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# PREFERENCE FACTORS REGARDING CENTRAL BANK DIGITAL CURRENCY ANONYMITY: BEHAVIOURAL, CULTURAL, OR INSTITUTIONAL

## ABSTRACT

Central Bank Digital Currencies (CBDCs) offer a model of monetary order that potentially reduces the social costs associated with money circulation compared to private cryptocurrencies, which are energy-intensive. However, the success of CBDCs is contingent on design choices, which may conflict with policy goals and consumer preferences. A key challenge is the balance between transaction privacy/anonymity and payment convenience/functionality. Preferences for privacy/convenience are influenced by cultural attitudes, behavioural factors, and trust in institutions. This research seeks to address the following questions: 1) How do cultural and behavioural factors interact to shape preferences for CBDC anonymity/privacy? 2) To what extent do behavioural biases moderate cultural constraints? 3) Is there a correlation between such moderation and levels of trust? A survey (Google Forms, 19 questions) was administered to 164 respondents from Eastern Europe, Asia, and Africa. Analysis reveals that regional homogeneity in responses suggests culturally conditioned preferences. However, preferences for anonymity over convenience are significantly influenced by institutional factors beyond culture. Culture does not appear to be a decisive factor in matters of trust. In cases of lower trust in monetary institutions, preferences for convenience outweigh anonymity. The study concludes that successful CBDC design is context-specific and depends on the unique circumstances of individual countries. Central banks must understand consumer preferences within their respective countries to choose an optimal CBDC design. However, excessive focus on "marketing" to consumer preferences may undermine the central bank's role as a policymaker, while choosing the right design is crucial for CBDC's success.

**Keywords:** digital money, Central Bank digital currency (CBDC), cultural attitudes, anonymity, privacy of money, institutions, culture

**JEL Classification:** E41, E42, E51, E58, G20

## INTRODUCTION

The proliferation of privately issued digital currencies and the response of central banks in the form of CBDC prospects has led to the realization that much of what has been taken for granted in traditional money is becoming a critical aspect of how the money of the future will evolve. The anonymity of the transferring process of solvency units from one economic agent to another, which is realized in all historical forms of money at the level of their physical and social nature, in the digital age, becomes a matter of choosing the optimal design. This is exactly what privacy is all about. The right to privacy is a fundamental component of the stability of a democratic society, while digital technologies and human interaction with them are blurring the boundaries of privacy very significantly. The "Privacy Paradox" (Athey et al., 2017) makes clear that there is a whole set of paradoxes in matters of privacy preference and in matters of people's actual behaviour regarding interaction with digital technologies. It is natural that behavioural distortions of the privacy problem can play a big role both in the success of digital money and in the deviation of the trajectory of its development from the optimal or most socially acceptable one.

Anonymity and privacy as the “honesty of money” are far from always obvious when extrapolated to digital money. Authors (Borgonovo et al., 2021) demonstrate that economic agents tend to regard the anonymity of money as an important feature that gives it value. A broad survey of preferences regarding the design of the future digital euro also notes that without solving the privacy issue, the European CBDC is unlikely to succeed (European Central Bank, 2019; European Central Bank, 2021). At the same time, authors (Koziuk et al., 2022) testify that a universal CBDC design is unlikely to be possible, particularly in terms of how economic agents perceive the problem of “anonymity vs convenience” considering cultural and institutional constraints.

The success of the CBDC project in many countries will allow solving a set of problems. Optimizing the costs for cash circulation, improving the availability of financial services, reducing the costs for money transfers, increasing the transparency of markets, etc. are established expected advantages of the spread of digital currencies of centralized emission. However, the success of CBDC will largely be determined by the demand for it. The scale of the demand, in turn, will determine the extent of its spread and the number of diverse groups of economic agents covered. In other words, the social efficiency of the CBDC project will be extremely sensitive to the magnitude of positive network externalities. This is not simply a question of the optimal allowable amount of the digital equivalent of central bank money holdings according to the likelihood of digital banking panics or disintermediation in the financial sector, as (Adalid et al., 2022) show. It's more a matter of whether the demand for CBDC should be driven by the benefits the technology brings to everyday life. And it is in this aspect that CBDC design will play a key role. To build an optimal design, we need clear data on what are the preferences of economic agents, how they see the solution to the dilemma “anonymity vs convenience”, and what are the likely behavioural distortions in the field of privacy in the digital world.

