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Svetlana Abramova and Rainer Böhme, *Universität Innsbruck;*
Helmut Elsinger, Helmut Stix, and Martin Summer, *Oesterreichische Nationalbank*

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What can central bank digital currency designers learn from asking potential users ?

Svetlana Abramova [*]
Universität Innsbruck

Rainer Böhme [*]
Universität Innsbruck

Helmut Elsinger [†]
Oesterreichische Nationalbank

Helmut Stix [†]
Oesterreichische Nationalbank

Martin Summer [†]
Oesterreichische Nationalbank

Abstract

The ongoing initiatives to offer central bank money to consumers in the form of retail central bank digital currency (CBDC) have triggered discussions on its optimal design. So far, the perspective of potential users has not been considered widely. To strengthen this, we survey 2006 Austrian residents using a tailored questionnaire on attitudes towards a digital euro, selected technical features as well as potential security and privacy concerns. Only about half of the surveyed respondents express at least some interest in a digital euro. This subsample tends to attribute more importance to security aspects than to transaction data privacy. Similarly, offline functionality is preferred over a feature to make direct payments between persons. Our findings suggest central banks to embrace a more user-centric design of CBDC. This effort should include communicating the key concepts and benefits to the potential users.

1 Introduction

The question on whether and how central banks should issue central bank money in digital form directly to consumers is high on the policy agenda. Reports and academic papers have contributed to the discussion of retail central bank digital currencies (CBDC) from various angles, including monetary policy [3, 13, 16], impact on the financial system [4, 28], and technology [5, 26]. Comparatively fewer studies have taken the perspective of potential users, let alone have applied methods to systematically collect data on a representative basis [11, 33]. To address this gap, this paper draws on a dataset collected from Austrian residents, who were asked about their interest in a digital euro. The respondents also stated their preferences on such key features of a retail CBDC as the access model, offline functionality, and person-to-person payments. They further reported the perceived importance of technical attributes, such as payments security and privacy (i. e., data protection). A series of logistic regression models is estimated and discussed with a view on informing the ongoing policy debate.

A distinctive feature of our study is that we do not only control for socio-economic factors, but also identify a typology of consumers based on their current use of payment instruments, the degree of technology-savviness, and the reported ownership of cryptocurrencies. We conjecture that these factors play distinct roles in the adoption path of a prospective digital euro. For example, users of non-cash payment instruments, tech-savvy persons, and owners of cryptocurrencies are likely to be among the first adopters of CBDC. Cryptocurrency owners deserve special attention as they have already collected experience with elements of new forms of (arguably) digital money, such as wallets or the handling of cryptographic keys. Their opinion may be more informed given that future CBDC is an abstract concept to most respondents in population surveys.

On the other hand, cash use is still widespread in many European countries. In prior work [8, 36], cash-affine users (i. e., those who prefer to pay with cash for their purchases) were found to have rather different attitudes towards payment instruments than users exercising a more flexible choice. Studying the views of cash-affine users is informative to gauge the initial "market potential" of CBDC. Their adop-

[*]Contact {svetlana.abramova | rainer.boehme} @ uibk.ac.at

[†]The views expressed here are those of the authors and do not necessarily represent the views of the Oesterreichische Nationalbank or the Eurosystem.

tion behavior might be pivotal to determine whether CBDC will develop to become a substitute or remain a complement to the existing payment instruments.

Our results show that consumers in Austria are largely unaware of a digital euro and express little interest in it when prompted. Using a series of tailored questions to elicit the preference between an account model for CBDC (inspired by online banking and card payments) and an access model using digital tokens (inspired by cryptocurrencies), we find overwhelming support for the account-based access. This result is corroborated by our findings on consumers' attitudes towards security and privacy. While the majority assigns high importance to security against fraud and theft, two attributes concerning transaction data privacy rank lowest in a list of nine general attributes: less than one third of the respondents considers it very important that individual transactions are untraceable.

Our paper makes a number of contributions. Drawing upon systematically collected data, we shed light on consumers' interest in a CBDC and their preferences regarding its key technical features. Given the innovative nature of this technology, we suggest a typology of consumer types, which aids to refine heterogeneous opinions and identify groups of prospective early adopters. Finally, we offer guidance for central banks, policy makers, and researchers that facilitates a more user-centric and empirically founded approach to CBDC design. As a high-level lesson, CBDC designers must not underestimate how exotic the concept of a digital euro is for large parts of its intended user base.

This paper is organized as follows. The next section recalls the background of this study and relates it to prior work. Section 3 describes our method, Section 4 presents the empirical results in detail, whereas Section 5 discusses the implications on a higher level. The paper closes with a brief conclusion.

2 Background

This section sets the scene. Subsection 2.1 briefly recalls the justifications for central banks' CBDC projects and relates them to the perspective of consumers studied in the present work. Subsection 2.2 introduces selected challenges in CBDC design and the associated terminology. Subsection 2.3 presents a review of closely related work. Readers familiar with these topics can safely skip this section.

2.1 Why CBDC?

According to the Bank for International Settlements (BIS), more than 75 central banks around the world are examining whether they should offer central bank money to the public not only as banknotes and coins but also in digital form [7]. This new form of money is referred to as retail CBDC.

Most central banks, including the European Central Bank (ECB), view their work on retail CBDC as a strategic project. It should enable universal access to central bank money in a future in which digital payments are becoming more important, while the payments market could be dominated by new private intermediaries, including the big global platform firms of the internet economy. While central banks' projects are in different stages of development, the majority of them are driven by administrative prudence and strategic foresight rather than the desire to phase out existing forms of money such as cash [10, 17]. Issues like the continued universal access to central bank money, control over monetary policy as well as sovereignty issues take a lot of room in the discussions of central banks and policy makers.

Consumers, by contrast, seem often unaware of these debates and currently do not exert much active pressure on central banks to offer new forms of money and payment instruments. However, a new form of digital money cannot be developed and implemented by a central bank decision alone. It needs to be adopted by users and provide functions that cater to real user needs and preferences. In our study, we want to better understand the current user perspective in order to inform the debate on CBDC.

2.2 Key CBDC design decisions

The design space for retail CBDC is large. It spans technical as well as economic and legal aspects. Our survey touches on a number of technical design decisions to be made before the launch of a CBDC that are costly (if not infeasible) to revert later. The selection of aspects was guided, on the one hand, by their relevance in the policy debate and, on the other hand, by what consumers can meaningfully state in a survey about an imagined form of money.

Account or token-based access The way how end users can access CBDC has far-reaching implications ranging from usability, privacy, security against theft and losses, perhaps including the mental model

future consumers form about money. While the technical design space is rich and not fully explored, it is commonly simplified to a dichotomy between account versus token-based access [5]. The former follows a conventional account model used in banking systems: ownership of and control over digital money is established by verifying the identity of an account holder. By contrast, the token-based model seeks to mimic the nature of banknotes and coins in digital form. Inspired by how cryptocurrencies manage access, token-based access conditions control (and hence ownership) on the mere knowledge of a secret, typically a private cryptographic key. Strictly speaking, token-based access refers to digital tokens; the model should not be confused with physical tokens (e. g., pieces of hardware) that can change hands just like cash. To illustrate the differences between account and token-based access, consider the protection against financial losses and privacy risks. The token-based model can offer more privacy by de-linking one's identity from transactions, however suffers from a higher risk of losing funds in case of stolen or forgotten keys. The loss of cryptographic keys would resemble the loss of a printed financial bearer instrument.

Offline and person-to-person payments Most consumers have experience with several of the existing electronic payment options offered by the private sector. Retail CBDC differs in the institutional arrangement and requires a new legal framework to ensure the stability of the currency in times of crises or when the demand for cash vanishes. However, it may be difficult for individuals to appreciate these social advantages in normal times and while cash is still widely used. Therefore, in order to increase the individual benefits of CBDC, policy makers may explore the idea of equipping CBDC with features that most existing electronic payments do not offer.

