Despite the advantages for MP, Pfister (2017) emphasizes that introduction of an interest-bearing CBDC is highly unlikely and setting a negative interest rate on CBDC would come at a high political cost (Pfister, 2017), and this research agrees.

Moreover, the results show that a tiered non-remunerated DE with a cost free tier for daily expenses with increasing expenses for higher amounts, like it was suggested by Bindseil (Bindseil, 2021) seems like a good approach. This research also confirmed that a cost-free tier of EUR 5,000 would be sufficient for most households.

Promote financial literacy and digital inclusion

This research reveals that a high percentage of EU respondents have limited prior awareness about the DE and CBDCs. However, those who are at least familiar with the basics of CBDCs indicate higher likelihood to embrace usage of CBDC as a payment or storage of value. This

aligns with findings from other studies, including Bijlsma et al., that consumer knowledge has a positive relationship with intended CBDC adoption (Bijlsma *et al.*, 2021).

Thus, it is strongly recommended that CBs undertake proactive communication and public awareness campaigns to become familiar with the concept of CBDCs and its pros and cons upon launch. The outreach should highlight the complementary usefulness of CBDC to cash and deposits while addressing common misconceptions and the concerns highlighted in this research.

Conclusion

This research examines the current sentiment of introducing the Digital Euro in the EU and CBDCs in general. Two independent surveys with 525 and 1,050 participants each evaluated EU consumer sentiment regarding the adoption of the DE and their familiarity with this topic. Three research questions were aimed at being answered in this research. The first research question was about the current overall familiarity level of private households with the DE and CBDC in general. One of the key findings from this research was the evident ambivalence toward CBDCs among EU citizens. Despite the digital age we live in, a significant knowledge gap exists regarding CBDCs and the Digital Euro. A high percentage of participants has little knowledge about the DE or CBDC or has not heard about this topic at all.

The second research question was about the main concerns of economic agents when they are confronted with the implementation of the DE, with many expressing concerns over privacy, security, and the possibility of increased government surveillance. These concerns align with the literature, suggesting a critical need to address privacy and security in the design and implementation of CBDCs to ensure wider public adoption. Interestingly, the research also showed a potential demand for CBDCs, contingent on their ability to offer enhanced security, lower costs, and greater privacy compared to traditional banking systems.

Despite the potential benefits of the DE or CBDCs, the research results reaffirmed a strong consumer preference for cash, suggesting that any transition toward digital currencies should be gradual and should consider public opinion. This preference underscores the necessity for CBDCs to complement rather than replace cash.

The third research question was about which design features the DE should have to enhance its adoption among private households and could be answered by suggesting important design features. The results emphasize the importance of privacy and security in the design of the DE, suggesting that the ECB evaluates appropriate anonymity thresholds and privacy-enhancing technologies. Moreover, it emphasizes the importance of promoting financial literacy and digital inclusion, highlighting the need for proactive communication to educate the public about the DE, its pros and cons and address common misconceptions.

This research contributes to the growing body of academic literature about the DE and CBDC by providing empirical evidence and offering a comprehensive analysis with primary data on consumer attitudes toward the DE and CBDCs.

However, it should be emphasized that this research is not without limitations alongside the contributions. The results are based on the survey responses. The participants responded to hypothetical scenarios which may not accurately reflect actual behavior. Also, the sampling method, relying on online platforms, may have introduced bias, making it

challenging to ensure a representative sample of EU citizens. Furthermore, other stakeholders such as businesses and policymakers were not included, limiting the findings' applicability primarily to a consumer perspective. Additionally, despite efforts to match the EU's demographic distribution, certain groups like the elderly or those less active online are likely underrepresented, affecting the generalizability of the results. Unobserved factors and general concerns may have also influenced the outcomes.

Overall, the rapidly shifting CBDC landscape poses a challenge to the longevity of this study. Unforeseen developments or other design choices than those assumed in this study can alter the validity of the research results.

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doc. Mgr. Ing. Petr Wawrosz, Ph.D.