In the article (Koziuk et al., 2022), the authors start with the idea that preferences regarding anonymity/privacy are subject to cultural constraints. But it should also be recognized that such cultural restrictions are not rigid in cases of the problem of institutional trust, “conformist culture”. This also applies to situations where behavioural distortions leave their mark. In practical terms, this poses a problem, for instance, in cases where the source of information on CBDC design preferences is solely a survey. On a more conceptual level, the problem is that certain aspects of digital money design can be prioritized differently depending on what is dominant: cultural attitudes, behavioural drivers, or trust in the institutional sense. This raises the question of the need to find out how cultural and behavioural factors of preferences regarding anonymity/privacy of CBDC interact, to what extent behavioural distortions soften cultural restrictions, and whether there is a correspondence between such softening and special cases of a trust problem.

In this paper, the two-fold methodology was applied. One pillar of it is devoted to finding how survey results are regionally dependent. Based on the analysis of the CBDC survey results, it is found that the regional homogeneity of the responses indicates the presence of culturally determined preferences. The second pillar focused on the consistency of each respondent's answers. This adds new knowledge about drivers of preferences then cultural factors are not strong. Due to this, we found that the question of anonymity over convenience preference is significantly influenced by behavioural factors that fall beyond regional (and in fact, cultural) conditioning. Also, we confirm the idea that when trust in institutions devoted to protecting privacy is weak, respondents are more likely to agree on convenience over anonymity. The problem of trust is considered as a reason why there is no behavioural consistency in anonymity/privacy preferences and willingness to sacrifice them for the sake of convenience.

## LITERATURE REVIEW

The emergence of blockchain economics demonstrates that modern technologies are likely to be a comprehensive structural shift. The question of money and its optimal forms in the digital world will be at the heart of this process (Halaburda et al., 2020; Brunnermeier et al., 2019). Also, the spread of cryptocurrencies challenged central banks, because of which the question of whether their power will increase or decrease in the future is discussed in the literature (Bordo et al., 2017; Raskin et al., 2016; Borio, 2019; Claeys et al., 2018). The response of central banks in the form of an issue of their own digital currency is often seen in the context of filling cryptocurrency market failures (Carstens, 2018; Carstens, 2020; Central bank digital currencies, 2018). In fact, there is a more complex process of money transformation behind it (Eichengreen, 2018).

Supply and demand for CBDC are studied in the context of structural factors' actions. The level of the shadow economy, the degree of financial intermediation development, the coverage of financial services, and the volume of cross-border transfers are noted in the literature. Such factors determine how desirable centralized emission digital money may be compared to alternative technological and institutional alternatives (Croxson et al., 2022; Auer et al., 2020; Alfonso et al., 2022; Zatonatska et al., 2022; Suslenko et al., 2022). At the same time, the literature notes several limitations regarding

the prospects for the spread of digital money. For example, (Frost, 2020) notes the presence of age restrictions on the spread of fintech. Authors (Fehr et al., 2003) suggest that trust is conditioned by age, and this is supported by numerous empirical studies. Age is recognized as a significant factor in differences in attitudes toward privacy in the digital world (Goldfarb et al., 2012). Author (Koziuk, 2021a; Koziuk, 2021b) claims that age is the most persistent factor that determines trust in digital money across structurally different countries. The author also notes that central banks do not have a clear advantage in trusting their digital money when inflation is low. This means that dissatisfaction with fiat money pushes for greater trust in digital money. Accordingly, a country's structural characteristics will influence the CBDC prospects, and central banks should consider that a successful design can compensate for a lack of trust when economic agents recognize its benefits.

However, the optimal CBDC design is a real challenge for central banks. The complexity of this problem is that technological capabilities allow for such a wide functionality that potentially goes beyond the division into monetary and fiscal power, greatly expands the understanding of what central banks are, or changes the idea of what money should be. For example, authors (Adolid et al., 2022) focus on the optimal amount of CBDC available to economic agents and the central bank digital currency supply model. Another group of authors (Agur et al., 2019) focused on the analysis of use cases and their technological aspects. Also, authors (Agur et al., 2019) consider options for how different use cases will potentially affect the price and financial stability. Scientists (Gross et al., 2019) analyse the features of money creation and credit creation, depending on the nature of money: fiat or digital. Several other works implicitly argue that central banks can control the systemic effects of CBDC implementation as they determine the design of their digital currency (Central bank digital currencies, 2018).