The features considered in our study are offline functionality and person-to-person payments. The former refers to the ability to make payments when there is no network coverage, for example in remote areas or during a temporary blackout. The latter refers to a simple way of passing money directly between individuals (i. e., without a merchant), typically in an interpersonal exchange. Scenarios include pocket money to children, donations and tips to unknown people, splitting bills, or yard sales.

Security and privacy Security and privacy are relevant non-functional properties of any payment system that processes large values or is widely adopted. As such, they set crucial boundary conditions for the design of digital currencies [25]. From the central bank's perspective, each property is costly to engineer, and certain security and privacy features are technically incompatible with each other [6].

Security primarily means that nobody except the legitimate owner can spend funds. As it is widely acknowledged that absolute security is infeasible, a broader notion of CBDC security should include the ease of becoming a proficient user, who makes few mistakes and does not fall for fraudulent requests (e. g., like phishing attempts, which cause a main security risk in online banking). The broadest notion of security from a consumer's point of view incorporates means to recover from failure, e. g., to dispute a transaction and revert payments in justified cases.

While security protects the user from unintended transactions, privacy means that intended transactions do not reveal unintended information about the transaction and the involved parties. As digital technology has matured to a level where storage of information is extremely cheap, many systems are designed to never forget. Such designs pose significant privacy risks. Electronic payments data is considered particularly sensitive as it may reveal information about individuals' wealth, attitudes, preferences, and behaviors. To protect individuals from undesirable consequences of secondary use (or misuse) of personal data that was initially collected for the purpose of payment processing, CBDCs could employ advanced technologies, some of which are still under ongoing research. These technologies support the principle of data minimization, which is adopted in many data protection laws, chiefly the EU's General Data Protection Regulation.

However, the deliberate choice to offer privacy is also subject to policy discussion: should CBDC offer the same level of anonymity and untraceability as cash payments, or should some data be retained and certain secondary uses be enabled? For example, law enforcement agencies could be allowed in justified cases to "follow the money" in order to solve crimes. This promises an increase in security at the cost of privacy. Such trade-offs appear in many forms. For example, having a record about a payee's identity makes it easier (if not enables) for the payer to claim back misdirected payments through the legal system.

2.3 Related work

The literature on CBDC has grown quickly recently. Most of the papers in policy discussions are concerned with strategic considerations as well as technological and economic analyses [7].

Research on user expectations, their preferences for digital central bank money, and the perspective on security and privacy aspects has remained relatively scarce. We are aware of four related empirical studies, two of which are based on surveys [11, 33], one involves focus groups [27], and one uses a mixed-methods approach [31]. An alternative way is to use survey data on existing payment instruments in order to predict demand for CBDC with structural models [24, 29].

The OMFIF study [33] analyzes survey data from more than 13,000 individuals in the age range from 16 to 75. The respondents were recruited from an online panel covering 12 countries. The survey focused on trust in different institutions as potential issuers of digital money, on the importance of different characteristics of payment methods from the user perspective, as well as the subjective assessment of some properties of different payment methods, such as speed, safety etc. The study finds that an openness to the prospective adoption of digital money rises with income and education but declines with age. Safety from theft and fraud ranks highest in the preferred ideal characteristics of a payment method.

An early survey study on the potential adoption of CBDC was [11]. The paper analyzes a sample of 3,293 individuals recruited from an online panel of Dutch residents aged 16 and above. In line with the OMFIF survey, the authors find that potential early adopters of a CBDC are younger, higher educated, and earn higher incomes. While the majority of respondents have never heard of CBDC before participating in the survey, when prompted about 50% expressed a general interest in CBDC, both as a means of payment and as a savings instrument.

The most recent study on consumer attitudes and expectations of a digital currency was published in a report by Kantar Public [27], which documents results from various focus groups analyzed for countries in the euro area on behalf of the ECB. These results are hence not based on representative surveys. Like in [33, 11], few people, including individuals who are characterized as "tech-savvy," have heard about a digital euro. The respondents would value universal access, ease and simplicity of use as well as speed and security most highly as properties of digital money in general. While people in the Kantar study do rank security highly, they do not express very strong concerns regarding privacy of transaction data.

The report by Maiden Labs [31] used both qualitative interviews and a national survey of 1,319 US citizens to learn about their relationship to and use of payment systems. In contrast to the other works, the surveyed respondents were found to be concerned about financial privacy risks, in particular with respect to their own social circles.

User experience in the domain of cryptocurrencies is another research area peripheral to our work. Empirical studies have shown that cryptocurrency owners have inadequate mental models of decentralized systems and crypto wallets serving as payment gateways [21, 30, 32, 38]. These tools, many of which were originally designed with little to no usability in mind, are often perceived to be complex and prone to security and privacy pitfalls. With CBDC initiatives being still in a formative stage, our work strives to advocate for integrating user perspectives into the design process at early stages.

Compared to this state of the art, this paper and its accompanying technical report[1] offer insights from representative—to the extent possible in times of a pandemic—data of a country in the euro area (Austria, 9 million residents, € 50,000 GDP per capita). A new breakdown of results by consumer types helps us to map the heterogeneity in attitudes and user needs with regard to payments in general, and possible future use of CBDC in particular. Collecting data in a country with a relatively high share of cryptocurrency ownership, and at the same time a large sub-group of users who have a strong preference for cash, allows us to contrast the needs and expectations of potential early adopters better than looking at broad mean values.

3 Method

This section documents the data collection, defines consumer types and other control variables, and explains the specification of the regression analyses.

3.1 Data

Our data are collected as part of a survey commissioned by the Austrian Central Bank ("OeNB

[1] https://www.oenb.at/dam/jcr:e3199ed9-0b24-4df5-aac9-52c12c2fbe72/WP_241.pdf

Barometer 2021/1"). The survey is undertaken semi-annually and mainly focuses on economic sentiments and expectations. The questionnaire used in this paper has been devised by the authors and appended as a special module to the regular survey.[2] After several iterations of pretests, it was administered between 18 June and 20 July 2021 by the Austrian IFES institute. The sample consists of 2,006 Austrian residents from age 16 and above, sampled at random from a database of phone numbers. The sampled persons were asked whether they would like to participate in the survey via telephone interview (CATI, 353 interviews) or online interview (CAWI, 1653 interviews). This mixed-mode design differed from past OeNB Barometer surveys, which were based on in-person interviews only. This choice had to be made due to the pandemic situation.

3.2 Approach

To analyze individuals' attitudes towards CBDC, we estimate regression models which evaluate the effect of different socio-economic characteristics. In addition, we consider three types of consumers: cryptocurrency owners, tech-savvy persons, and cash-affine consumers.

Consumer types Our typology of consumers is based on the following considerations. First, since both future CBDCs and cryptocurrencies represent some form of "digital money," we assume that it is easier for cryptocurrency owners to imagine handling a digital euro and the necessary elements (e. g., wallets, cryptographic keys). Therefore, cryptocurrency owners may serve as valuable informants to the designers of CBDCs concerning technical aspects and user experience. In addition, collecting individuals' attitudes toward a visionary, non-existent technology might be prone to biases and misreporting [31]. For cryptocurrency owners, these will be alleviated.

Second, tech-savvy persons are likely to be among the first adopters of the new technology.[3] This is supported by studies showing that there exists a segment of consumers who tend to adopt innovative technologies early on [2, 15, 35]. These consumers take the role of opinion leaders and influence others' attitudes or adoption decisions regarding technological products. They are characterized by a strong intrinsic affinity to high-tech, cutting-edge products and services, and are often deemed to play a special role in the process of the diffusion of innovations [34]. Hence, these persons' attitudes are informative, e. g., to assess potential initial demand for CBDC. While it is evident that cryptocurrency ownership and tech-affinity correlate, it turns out that the correlation is not as strong as one might think—most tech-affine consumers do not own cryptocurrencies. This allows us to separately analyze both tech-savviness and cryptocurrency ownership.