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Appendix A: Survey I questionnaire **(excluding questions regarding the ELB and negative interest rate policy)**

Introduction of Central Bank Digital Currencies (CBDCs), and the Implications of Negative Interest Rates

This survey examines your opinion on Central Bank Digital Currencies (CBDCs) like the Digital Euro. Also, it is about your tolerance to negative interest rates and whether you would start converting your bank deposits rather into cash or a new secure CBDC to avoid a negative yield on your bank account.

Your participation, which will take less than 10 minutes, is greatly appreciated. It will significantly contribute to my PhD research. My study focuses on the impact of CBDCs on payments and value storage, especially during periods of negative interest rates.

Please note that the underlying currency for this survey is the Euro (EUR). If you are participating from Bulgaria, Czech Republic, Denmark, Hungary, Poland, Romania, or Sweden, kindly convert your currency values into Euros. Thank you.

Section

1

Removal of cash and introduction of a Central Bank Digital Currency (CBDC)

It is important to point out a few things to avoid misunderstandings about CBDC:

More than 90% of the Central Banks are presently evaluating CBDCs. CBDCs have the potential to significantly alter our spending habits and methods of value storage. Currently, cash transactions are cost-free and anonymous. However, possessing large sums of cash comes with inconvenience, increased effort in exchanging, and security risks. A proposed CBDC could enhance the safety of daily payments and value storage, as it could be securely maintained in a digital wallet and easily transferred. Nonetheless, this could result in transparency of expenditures to regulatory authorities. Note: So, please keep in mind for all answers:

1. CBDC is central bank money and therefore - just like bank notes - its value is protected (unlike cryptocurrencies or excessive deposits at your bank)
2. A CBDC could be easier to handle than cash. Just like credit- or debit cards, apple- or google pay, or paypal etc.
3. Using CBDC could be less anonymous than using cash. Though the EU plans to respect privacy, all transactions might be recorded (just like all other electronic payments nowadays).

1.1. How familiar are you with the discussion about the introduction of a CBDC such as the Digital Euro?

(Multiple choice:)

- Not at all familiar
- Somewhat familiar
- Familiar
- Very familiar
- Extremely familiar

1.2. Imagine, the Central Bank would introduce a CBDC in addition to cash. A CBDC could be more secure and easier to handle than cash. However, CBDC is potentially less anonymous because all payments could be recorded. Would you use this CBDC instead of using current forms of payment (e.g. cash, debit- or credit cards) for your daily payments?

(Multiple choice:)

- I would strictly avoid using the CBDC,
- I would probably not use the CBDC where I don't have to.
- I don't care whether I use other forms of payment or CBDC.
- I tend to use CBDC over cash.
- I would use the CBDC wherever I can.

1.3. If the Central Bank introduces CBDC with a limited free-of-charge amount, and charges fees on any excess amount, what do you think would be a fair and appropriate limit for this free CBDC amount?

(Multiple choice:)

- €1,000
- €2,000
- €3,000
- €5,000
- €10,000
- €20,000
- €50,000
- €100,000
- Other: _____

1.4. If the Central Bank limits the free-of-charge usage of CBDC to a certain amount (e.g., € 10,000). Would you use this amount for daily expenses and keep a balance on your CBDC account if the CBDC payment was easy, widely accepted and safe?

(Multiple choice:)

- No, I would not use CBDC. I would use other payment options
- Yes, I would keep a balance on my CBDC account of around €500
- Yes, I would keep a balance on my CBDC account of around €1,000
- Yes, I would keep a balance on my CBDC account of around €1,500
- Yes, I would keep a balance on my CBDC account of around €3,000
- Yes, I would keep a balance on my CBDC account of around €5,000
- Yes, I would keep a balance on my CBDC account of around €7,500
- Yes, I would keep a balance on my CBDC account of around €10,000

1.5. In an extreme scenario a central bank could replace bank notes with CBDC. Would you support the removal of cash in general, and therefore completely switch to digital payment options (e. g. debit- and credit cards, CBDC, cryptocurrencies, google- or apple pay etc.)?