An important dimension of the difference between digital money and its previous evolutionary forms is the traceability of transactions. As soon as transactions become traceable, the problem of anonymity/privacy immediately arises, which is not inherent in all historical forms of money. Authors (Chaum et al., 2021) show why privacy is important. Firstly, there is the problem of misfeasance and the domination of power over the individual. The procedures used for gaining access to private operations are not always transparent, and the institutions that carry them out are not perfectly accountable. Secondly, the privacy of transactions limits the so-called "exploitation of data" when the latter becomes a factor of competition and market efficiency. For instance, the platform business model is extremely sensitive to advantages in accessing and processing a large set of data generated by private transactions. Thirdly, privacy is a guarantee against the risk of opportunistic behaviour of the counterparty of the transaction post factum. The risk of cyber fraud is one case of this. This problem resonates with the well-known fact that operating in the digital world often exhibits a much lower level of propensity for privacy, compared to what has been claimed (the "privacy paradox") (Athey et al., 2017). On the other hand, privacy concerns are constantly increasing. Economic agents are more and more concerned about how data is used, and old people are much more concerned about it (Goldfarb et al., 2012). That is, the issue of anonymity/privacy can be considered as a zone of behavioural distortions, which will deviate the trajectory of digital money development from the socially optimal one. In the case of cryptocurrencies, this can be considered a market failure, and in the case of CBDC – a way to overcome a market failure. But this does not remove the question of the extent to which the current institutional format of the central banks functioning allows them to determine the design of the digital currency at their discretion, precisely in the context of the social dimension of anonymity/privacy problem.

The importance of anonymity/privacy in the context of CBDC design is confirmed in several works. For instance, an ECB survey confirmed that for Europeans, privacy is a key requirement for the e-euro (European Central Bank, 2021). Authors (Grothoff et al., 2021) state that there is a dilemma on how to interpret the results of surveys on privacy preferences, as economic agents can often reject it, tempted by the convenience offered by new payment services. Researchers (Koziuk et al., 2022) also point out that the choice between anonymity and convenience is often driven by additional factors rather than a conscious choice. Authors (Goldfarb et al., 2012) note that privacy falls under the problem of conditioning by context. Economic agents have incomplete knowledge about how information about them may be used and therefore assume that restrictions on the use of information, that is constitutive of privacy, are effective, even though this may not be the case (Nissenbaum, 2009). Other researchers (Ahnert et al., 2022a; Ahnert et al., 2022b), in turn, state that economic agents are aware of the fact that with different market structures, the possibility to extract rent from information differs, and therefore are inclined to greater privacy if the market structure of creditors tends to monopoly, and to less privacy – if the market structure tends towards competition. Also, economic agents understand that privacy can provide certain benefits, just as the traceability of transactions can be a kind of payment for other benefits. It follows that economic agents tend to optimally choose between the privacy vs. convenience alternative. However, this leads to market fragmentation and economic losses. CBDCs are designed to fill this gap. The same opinion is consistent with the broader context of the economic arguments analysis in favour of CBDC (Ahnert et al., 2022b).

However, there are technological challenges in how to ensure privacy in the issuance of digital money while maintaining the benefits of AML, KYC procedures, imposing restrictions on illegal activities, etc. (European Central Bank, 2019). Authors (Chaum et al., 2021) demonstrate that an optimal combination of privacy guarantees and requirements of the legislation regarding illegal activities is possible within a framework of CBDC, but then it should not be blockchain-based. If there are technological alternatives to ensure a socially acceptable level of privacy, this further raises the problem of the central bank's sensitivity to social requests. In this case, technological decisions are directly tied to an institutional choice.