Third, cash still accounts for a large share of payment transactions in many advanced economies [18]. The payments literature has established that cash use is largely driven by consumers' preferences: cash is used for its low costs, for convenience, for its simplicity, for expenditure control, and to preserve privacy [36]. There are two main competing conjectures about how cash-affine consumers may view CBDC. On one hand, it is well conceivable that cash-affine people will not have a demand for a (new) digital payment instrument—simply because cash fulfills their needs. On the other hand, CBDC may as well be attractive to cash-affine users, in particular if it is convenient, generates low costs, and resolves the concerns that might have stopped them from adopting digital payments offered by the private sector [24].

The three consumer types are measured with the dummy variables *Cash-affine*, *Tech-savvy* and *Cryptocurrency owner*, respectively. Appendix B presents a definition of all variables and Table C.1 reports descriptive statistics. In our sample, 8% are cryptocurrency owners, 15% are tech-savvy and 35% are cash-affine. While the groups are intentionally not disjoint, as visualized in Figure 1, the correlation between these three groups is rather low such that we can include all three dummies simultaneously.

Further controls In order to account for confounding effects, we consider a number of basic socio-economic controls. Moreover, we include a set of background variables that could potentially have implications on respondents' attitudes towards CBDC: the stated importance of retaining cash for anonymous payments, the stated importance of hoarding cash, and trust in the central bank. To rule out that the latter variable merely reflects whether a person

[2] The questionnaire in German is available from the authors upon request.

[3] The take-up of financial innovations or digital services by tech-savvy persons is substantially higher than that of non tech-savvy persons. As a case in point, unpublished survey data shows they are about three times more likely to use alternative payment services providers like Apple Pay or Google Pay or mobile apps to send/receive money to/from persons.

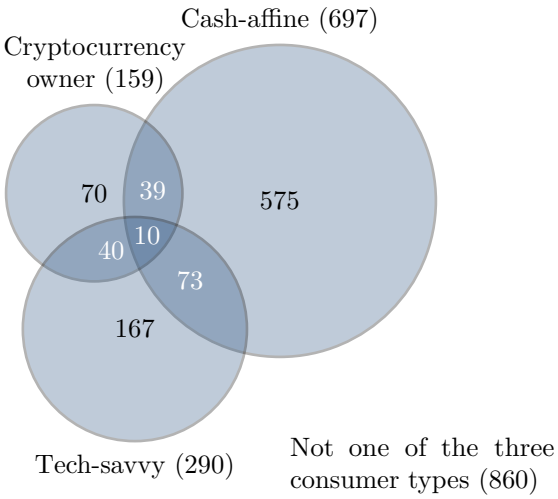

Figure 1: Venn diagram for the three consumer types (in absolute numbers). The total number of observations for each type is provided in parentheses.

is generally less or more trusting, we also include a variable measuring trust in people.

3.3 Specification

For each binary dependent variable of interest Y_i, we estimate a series of multivariate logistic regression models, specified in the basic form as

$$P(Y_i = 1|X_i) = \frac{\exp(X_i\beta)}{1+\exp(X_i\beta)}, \qquad (1)$$

where X_i denotes the row vector of respective control variables. We dichotomize individual responses reported on ordinal scales to a binary outcome following predefined rules. For compactness, each table in Appendix reports results from four regression specifications run separately for each of the two dependent variables. In the default specification (specification 1, respectively 5), X_i consists of a constant term and the three consumer types defined above. This default specification is extended with binary control variables in three steps. Specification (2, resp. 6) adds a set of socio-economic controls. This specification is fitted *without* the consumer types. Specification (3, resp. 7) combines the consumer types and the socio-economic controls. Specification (4, resp. 8) additionally includes the behavioral controls of interest (*hoarding of cash important*, *anonymity of cash important*, *trust in central bank*, *trust in people*). Occasionally, special controls are included for selected dependent variables and discussed in the respective sections below.

The logistic regression models are fitted with the maximum likelihood method. For the sake of interpretability, we refrain from reporting raw logistic regression coefficients. Instead, we calculate the average marginal effects and test their statistical significance. The coefficient values indicate the average percentage points change in the dependent variable if the binary predictor changes from zero to one. Each table also reports means of the dependent variable (which may vary across specifications due to a list-wise exclusion of missing values), the number of cases, and two goodness-of-fit measures.

Empirical studies of cryptocurrency users [1, 9, 37] find an interest in the technology to be one of the prime reasons for cryptocurrency ownership. This would suggest that cryptocurrency owners are rather similar to tech-savvy consumers. A smaller fraction of cryptocurrency ownership, however, has been found to be driven by other considerations, like the independence from banks, the idea of decentralized finance, etc. This would suggest that cryptocurrency owners have different attitudes towards money than tech-savvy persons. To test whether the respective coefficients of *Cryptocurrency owners* and *Tech-savvy* differ statistically, we report results from a likelihood ratio test (LRT) for the null hypothesis that the two coefficients are equal. The test statistic is computed from the underlying logistic model and we report the p-value for each specification where it applies.

Each regression analysis deliberately uses similar specifications. This approach inhibits the search for statistically significant effects and limits potential model selection bias.

4 Results

Before presenting the results, we note that the survey module on the digital euro was introduced by a general and simplified explanation of the digital euro. It was explicitly stated that a digital euro would be complementary to cash and that one digital euro would have the same value as one euro in cash. Respondents were told that digital euro payments would be free of charge, secure, and convenient.

4.1 Interest in CBDC

We first assess people's principal interest in the digital euro. Overall, we find that 17% of the sample

express an explicit interest and 37% state that their interest is rather limited (in the subsequent regressions these two categories are collated). 46% of the sample is not interested at all.

Column 2 in Table C.4 shows that interest is significantly higher among younger, higher income, and higher educated respondents. These findings largely mirror the results of other studies on the adoption of financial technologies [36, 8]. We find strong differences between our consumer types: tech-savvy respondents are 23 percentage points (pp) more likely to be interested and cryptocurrency owners are 15 pp more likely to be interested (column 1) than the respective comparison groups, confirming our presumption that these two groups are open-minded to the new technology. In contrast, cash-affine consumers are 29 pp less likely to be interested than non cash-affine ones. In column 3, we include socio-demographic controls and our type variables jointly. The respective results are qualitatively similar, which shows that the differences across type variables are not driven by socio-demographic factors.

To control for further confounding effects, specification 4 includes a set of additional variables: the stated importance of hoarding cash and making anonymous cash payments, as well as trust in the central bank. These variables enter significantly with the expected signs. The point estimate for *Cash-affine* is reduced slightly. Qualitatively, however, the finding that cash-affine users have a much lower interest in CBDC remains unchanged. This corroborates results from the payment literature which shows that cash users tend to react to payment innovations only sluggishly.[4] Our results indicate that this reaction is unaffected by whether the innovation is a new payment card, for example, issued by a private entity, or a new form of money issued by a central bank.

The results in Table C.4 (i. e., specifications 1–4) are of significant importance for the remainder of this paper as most of the **subsequent analyses are based on the subsample of persons reporting at least some interest in the digital euro**. This avoids noise in the data which would arise if persons who are completely uninterested in the digital euro were asked for their attitudes and preferences.

Our focus on this smaller sample introduces some changes in its key characteristics. About two thirds of cash-affine users are not interested in a digital euro. In contrast, more than 70% of tech-savvy persons and cryptocurrency owners are interested. Table C.2 contrasts the sample characteristics for interested (column 2) and uninterested persons (column 1). For almost all variables we find significant and often sizable differences, e. g., the sample we analyze henceforth is characterized by a substantial underrepresentation of cash-affine users, older persons, persons who prefer anonymous payments, persons for whom hoarding of cash is important, and risk averse persons. In contrast, there is a strong overrepresentation of tech-savvy persons, cryptocurrency owners, young, higher educated, high income persons, and of those who trust in central banks and people.