(Multiple choice:)

- I am strictly against the removal of cash.
- I tend to be against the removal of cash.
- I don't care if cash was removed and live with whatever is the standard.
- I somehow support the removal of cash.
- I strongly support the removal of cash.
- I don't know
- Other: _____

1.6. Which concerns do you have when CBDC were implemented?

(Multiple choice grid:)

	not at all	slightly	moderately	very	extremely
Security (theft, fraud, hacking etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Privacy (transparency to the government)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Control of the government about your finances	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Stability of the financial system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
System black outs and loss of data	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gradual removal of cash	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Applied cost on your CBDC account	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you for answering the first part.

Personal questions (we do not collect any personal information):

It really helps us, if you would tell us a little bit about yourself! Especially, to put your answers in relation to the current development in your country regarding CBDC

3.1. Please select your gender.

(Multiple choice:)

- Female
- Male
- Non-Binary
- Prefer not to say

3.2. What is your age? (please enter a number)

(Text box:)

3.3. Which country is your primary residence?

(Drop down choice:)

Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom, USA

3.4. Please select your level of education:

(Multiple choice:)

- High School or lower
- Some college or vocational training
- Bachelor's degree
- Master's degree
- Doctorate or higher
- Prefer not to say

3.5. What's your current employment status?

(Multiple choice:)

- Employed full-time
- Employed part-time
- Self-employed
- Unemployed
- Student
- Retired
- Prefer not to say

3.6. What is your approximate household income on an annual basis?

(Multiple choice:)

- €0 - 4,999
- €5,000 - 9,999
- €10,000 - 14,999
- €15,000 - 19,999
- €20,000 - 24,999
- €25,000 - 29,999
- €30,000 - 39,999
- €40,000 - 49,999
- €50,000 – 74,999
- €75,000 - 99,999
- €100,000 - 199,999
- €200,000 and more
- I prefer not to say

3.7. Any additional remarks you have regarding this topic and the survey?

(Text box:)

Thank you for participating in this survey! You have done a great job supporting science!

If you participated via CLICKWORKER please don't forget to hit the "submit" button. Your CLICKWORKER Code will be shown on the following page!

If you like to receive the results of this survey, please leave your email here

(Text box:)

Appendix B: Survey II questionnaire
(excluding questions regarding the ELB and negative interest rate policy)

The Digital Euro as an alternative to Cash, and the Implications of Negative Interest Rates

This survey examines your opinions on the **Digital Euro** as an alternative to cash. Additionally, it explores your **tolerance for negative interest rates** and whether you would consider converting your bank deposits into cash or the new Digital Euro (when available) to **avoid negative interest rates on your bank account**.

Your participation, (which will take around **5 minutes**), will significantly contribute to my PhD research on the Digital Euro.

Please read the questions carefully, as accurate responses are crucial for the validity of my research results.

Note for CLICKWORKER Participants: Don't forget to hit the "submit" button at the end of the survey. Your CLICKWORKER Code will be displayed on the following page.

Thank you for your participation!

Mick

Section 1:

Before starting the survey, please read this **brief introduction** to the Digital Euro.

What is the Digital Euro?

The Digital Euro is a digital form of currency which might be issued by the European Central Bank (ECB) somewhen in the future. It is not a cryptocurrency like Bitcoin, but rather a digital version of the Euro, with the same value as physical cash. So, it's value is safe just like cash, even in times of financial turmoil.

Key Features:

Accessibility: The Digital Euro is intended to be accessible to all, ensuring that everyone has access to a safe form of money in a digitalizing world.

Costs: The current design includes cost-free payments for day-to-day expenses. Anyhow, since intermediaries such as banks might be involved, some services (storage or transfer of larger Euro amounts) might come at a cost.