In a broader sense, anonymity/privacy is an important element of the money value. As (Khan et al., 2004) show, most views on money as a tool for solving the problem of information storage and transmission in the credit money system do not consider that anonymity is the factor that gives money value. This value is confirmed in behavioural experiments [2, 38]. According to (Masciandro, 2018), the anonymity and privacy of money derive from its ability to accumulate and transmit information. A behavioural experiment by (Borgonovo et al., 2021) suggests that anonymity is important for economic agents, preference for anonymity is related to the propensity to risk, loss of liquidity advantage should be rewarded with higher income, and the optimal combination of liquidity advantages, alternative losses of money possession and preference for anonymity is determined individually. Authors (Koziuk et al., 2022) consider this aspect in terms of the role of cultural attitudes since anonymity and privacy can be considered attributive to culture. However, cultural factors can be distorted by institutional factors related to trust.

However, attitudes to privacy differ across countries, which served as the starting point for the analysis by (Koziuk et al., 2022). In a broader sense, cultural drivers of economic behaviour, money habits and even the design of monetary institutions are presented in the literature (Falicov, 2001; Guiso et al., 2006; Jong, 2002; Tognato, 2012; Henchoz et al., 2019; Jost, 2018). As for privacy, studies have noted the presence of connections between it and cultural attitudes. For instance, anonymity and privacy are more pronounced in countries where people tend to be more individualistic (Li et al., 2017), the same is true for uncertainty avoidance (Trepte et al., 2017), as well as the relationship between privacy and egalitarianism and competition between people in society (Omrani et al., 2017).

Empirical evidence supports the thesis on the heterogeneity of attitudes to privacy across countries. Author (Carstens, 2021) shows that heterogeneity applies to both countries and regions. Within the same continent, there can be significant differences in willingness to share information about one's financial affairs. Surveys conducted by (Chen et al., 2021) in 28 countries on 3 continents are fairly unequivocal about the fact that there are significant differences in willingness to disclose financial information about oneself across regions and genders. Men tolerate privacy less. At the same time, residents of Asia are less inclined toward privacy. Although intra-regional differences are also significant. However, both (Chen et al., 2021; Carstens, 2021) emphasize the issue of fintech spread. The search question refers to the willingness to share information about one's financial affairs in order to receive better financial services. In contrast to this view on privacy, in the work (Koziuk et al., 2022), the search questions explicitly refer to CBDC, in particular, the dilemma of "anonymity vs convenience". Cultural factors based on the regional belonging of the respondents are sometimes significant, sometimes not. Authors (Carstens, 2021; Chen et al., 2021) do not appeal to the question of cultural differences at all; they only state the fact of countries' heterogeneity in terms of privacy preferences.

Based on the indicated results of previous studies, there is a certain problem that will determine the optimality of the CBDC design in terms of anonymity and privacy. The preference for anonymity and privacy are cultural (but also age and gender) phenomena. Cultural factors can be distorted by institutional trust factors, as (Koziuk et al., 2022) show. In turn, behavioural experiments show a significant role in individual traits when it comes to the preference for anonymity over other properties of money (Borgonovo et al., 2021). Given the results of (Borgonovo et al., 2021), one cannot completely deny the fact that individual preferences may not be determined by the framework of cultural affiliation, which in turn does not negate the possibility of rigid cultural frameworks of anonymity preferences destruction from the side of institutional trust when it comes to money and ease of its use.

The basic assumption of the article is the existence of a potential contradiction between cultural factors of anonymity/privacy preferences and individual preferences independent of cultural attitudes. This contradiction arises in the areas of social experience, which have either been most distorted by the problem of institutional trust or are most subject to behavioural distortions due to the complexity of the environment in which such experience is implemented. Such a contradiction requires a combination of at least two empirical techniques for analysing the survey results conducted to identify preferences regarding CBDC design. The regional factor validity of the surveys is contrasted with the analysis of binary data correlations regarding the choice made. The latter is also designed to reveal the presence of preference transitivity. Choices regarding anonymity/privacy are further tested for how resilient cultural attitudes such as hierarchies and egalitarianism are under the influence of additional monetary incentives. The article confirms that cultural differences must be

considered when designing CBDC. Still, issues of trust and behavioural distortions do not make the cultural frameworks of choice regarding anonymity and convenience rigidly set.

## AIMS AND OBJECTIVES

The primary purpose of the article is to delve into the intricate factors that shape individuals' preferences for anonymity and privacy within the context of Central Bank Digital Currencies (CBDCs). The research specifically aims to shed light on the dynamic interplay between cultural norms, individual behaviours, and trust in institutions, and how these elements collectively influence the way people perceive and value privacy in the realm of digital transactions. In pursuit of this overarching goal, the authors set out to address the following key questions: The research seeks to unravel the complex relationship between cultural norms and individual behaviours in shaping preferences for anonymity and privacy in CBDC transactions.