[4] For example, [14] show that payment behavior of (intensive) cash users is barely affected by the availability of contactless debit cards.

4.2 The future of cash

A common thread in policy discussions on CBDC is the question whether a CBDC may complement or substitute cash. Cash payments have declined in many countries over the past couple of years, with Sweden or Norway being known as forerunners in the transition to a cashless society [20]. CBDC could potentially accelerate this shift. We asked all survey respondents whether they believe that cash should keep its current relevance or whether it can lose importance or disappear altogether. Overall, 64% of the respondents state that cash should retain its current relevance.

Table C.4 reports the logistic regression results (specifications 5–8). Consistent with the literature [14, 23, 36], older consumers value traditional experiences and, as a result of their technology inertia, strongly advocate for the retention of cash payments. Persons with higher education or income tend to accept a decline in the relevance of cash (column 6). The effect fades out as the consumer types and other behavioral controls are added (columns 7 and 8). Unsurprisingly, cash-affine users are much more likely, whereas tech-savvy persons and cryptocurrency owners are much less likely to state that "cash should keep its current relevance." These results show that cash-affine users not only tend to oppose a digital euro, but also want cash to remain important. Some drivers for this, included in the specification 8, turn out to have strong effects. People who state that cash is needed to make anonymous payments are 26 pp more likely to support the relevance of cash. The importance of hoarding cash adds 21 pp. On average, people who agree to both reasons support the retention of cash almost unanimously. While tech-savvy respondents have a significantly lower support for

cash than the comparison group, on average, the share supporting cash is still above 50%. The same holds for cryptocurrency owners. These results empirically underpin the approach of central banks to offer CBDC as an additional offer to consumers such that cash will not be replaced.[5]

4.3 Account or token-based access

Considering the implications and path dependencies emerging from the choice of an access model, it is of interest to find out which option is more preferred by the general public. Two idealized access models, account and token-based, were presented to respondents in simplified scenarios – using the analogy of debit card and cash payments and avoiding any technical jargon. Since it is not trivial to present these choices to respondents and question wording may affect responses, Figure 2 displays the formulation of questions and the respective answers. Specifically, we have used a sequence of three questions to introduce the trade-off to the respondents. The answers show that an account-based digital euro is preferred to a token-based system (50% versus 23%). 15% of respondents have no clear preference and 13% answer that they don't know. The support for an account-based implementation is also found in the sub-populations of cash-affine users, tech-savvy persons, and cryptocurrency owners.

For the logistic regressions we have constructed a dummy variable which is 1 if respondents are in favor of a cash-like (token-based) system and 0 if they are in favor of an account-like system or if they do not care.[6] The results presented in Table C.5 show that the token-based access model is significantly less likely to be endorsed by female and older repondents. Cash-affine persons are more likely to prefer digital tokens (column 3), however the difference of 7 pp is not large enough to make the majority of this group to support a cash-like CBDC. Cryptocurrency owners show the strongest support (in relative terms) for a token-based model, which we explain with their greater familiarity with this access mode.

Typically, females and older persons are found to be more risk averse than the average consumer [22]. Specification 4 includes a dummy variable *Risk averse* which is 1 if a person is not willing to accept any financial risks in exchange for a higher than average return (see the Appendix for a definition of variables), which applies to 50% of the population. The results show that risk averse persons have a lower preference for a token-based system, on average. Controlling for risk aversion also moderates the effect of gender, age and cash affinity, as expected. Finally, column 4 includes trust in the central bank. The results show that the preference for an account model increases with the amount of trust in central banks.

Taken together, our results indicate that an overwhelming share of the population has a preference for an account-like CBDC. This applies to cash-affine consumers, tech-savvy persons, and cryptocurrency owners. This finding is connected to the risk of financial losses with risk averse persons being significantly more likely to prefer an account-based access model.[7]

4.4 Offline and P2P payments

We also asked the respondents about their preferences on selected features that have been brought up in policy discussions on CBDC design. One example is the perceived importance of making offline payments. About 40% of the respondents stated that offline functionality is "very important," another 33% considered it "important," 11% "rather not important," and only 8% "not important at all." 7% responded that they do not know. We construct a dummy variable taking a value of 1 for the first two categories and 0 otherwise (omitting don't knows).

Table C.6 (columns 1–4) reports the logistics regression results. Tech-savvy users are 12 pp more likely to consider offline functionality important than the reference group. Given the high mean of the dependent variable across the sample, this suggests that this consumer type overwhelmingly regards an offline option as indispensable. In other words, even tech-savvy persons do not believe that the internet connectivity can always be taken for granted in all future payment situations. By contrast, cash-affine users are at least 6 pp less likely to consider offline features of CBDC important. While this decline is modest against the high mean value, the result might reflect that cash-affine users have already an offline payment instrument in use.

[5] E. g., "The digital euro would not replace cash", ECB President Lagarde (https://www.ecb.europa.eu/press/key/date/2022/html/ecb.sp220114~fe1e70ec1a.en.html).

[6] Omitting don't know answers does not affect the regression results qualitatively.

[7] Although we are confident about these general findings, we note that answers are likely biased in the direction of an account-based CBDC as the questions emphasize the risk of financial losses. In future implementations of such surveys, it would be interesting to implement survey experiments with different formulations.

Q Cash-like digital euro

"Suppose that the digital euro works very similar to cash. Payments are not linked to your identity and are hard to trace. However, in case you lose such a digital euro or if you fall victim to theft, the monetary loss is irrevocable. Under such conditions, would you use a digital euro?"

Q Account-like digital euro

"And now suppose that the digital euro functions like a debit card with an account. Such payments can be linked to your identity and are traceable, but the risk of loss is very low. Under such conditions, would you use a digital euro?"

%	Would use cash-like	Would use account-like
Yes, certainly	10	15
Rather yes	31	45
Rather not	25	21
No, certainly not	24	8
I don't know.	10	11
	100	100

Q Preferences cash-like vs. account-like

"And which of these variants would you prefer: Would you rather disclose your identity and open an account to keep the risk of loss low, or would you prefer a cash-like digital euro?"

Identified account and thus no risk of loss	50
No account, but risk of loss	23
I don't care.	15
I don't know.	13
	100

Note: Subset of respondents who are generally interested in the digital euro.

Figure 2: Sequence of questions to elicit consumer preferences on token vs account-based access.

A similar picture emerges for person-to-person (P2P) payments. About 20% of the respondents consider the P2P functionality as "very important", 33% "important," 23% "rather not important," and 16% "not important at all;" 7% do not know. Table C.6 shows the regression results for a dummy variable that is constructed in the same way as before. Although fewer respondents, on average, consider the P2P functionality important than the offline fallback, we observe the same direction of effects for the controls. Tech-savvy persons are more likely to demand P2P functionality. Cash-affine users demand it less, confirming our interpretation above that these users cannot be "bought in" with features. Moreover, respondents who value the anonymity of cash payments are 12 pp less likely to demand P2P functionality than the reference group. Perhaps, they believe that cash is and will remain unchallenged for P2P payments, which indeed involve some anonymity in many social contexts (e. g., donations, but also bribes, which were not prompted). Most interestingly, cryptocurrency owners are 21 pp more supportive of the P2P payment feature. One possible explanation is that cryptocurrency owners in principle like the P2P functionality offered by cryptocurrencies, but it is not very useful for them in daily life as too few counterparties exist to transact with. Currently, making cryptocurrency payments is a niche application.[8] Cryptocurrency owners might expect that a CBDC would lead to a wider adoption of digital P2P payments in the general economy. As a result, they could benefit from the emerging network externalities.

In summary, our respondents consider an offline fallback relatively more important than P2P functionality. Both features will benefit tech-savvy users, in particular, but are unlikely to convince cash-affine persons to revisit their aversion against a digital euro.

4.5 Attitudes to security and privacy

CBDC design decisions regarding security and privacy are considered among the most critical for a broad acceptance of CBDC among consumers.