Security: Backed by the ECB, it offers a high level of security and is a direct claim on the ECB, similar to cash. But it cannot be out ruled, that theft, hacking etc. is possible, just like your cash might get stolen.

Privacy: The Digital Euro is designed with privacy considerations, but unlike cash, it may involve some level of digital record-keeping. Especially for larger amounts.

Ease of Use: It can be used for daily transactions, online purchases, and peer-to-peer payments. Payments will be as easy as with your debit- or credit card.

1.1. How important are the following **qualities** to you when considering a form of payment or storage of value (such as Cash, Bank Deposits or Digital Currencies like the Digital Euro). Please rate each quality on a scale from 1 to 10.

Costs for exchanging, transporting, holding, securing etc. for payments or storage of value.

Not at all important to Extremely important (on a scale from 1 to 10)

Security from theft, hacking, financial turmoil etc.

Not at all important to Extremely important (on a scale from 1 to 10)

Privacy of payments and holdings of value from banks or authorities.

Not at all important to Extremely important (on a scale from 1 to 10)

Overall Preferences: For instance, consider aspects like **convenience** to handle and your **familiarity** with payment methods. Please rate the importance on a scale.

Not at all important to Extremely important (on a scale from 1 to 10)

1.2. How would you rate the **qualities** of **Cash** or the **Digital Euro** below? Please **choose a score** for each quality.

How do you evaluate the costs associated with using Cash? Please consider factors such as the expenses involved in exchanging deposits, transporting money, and storing larger amounts, which might include costs for a vault, insurance, etc.

Very little costs to Extremely (costly on a scale from 1 to 10)

Costs for the Digital Euro: How do you evaluate the costs for the Digital Euro? Please remember, that setting up a wallet, get familiar with the functionality might come at a cost. Also, transferring and storing large amounts might come at a cost. Day-to-day payments are free of charge.

Very little costs to Extremely costly (on a scale from 1 to 10)

How do you rate the **security of Cash** in terms of payments and as a store of value? Please consider that storing cash, especially in larger amounts, may expose you to the risk of theft.

Extremely risky to Extremely safe (on a scale from 1 to 10)

How do you rate the **security of the Digital Euro** for payments and as a store of value? Please keep in mind that, although its design is intended to be secure, there may still be risks such as theft or hacking.

Extremely risky to Extremely safe (on a scale from 1 to 10)

How do you rate the **privacy** associated with **using Cash**? Keep in mind that cash payments are completely anonymous. However, converting large deposits into cash (and vice versa) might be recorded by your bank.

Not private at all to Extremely private (on a scale from 1 to 10)

How do you assess the **privacy level of the Digital Euro**? The design aims to ensure privacy for smaller payments while maintaining a record of larger payments (specific amounts yet to be defined). However, it's important to note that, in general, all digital payments might be fully transparent to authorities.

Not private at all to Extremely private (on a scale from 1 to 10)

Based on your knowledge and the frequency of your usage in daily life, how would you rate your **overall preference for cash**?

I don't like cash at all to I have a high preference for cash (on a scale from 1 to 10)

Based on your current knowledge about the **Digital Euro** (even if limited), what is your **overall preference** for it? Please rate your likelihood of using the Digital Euro.

I don't like the Digital Euro at all to I have a high preference for the Digital Euro
(on a scale from 1 to 10)

Thank you for answering the first part.

Personal questions (we do not collect any personal information):

It really helps us, if you would tell us a little bit about yourself! Especially to put your answers in relation to the current development in your country regarding CBDC

3.1. Please select your gender?

Female

Male

Prefer not to say

3.2. What is your age?

(please enter a number)

Your answer

3.3. Which country is your primary residence?



Choose from EU countries

3.4. Any additional remarks you have regarding this topic and the survey?

Your answer

Thank you for participating in this survey! You have done a great job supporting science!

If you participated via CLICKWORKER please don't forget to hit the "submit" button. Your CLICKWORKER Code will be shown on the following page!

If you like to receive the results of this survey, please leave your email here

Your answer:

Mladá veda

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