It aims to explore how cultural values and beliefs interact with individual decision-making processes and behavioural patterns to influence the degree to which people prioritize privacy in the digital currency context. The study also investigates the extent to which inherent behavioural biases, such as the tendency to prioritize immediate convenience over long-term privacy concerns, can influence and potentially override the impact of cultural norms on privacy preferences. It aims to understand how these biases might lead individuals to make choices that deviate from what their cultural background might suggest. Finally, the research explores the potential connection between the moderation of cultural constraints by behavioural biases and the level of trust individuals place in institutions, particularly those responsible for managing and safeguarding CBDCs. It aims to examine whether a lack of trust in institutions might amplify the influence of behavioural biases, leading to a greater willingness to compromise on privacy for the sake of convenience or other perceived benefits.

## METHODS

Surveys have become an important component of behavioural analysis and identification of preferences. The spread of cryptocurrencies and the corresponding development of digital money as well as payment services have significantly increased the interest of researchers in the issue of the economic agents' behaviour in the new digital reality. From the conducted surveys, it is clear that the attitude towards crypto-assets is ambiguous, speculatively oriented and determined by the degree of awareness of their nature [50-55] (OECD, 2019; FCA, 2019; FCA, 2021; AFM, 2018; Ritzberger-Grünwald et al., 2018; Panos et al., 2019). They do not present questions that expand our understanding of the problem of anonymity in the world of digital money. Authors (Chen et al., 2021) emphasize the indirect detection of attitudes to privacy in the form of a question about the willingness to disclose information about financial transactions in order to receive better service. Although the obtained results are extremely important for building hypotheses about the cultural conditionality of the preference for anonymity/privacy, the very formulation of the question in (Chen et al., 2021), similar to that presented in (Goldfarb et al., 2012), reflects the tradition of interpreting the implicit assumption hidden in an open question. In contrast, (Kozziuk et al., 2022) present the results of a survey with an explicit question about preferences regarding CBDC design, in particular regarding anonymity/privacy, choosing between anonymity and convenience, conditions under which respondents would agree to lose some privacy, etc.

This study is a continuation of that presented by (Kozziuk et al., 2022). It is based on data from a survey of 164 respondents sent to them via Google Forms. Around 79 respondents are from Eastern Europe, 45 – from Asia, and 40 – from Africa. The questionnaire had a clear structure, including details about the survey's purpose, instructions, and a data privacy policy. Participants accessed the survey through the Google Forms service. A crucial part of the study was carefully selecting participants. Only those who successfully passed a test on fundamental money market concepts were invited to join, ensuring high-quality responses. Importantly, the same questionnaire was used in this article's analysis, but the earlier study focused on testing different assumptions that laid the groundwork for those discussed here.

On the one hand, we start from the assumption that behavioural experiments cannot always identify the cultural conditionality of responses and are more effective in analysing individual behaviour. At the same time, cultural factors of behaviour can, by assumption, be identified with the region of the respondents' origin. For instance, economic agents from different regions of Switzerland show different money habits and this can be explained solely by a cultural factor and not by any other (Henchoz et al., 2019; Jost, 2018). Taking into account that anonymity/privacy has a cultural origin, a certain logical sequence can be built: region of the respondents' origin – culture – cultural attitudes – stated preferences – confirmation of stated preferences through additional questions that reflect the influence of monetary incentives over cultural attitudes.

In order to identify the regional conditionality of respondents' answers, the cross-tabulation method is used. Exceeding the actual value of the  $\chi^2$  test over the critical one will indicate the truth of the alternative hypothesis that the relationship between the preferences and the region of the respondents' origin really exists, that is, it will indicate that the cultural environment affects the system of their preferences. To assess the level of such a connection, the contingency coefficient proposed by K. Pearson is calculated:

$$C = \sqrt{\frac{\chi^2}{\chi^2 + N}}$$

where  $\chi^2$  - the calculated value of the chi square test,  $N$  - number of respondents.