To inform CBDC designers, the survey elicits respondents' assessment of several basic attributes of a digital euro with the question "How important are the following attributes of a digital euro to you?" Answers were given on a scale from 1 (very important) to 5 (not important at all). Before discussing results, it should be noted that such an exercise, evidently, represents only a first attempt to eliciting user needs. As outlined above, the involved trade-offs are complex (e. g., between privacy and retention of transaction data) and it is difficult to make respondents aware of them by means of short survey questions. In addition, answers will depend on the chosen question wording. This cautions against stretching

[8] A striking 67% of cryptocurrency owners in our sample state that they have "never" used Bitcoin or other cryptocurrencies to pay for goods or services. Only 5% state that they do so "one or more times per month."

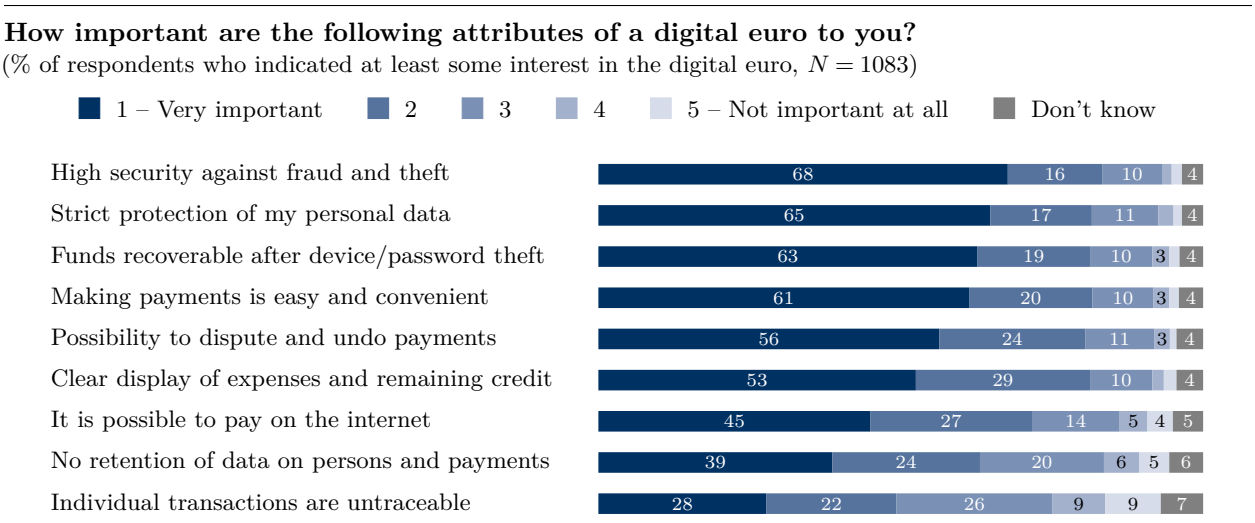

Figure 3: Importance of attributes including security and privacy items.

the interpretation of the results. Nevertheless, we consider the responses informative on how potential CBDC adopters rank security and privacy aspects.

Figure 3 summarizes the answers on all items, ranked by their importance. We have asked respondents to rate three aspects of security ("high security against fraud and theft", "funds recoverable after device/password theft", "possibility to dispute and undo payments") and three aspects of privacy ("strict protection of my personal data", "no retention of data on persons and payments", "individual transactions are untraceable"). On average, security aspects tend to be considered more important than privacy aspects. For example, almost 70% of the respondents state that high security against fraud and theft is very important. Interestingly, two privacy aspects are ranked lowest by respondents, on average. This likely reflects that most consumers have experience with electronic forms of money and have not encountered problems with the processing of respective data (e. g., by banks).

Table C.5 (specifications 5-8) reports the regression results for the leading security attribute ("high security against fraud and theft").[9] The findings show that there are no qualitative differences between cryptocurrency owners, tech-savvy persons and cash users regarding the importance of security.

Some differences are found for female and older respondents, who value security significantly more than males and the young generation (up to 35 years). In addition, risk averse persons and persons with high trust in the central bank attach more importance to security. As with regards to the consumer types, we find small significant effects, e. g., cash-affine users are 5 pp less likely to favor "high security against fraud and theft" in comparison to the reference group (specification 5 of Table C.5). Overall, these differences appear negligible in comparison to the average support for a high security against fraud and theft.

Table C.7 with results for the leading privacy attribute ("strict protection of personal data") looks very similar in terms of socio-demographic controls. Interestingly, we do not find any significant differences between the consumer types. Quite expectedly, respondents who value the anonymity of cash are more likely to emphasize the importance of personal data protection (specification 4 of Table C.7).

To rule out that the absence of significant correlations is caused by the generally high approval of these attributes, Table C.7 also presents the results for the lowest-ranked item ("individual transactions are untraceable"). We do not find any significant differences across socio-demographic variables. Among the consumer types, cryptocurrency owners are the only ones who express a sizably higher preference for untraceable transactions. This is interesting given the well-known privacy limitation of Bitcoin and other similar cryptocurrencies, in which all the transactions are public and traceable [12]. It is also

[9] We have recoded answers to a dummy variable which is 1 for "very important" and "rather important" and 0 otherwise (omitting don't know answers).

notable that cash-affine users do not endorse this privacy feature significantly more, although attitudes on the importance of the anonymity of cash as well as cash hoarding are strongly and positively associated. Perhaps only a fraction of the cash-affine respondents could link anonymity to untraceability, two non-trivial concepts, whereas many others stick to cash for convenience, conservatism, or out of habit.

5 Discussion

Our results highlight a fairly sharp divide in the perceptions of individuals who use cash more intensively as opposed to the rest. The significantly lower interest in the digital euro by cash-affine respondents is not primarily driven by socio-economic characteristics or by background variables that affect both cash-use and interest in CBDC. Overall, only slightly more than half of the respondents show some interest in the digital euro at all. Please keep in mind that the following discussion refers to this rather peculiar sub-population that has at least some interest.

User needs In terms of user needs, roughly one third of the respondents expect some advantage for themselves, should a digital euro be available as a payment instrument. Not very surprisingly and in line with [33] and [11], the responses show that younger people see more advantages than older ones. Cash-affine respondents are less likely to see an advantage from the digital euro than tech-savvy respondents or cryptocurrency owners. The sharp divide between cash-affine users and the others is corroborated by the fact that this user group not only is hesitant about the adoption of a digital euro, but also wants to see an important role for cash in the future. Note that even among the tech-savvy respondents, who are most likely to adopt a digital euro, the support for cash is strong. More than 50% wish that cash retains an important role in the future. We acknowledge that this finding may well reflect an Austrian specificity, given its still high cash intensity. Contrasting this with results from a highly cash-less society, for example, the Netherlands, could be instructive for future research.

Technology preference CBDC developers face a number of challenges when choosing specific technical implementations. The decisions often involve trade-offs. The ECB [17] presents some of these challenges in terms of principles or desiderata to be fulfilled simultaneously. Our data allow us to inform this discussion with a perspective from potential users. When confronted with simplified versions of a key trade-off, users strongly prefer an access model that resembles a bank account rather than a digital token (i.e., a digital equivalent of a bearer instrument that can get lost). This holds across all consumer types. The data suggest that risk aversion might be a key driver of this preference, which could have been amplified by the chosen question wording emphasizing the risk of losses. Despite the strength of this result, it should be considered tentative and the sensitivity to framing effects should be evaluated before deriving design decisions.

The question whether a digital euro should be equipped with offline functionality is debated among policy makers. While sometimes justified with better resilience, an offline functionality could also give a CBDC a comparative advantage over most existing forms of electronic payments. The main lesson we can learn from this study is that such a feature is regarded important by the user group we describe as tech-savvy. Cash-affine users, however, express less need for this feature, indicating that the missing offline functionality is not the main reason why they prefer cash over other available electronic payment options. When it comes to the opportunity to use the digital euro for direct payments between persons (P2P), it is overall regarded as less important compared to the offline functionality. Among the three consumer types studied, cryptocurrency owners are most supportive for a P2P functionality of a digital euro. In summary, although offline and P2P functions could make the digital euro more cash-like, offering these features would not be sufficient to convince cash-affine users to adopt it.

Security and privacy preference The public consultation by the ECB [19] revealed that security and privacy of transactions are high priority issues (for the participants of the consultation). Of course, such a consultation is prone to selection bias, which is not easy to correct for. We asked potential users about specific security and privacy concerns. Overall, our respondents seem to attribute more importance to security than to transaction privacy. This is in some contrast to the findings of the ECB consultation but concords with the results in [27]. Note that we stressed in our questionnaire that physical cash will remain available. Arguably, our respondents see no need for CBDC to provide privacy in payments.

Policy implications The debate and the feeling of urgency for the provision of CBDC in policy circles is not mirrored in the broader population: many people have not heard about a digital euro at all, and many respondents show no interest. In the group that shows some interest, we see a marked division between cash-affine users and the rest. Cash-affine users seem difficult to buy in to the idea of a retail CBDC. So, the most likely early adopters are among tech-savvy users and cryptocurrency owners. These two groups, however, do not always share the same views with respect to some key design considerations. In terms of implementation, users seem to prefer an account-like solution and be surprisingly (to the authors) indifferent with respect to transaction data privacy. These conclusions need, however, qualifications, which we have provided in the text.

CBDC designers should at least be aware how new, unknown, and exotic their considerations are to the general public. To minimize the risk of retail CBDC becoming an unsuccessful government project, they are advised to extensively and clearly explain the design options and trade-offs to the group of prospect adopters. Perhaps, the most general lesson emerging from this study is that CBDC designers cannot hope to get very precise guidance on the key design decisions by just asking users about a payment instrument that does not yet exist and that necessarily appear a bit elusive and mysterious. The development of a retail CBDC will need an intensive interaction and dialogue with prospective users. This involves monitoring the effectiveness of communication activities as well as collecting information about prevailing concerns with repeated empirical studies and methods that are robust to selection bias.

Limitations The pandemic situation forced us to use a new sampling procedure relative to prior OeNB Barometer surveys. As a result, we have limited information on the non-response bias. Both the initial contact via telephone and a rather high share of self-selected CAWI interviews cause uncertainty. To compensate for this, we checked for potential biases in relevant variables by benchmarking against external data sources and past OeNB Barometer surveys (see Appendix A). Our sample seems somewhat biased with respect to internet use, financial market participation, and risk appetite in financial investments. These variables are likely to be correlated with the willingness to adopt CBDC. We took two measures to account for this uncontrollable bias. First, we only present unweighted results.[10] Second, when discussing aggregate results, we refer to the "sample" and not to the "population." The potential sample bias is less problematic when discussing results from our multivariate analyses because we control for variables that are correlated with internet use, financial market participation, and risk attitudes.

Concerning validity, our survey demanded a lot of imagination from its participants as we were interviewing about a hypothetical technology many of them knew nothing about. Moreover, the data quality hinges on the instrument design, specifically the wording of questions. For many concepts we could not draw on established constructs and scales. While we tried to evade all avoidable pitfalls with extensive pretests, and are generally confident in the results given their coherence and plausibility, some potential framing effects cannot be fully ruled out. Finally, Austria is a small country with comparatively high cash use. Not all results from Austrian consumers might generalize to more cashless societies or the euro area as a whole.

6 Conclusion

Our empirical results suggest that it is far from certain that the introduction of a digital euro will unconditionally lead to its widespread adoption. While we provide some concrete guidance for CBDC design, we interpret our findings as tentative and exploratory.

While the scope of the data collection should be extended beyond Austria, either to the euro area as a whole or to a selected set of countries with distinct payment conventions, it is important to keep in mind that some of the assumed *social* benefits of CBDC, such as stability and privacy, seem incredibly hard to evaluate with direct questions to potential users. Innovative (combinations of) empirical methods are needed to collect valid and generalizable evidence that speaks to these questions. Our approach to identify consumer types that are more experienced with specific aspects than the general population may be worth retaining in such studies. Scaling up this research requires a lot of effort, which is worthwhile given the strategic importance attributed to retail CBDC and the strong path dependencies inherent to its technical and economic design.

[10] Post-stratification weights are available. Qualitatively, the use of weights has only a minor impact on reported percentages. See Table C.1 in the appendix for a comparison of weighted and unweighted sample means.

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A Data quality check

Given the break in the survey mode, the fact that we have very little information on non response bias due to the contact via telephone and a rather high share of self-selected CAWI interviews, we checked for potential biases in relevant variables by comparing against external data sources and past OeNB Barometer surveys.

With respect to region, age, gender, education and income our sample is comparable with samples from previous OeNB Barometer surveys. Also employment status is comparable with a slightly lower share of retired individuals when compared to past surveys. The unweigthed sample has a slightly higher share of highly educated individuals if compared to past surveys.

As regards internet use, 94 % of individuals report that the use the internet privately on a regular base. This number can be checked against two external sources: the Austrian Internet Monitor (AIM, 2021/1)[11] with 90% and a survey by Statistics Austria from 2020 with 92%.[12]

Further splitting internet use across subpopulations, we find that internet use is 95 % among men and 93 % among women. In comparison AIM reports 94% and 87%. In our sample 80% of individuals report daily use of the internet. This compares to a rate of 80% at AIM. While the comparison suggests that our sample is by and large representative, we see nevertheless a bias in the joint consideration of age and internet use. In the age group 20-59 the gap between the OeNB-Barometer and AIM is minor with respect to internet use, the gap increases if we look at the age group above 60. For example in our sample internet use in the group 60-69 is 96% compared to 83% at AIM. For individuals above 70 we have 74% and AIM has 57%. We therefore must take into account that our sample is biased with regards to internet use in general and in particular when we look at older internet users. We suspect that the participation rate among the individuals who chose the online option is higher than for those who could give an interview by phone only.

With respect to risk attitudes we see that in the OeNB Barometer 2018 and 2019 55% reported zero risk tolerance with respect to financial decisions. In our sample the comparative rate is 50%. In past waves, 14% reported that they would accept a higher risk for a higher expected return. In our sample this share is 20%.

A direct comparison with respect to ownership of financial products is not possible since external data refer to households whereas the OeNB Barometer refers to individuals. If we take the third wave of the Household Finance and Consumption Survey (HFCS) as a reference point, we can say that 86% of households had a savings account, a life insurance or a home loan and savings contract.[13] Our sample has 79%. According to HFCS 5% of households in Austria hold stocks. In our survey 13% of individuals report stock ownership. In the OeNB-Barometer 2020/2 which was conducted with mixed methods also the stock ownership rate was 8% and thus nearer to the HFCS numbers.

Finally, we note that 8% of respondents state that they own cryptocurrencies. Previous surveys from 2019 report an ownership rate of about 2% ([37]). We consider it likely that ownership has increased from 2019 to 2021. The finding that about 40% of respondents state that they hold less than 1,000 euro in cryptocurencies suggest an inflow of new investors. Nevertheless, the ownership seems rather high when comparing with international surveys. For example, in the U.K. ownership was estimated to be 4.4% (Source: Financial Conduct Authority, 2021).

B Description of variables

Cryptocurrency owner: Derived from two survey questions. The first question asks whether respondents have heard of "Bitcoin or of other so-called cryptocurrencies". For those respon-

[11] Source: INTEGRAL Markt- und Meinungsforschungsges.m.b.H. https://www.integral.co.at/downloads/Internet/2021/07/AIM-C_1HJ21.pdf.

[12] Source: Statistik Austria https://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/informationsgesellschaft/ikt-einsatz_in_haushalten/index.html.

[13] See https://www.hfcs.at/ergebnisse-tabellen/hfcs-2017.html.

dents that have heard of cryptocurrencies, a follow-up question elicits the degree of interest in cryptocurrencies. Dummy variable = 1 for answers "I currently own Bitcoin" and "I currently own other cryptocurrencies", 0 otherwise.

Tech-savvy: Based on the following question: "How would you assess yourself in relation to technological developments, e.g. new devices or applications? Which of the following statement best applies to you?" Answers comprise "a) Highly interested, I would like to try new devices or applications immediately", "b) I am interested, but would not want to buy or try new devices or applications immediately", "c) I buy new devices or applications only if I see a benefit", "d) I am not interested in technological developments and only buy new devices when I need them". Tech interest high = 1 if respondents choose answer a, 0 otherwise.

Cash-affine: Derived from self-stated payment behavior. "If you think about all your purchases, including those made online, for food, clothing, services, gasoline, etc. Do you spend more (by value) in cash or more cashless – with cards or cell-phone?". Dummy variable=1 if "exclusively cash" and "more cash than cashless", 0 if "about equal", "more cashless than cash", "predominantly cashless."

Age: Measured by three dummy variables *Age group 16–35*, *Age group 36–65* and *Age group 66+*.

Female: Binary variable coded 1 for female respondents and 0 otherwise.

Urban: Dummy variable which takes a value of 1 if a respondent reports to reside in a municipality with 20,000 and more inhabitants.

High net income; income NA: Dummy variables. For those respondents who provided an answer about their household income, we compute tercils. *High net income* is coded 1 for respondents with a reported household income in the highest tercil (3.750 euro, mid-point of income brackets). *Income NA* is coded 1 for respondents who did not provide their household income (about 21% of the sample).

Academic: Dummy variable which encodes respondents with university education (1) and with non-academic background (0; e. g., mandatory schooling or technical colleges).

Hoarding of cash important: Based on "There are many people who like to have more cash at their disposal than would be necessary for daily life, as a reserve or to save. How important is it for you personally that one can hold a higher amount of cash?" Dummy variable coded as 1 for "very important" and "important", 0 for "rather not important" & "not important at all".

Anonymity of cash important: Based on the statement "Cash should be retained such that anonymuous payments can be made". Dummy variable coded as 1 if respondents "fully agree" or "somewhat agree", 0 if "somewhat disagree" and "fully disagree."

Trust in central bank: Based on "How much do you trust the following institution ... the Österreichische Nationalbank" (Central Bank of Austria)? Dummy variable coded as 1 if "very high" and "high", 0 if "rather low" or "very low".

Trust in people: Based on "Generally speaking, would you say that most people can be trusted or that you cannot be too careful in life?". Answers range from 0 ("cannot be too careful") to 10 "most people can be trusted," linearly rescaled to the unit interval.

Risk averse: Based on the question: "If there are financial decisions in your household: which of the following statements best describes your attitude toward risk: a) if I can expect a substantial profit, I am willing to take substantial financial risks; b) if I can expect an above-average profit, I am willing to take above-average risks; c) if I can expect average profits, I am willing to take average financial risks; d) I do not want to take any risk." *Risk averse* = 1 if respondents choose answer d), 0 otherwise.

C Statistical tables

Table C.1: Descriptive statistics

Variable	N	Mean value	
		unweighted	weighted
Panel A. Dependent variables (full sample)			
Interested in the introduction of a digital euro	2006	0.54	0.52
Panel B. Dependent variables (interested in the offer of a digital euro = 1)			
Belief that the digital euro brings personal advantages	914	0.43	0.43
Cash should keep its current relevance	1078	0.48	0.48
Need for a digital euro for payments on the internet	1003	0.54	0.54
Need for a digital euro for larger payments	991	0.53	0.52
Need for a digital euro for spending when traveling abroad	962	0.53	0.53
Need for a digital euro for payments for daily grocery shopping	997	0.40	0.39
Need for a digital euro for payments in hotels and restaurants	996	0.37	0.37
Need for a digital euro for sending money to persons abroad	868	0.40	0.40
Need for a digital euro for payments to persons (gifts, tips, yard sale)	986	0.33	0.34
Need for a digital euro for hoarding/saving of money	971	0.34	0.34
Preference for a cash-like digital euro	945	0.26	0.27
Would use if cash-like	970	0.46	0.47
Would use if account-like	969	0.67	0.66
Importance of offline functionality	1007	0.79	0.78
Importance of P2P functionality	1007	0.57	0.57
High security against fraud and theft	1045	0.86	0.86
Strict protection of my personal data	1045	0.85	0.83
Funds recoverable after device/password theft	1041	0.85	0.84
Making payments is easy and convenient	1040	0.85	0.84
Possibility to dispute and undo payments	1035	0.84	0.84
Clear display of expenses and remaining credit	1035	0.85	0.84
It is possible to pay on the internet	1029	0.76	0.74
No retention of data on persons and payments	1022	0.67	0.66
Individual transactions are untraceable	1007	0.53	0.53
Trust in central bank as issuer of CBDC	983	0.81	0.81
Trust in own commerical bank as issuer of CBDC	1030	0.83	0.82
Panel C. Main explanatory variables (full sample)			
Cash-affine	1984	0.35	0.38
Tech-savvy	2006	0.15	0.14
Cryptocurrency owner	2006	0.08	0.07
Panel D. Explanatory variables (interested in the offer of a digital euro = 1)			
Cash-affine	1075	0.22	0.22
Tech-savvy	1083	0.20	0.21
Cryptocurrency owner	1083	0.11	0.10
Age group 16–35	1083	0.40	0.37
Age group 36–65	1083	0.48	0.50
Age group 66+	1083	0.12	0.13
Female	1083	0.50	0.46
Academic	1083	0.21	0.17
Urban	1083	0.50	0.53
High net income	1083	0.29	0.28
Income NA	1083	0.19	0.18
Hoarding of cash important	1046	0.51	0.51
Anonymity of cash important	1060	0.82	0.82
Trust in central bank	1000	0.74	0.73
Trust in people	1071	0.42	0.43
Risk averse	1083	0.35	0.36

Table C.2: Sample comparison: Interested vs not interested in the digital euro

	Not interested Mean (1)	Interested Mean (2)	Test of equal means p-value (3)
Cash-affine	**0.51**	0.22	***
Tech-savvy	0.08	**0.20**	***
Cryptocurrency owner	0.05	**0.11**	***
Age group 36–65	**0.57**	0.48	***
Age group 66+	**0.21**	0.12	***
Female	**0.53**	0.50	
Academic	0.12	**0.21**	***
Urban	0.44	**0.50**	**
High net income	0.20	**0.29**	***
Income NA	**0.24**	0.19	**
Hoarding of cash important	**0.68**	0.51	***
Anonymity of cash important	**0.93**	0.82	***
Trust in central bank	0.63	**0.74**	***
Trust in people	0.38	**0.42**	**
Risk averse	**0.63**	0.35	***

Note: The table shows means of variables (in rows) for the sample of uninterested respondents and the sample of interested respondents. Row-wise maxima are highlighted. Significance levels for t-tests of equal means: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table C.3: Belief that the digital euro brings personal advantages

	(1)	(2)	(3)	(4)
Cash-affine	−0.09 *		−0.09 *	−0.09 *
Tech-savvy	0.22 ***		0.20 ***	0.19 ***
Cryptocurrency owner	0.25 ***		0.23 ***	0.26 ***
Age group 36–65		−0.14 ***	−0.11 **	−0.12 ***
Age group 66+		−0.19 ***	−0.14 **	−0.13 **
Female		−0.08 *	−0.04	−0.01
Academic		0.04	0.03	0.02
Urban		−0.01	−0.01	−0.03
High net income		0.00	−0.02	−0.03
Income NA		−0.09 *	−0.09 *	−0.08
Hoarding of cash important				−0.02
Anonymity of cash important				−0.04
Trust in central bank				0.01
Trust in people				0.31 ***
Mean dependent variable	0.426	0.426	0.426	0.434
LRT tech-savvy = crypto owner	0.098		0.149	0.055
Pseudo-R^2	0.06	0.02	0.08	0.18
Log likelihood	−584	−608	−575	−509
Observations	908	914	908	829

The table shows marginal effects from logit regressions.
Subset of respondents who report at least some interest in the digital euro.
Significance levels: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table C.4: Results of two logistic regressions (the dependent variable is shown in a multi-column header)

	Interested in a digital euro				Cash should keep its relevance			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash-affine	−0.29 ***		−0.26 ***	−0.22 ***	0.34 ***		0.33 ***	0.22 ***
Tech-savvy	0.23 ***		0.18 ***	0.17 ***	−0.11 ***		−0.07 **	−0.08 **
Cryptocurrency owner	0.15 ***		0.11 *	0.14 **	−0.11 **		−0.09 *	−0.09 *
Age group 36–65		−0.18 ***	−0.15 ***	−0.15 ***		0.16 ***	0.12 ***	0.12 ***
Age group 66+		−0.27 ***	−0.21 ***	−0.22 ***		0.14 ***	0.08 **	0.09 **
Female		−0.05 *	−0.03	−0.02		0.04 *	0.03	0.02
Academic		0.15 ***	0.11 ***	0.08 **		−0.11 ***	−0.07 *	−0.04
Urban		0.06 *	0.04	0.03		−0.01	0.01	0.01
High net income		0.07 **	0.04	0.03		−0.06 *	−0.03	−0.04
Income NA		−0.06 *	−0.04	−0.04		0.06 *	0.05 *	0.03
Hoarding of cash important				−0.11 ***				0.21 ***
Anonymity of cash important				−0.11 **				0.26 ***
Trust in central bank				0.08 ***				−0.02
Trust in people				0.04				−0.08 *
Mean dependent variable	0.542	0.540	0.542	0.548	0.646	0.644	0.646	0.647
LRT tech-savvy = crypto owner	0.017		0.049	0.183	0.192		0.311	0.233
Pseudo-R^2	0.11	0.05	0.14	0.27	0.11	0.03	0.13	0.33
Log likelihood	−1237	−1310	−1194	−1013	−1148	−1254	−1126	−868
Observations	1984	2006	1984	1738	1975	1991	1975	1736

The table shows marginal effects from logit regressions.
Significance levels: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table C.5: Results of two logistic regressions (the dependent variable is shown in a multi-column header)

	Preference for a token-based access				High security is important			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash-affine	0.08 *		0.07 *	0.05	−0.05 *		−0.04	−0.06 **
Tech-savvy	0.07 *		0.04	0.04	0.03		0.06 *	0.06 *
Cryptocurrency owner	0.14 ***		0.10 *	0.08	−0.04		−0.01	0.01
Age group 36–65		−0.09 **	−0.08 **	−0.05		0.13 ***	0.14 ***	0.10 ***
Age group 66+		−0.20 ***	−0.18 ***	−0.15 ***		0.11 ***	0.11 ***	0.07 **
Female		−0.11 ***	−0.09 **	−0.07 *		0.10 ***	0.10 ***	0.08 ***
Academic		0.07	0.06	0.07		0.03	0.03	0.02
Urban		0.02	0.03	0.02		0.02	0.02	0.04
High net income		0.00	0.00	−0.01		0.01	0.00	0.00
Income NA		−0.02	−0.02	−0.04		−0.03	−0.03	−0.01
Hoarding of cash important				0.00				0.02
Anonymity of cash important				0.09 *				0.04
Trust in central bank				−0.07 *				0.07 **
Trust in people				0.10				−0.02
Risk averse				−0.09 **				0.08 **
Mean dependent variable	0.261	0.259	0.261	0.259	0.864	0.863	0.864	0.876
LRT tech-savvy = crypto owner	0.014		0.044	0.108	0.131		0.118	0.326
Pseudo-R^2	0.03	0.04	0.05	0.16	0.02	0.07	0.09	0.26
Log likelihood	−527	−521	−513	−455	−409	−388	−380	−309
Observations	940	945	940	853	1039	1045	1039	929

The table shows marginal effects from logit regressions.
Subset of respondents who report at least some interest in the digital euro.
Significance levels: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table C.6: Results of two logistic regressions (the dependent variable is shown in a multi-column header)

	Importance of offline functionality				Importance of P2P functionality			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash-affine	−0.06 *		−0.06 *	−0.08 *	−0.16 ***		−0.16 ***	−0.18 ***
Tech-savvy	0.12 **		0.11 **	0.12 **	0.14 ***		0.10 **	0.10 *
Cryptocurrency owner	0.01		0.00	0.04	0.21 ***		0.18 **	0.22 ***
Age group 36–65		−0.05	−0.04	−0.04		−0.16 ***	−0.15 ***	−0.15 ***
Age group 66+		−0.13 **	−0.12 *	−0.10 *		−0.30 ***	−0.27 ***	−0.26 ***
Female		0.03	0.04	0.04		−0.06 *	−0.04	−0.03
Academic		0.05	0.05	0.02		0.05	0.04	0.01
Urban		−0.01	−0.01	−0.01		0.05	0.04	0.05
High net income		−0.01	−0.01	−0.03		0.03	0.01	0.00
Income NA		−0.01	−0.02	−0.04		0.01	0.00	−0.02
Hoarding of cash important				0.02				0.05
Anonymity of cash important				0.02				−0.12 **
Trust in central bank				0.08 **				0.06
Trust in people				0.04				0.07
Mean dependent variable	0.790	0.789	0.790	0.793	0.571	0.573	0.571	0.573
LRT tech-savvy = crypto owner	0.425		0.313	0.197	0.140		0.150	0.053
Pseudo-R^2	0.02	0.01	0.04	0.15	0.04	0.04	0.07	0.18
Log likelihood	−506	−511	−499	−439	−659	−663	−640	−565
Observations	1000	1007	1000	897	1001	1007	1001	905

The table shows marginal effects from logit regressions.
Subset of respondents who report at least some interest in the digital euro.
Significance levels: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table C.7: Results of two logistic regressions (the dependent variable is shown in a multi-column header)

	Importance of protecting personal data				Importance of transaction untraceability			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cash-affine	−0.03		−0.02	−0.05	0.06		0.06	−0.01
Tech-savvy	−0.02		0.01	0.01	0.06		0.06	0.03
Cryptocurrency owner	−0.02		0.00	0.04	0.15 **		0.17 **	0.17 **
Age group 36–65		0.10 ***	0.10 ***	0.07 **		−0.04	−0.02	−0.03
Age group 66+		0.11 ***	0.10 ***	0.07 *		0.02	0.05	0.04
Female		0.10 ***	0.10 ***	0.07 **		−0.01	0.02	0.00
Academic		0.05	0.04	0.04		−0.01	−0.02	0.00
Urban		−0.01	−0.01	−0.01		−0.01	−0.01	−0.01
High net income		−0.02	−0.02	−0.04		−0.03	−0.03	−0.05
Income NA		0.00	0.00	−0.01		0.03	0.03	−0.01
Hoarding of cash important				0.04				0.10 **
Anonymity of cash important				0.07 *				0.23 ***
Trust in central bank				0.11 ***				−0.02
Trust in people				−0.09 *				−0.03
Risk averse				0.10 ***				−0.06
Mean dependent variable	0.848	0.846	0.848	0.849	0.531	0.530	0.531	0.533
LRT tech-savvy = crypto owner	0.664		0.952	0.610	0.023		0.016	0.016
Pseudo-R^2	0.02	0.05	0.06	0.21	0.02	0.00	0.02	0.15
Log likelihood	−442	−429	−424	−353	−685	−694	−683	−592
Observations	1039	1045	1039	929	1002	1007	1002	903

The table shows marginal effects from logit regressions.
Subset of respondents who report at least some interest in the digital euro.
Significance levels: $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.