At the same time, the comparison of interregional differences is not the focus of this study, although it can be noted that the tendency for privacy in Asia is much lower than in Eastern Europe, and Africa occupies an intermediate place (Koziuk et al., 2022).

On the other hand, as shown in (Borgonovo et al., 2021), individual preferences are significant when it comes to complex choices regarding anonymity, advantages of liquidity and opportunity costs of owning money. That is, behavioural distortions can distort the rigidity of the logical sequence "region of the respondents' origin – culture – cultural attitudes – stated preferences – confirmation of stated preferences." Also, such a sequence can be distorted not so much by behavioural factors as by institutional ones. The quality of institutions plays an important role when it comes to digital money and dissatisfaction with the traditional central banking model of fiat money (Koziuk et al., 2022). In the case of a lack of trust in financial regulators, the cultural conditioning of choosing between the convenience of transactions and their anonymity may weaken. Economic agents, not trusting the institutional format of anonymity guaranteeing, will more easily agree to the advantage of convenience, since the mere fact of anonymity is no longer self-sufficient for them. And this is not a manifestation of cultural attitudes regarding the fact that a higher propensity for anonymity corresponds with individualistic values, and less tolerance of egalitarianism and hierarchy (Koziuk et al., 2022). For these reasons, the logical sequence of answers needs to be analysed not according to regional conditioning, which is designed to reveal the role of culture, but according to individual conditioning. Cross-tabulation analysis was also used to determine the consistency of individual preferences. Due to it, an attempt was made to trace the logical sequence of answers not in the regional dimension, but in the individual one within the entire sample as well. In the process of analysis, Pearson's  $\chi^2$  test was calculated for each pair of variables. The statistical significance of the relationship between categorical variables was estimated by its value.

The applied methodical approach will allow us to see which preferences and their confirmation in additional questions are due to cultural factors, in which cases the role of culture is not decisive, and how this correlates with the clarity of consistency in preferences at the individual level. Also, the presence of a logical sequence in preferences at the individual level will indicate that the role of behavioural distortions is not significant. In the opposite case, the hypothesis about the significant role of behavioural factors that distort the transitivity of preferences in complex issues of economic choice should not be rejected. In turn, the soft connections within the response sequence also require institutional analysis with reference to the context, as the nature of behavioural distortions may not always be explicitly understood. Moreover, the research is not directly addressed to the identification of the reasons why and in what form certain behavioural shifts occur.

## RESULTS

Following the methodology outlined above, the empirical test consists of two parts. The first part demonstrates whether the answers are determined by the regional belonging of the respondents. In other words, if we assume equivalence between the regional origin of the respondents and the cultural factors of the responses, a statistically strong relationship would indicate that the latter plays a significant role, and vice versa. For this, the  $\chi^2$  method was used. In the case of  $\chi^2$  statistical significance, the cultural factor can be considered predominant (see (Koziuk et al., 2022) for details). Accordingly, in Table 1, the description considers that if the answer to the question can be interpreted in the context of cultural conditioning, the importance of the cultural factor is explicitly recognized. In the case where there is no direct relation to cultural affiliation, but the  $\chi^2$  is statistically significant, the interpretation is given in the form of regional factor weight. In other cases, a possible explanation for the lack of statistical significance is indicated according to (Koziuk et al., 2022).

As can be seen from the data in Table 1, there is a certain problem with the claim that privacy or preference for anonymity is rigidly determined by culture when it comes to the possibilities of digital transactions. Moreover, the drop in statistical significance of the  $\chi^2$  indicator occurs precisely in those cases when it is directly about the expectation of benefits from

digital transactions, or when it concerns trust in legal forms of payments (questions 8 and 10). Although regional differences in the answers to these questions still exist (Koziuk et al., 2022), the role of cultural attitudes is most likely replaced by more expressive institutional drivers of preferences. That is, preferences for digital transactions are stronger where there is less trust in existing legal forms of transactions. And if the trust in the latter is low, the loss of anonymity/privacy is not considered as something significant, if the economic agent receives benefits in the form of convenience. The fact of the initial lack of trust in official monetary institutions drives the choice within the alternative of the convenience of transactions vs privacy/anonymity. It is in this aspect that the potential conflict between cultural and institutional factors of choice is laid within the alternative of the convenience of transactions vs. privacy/anonymity.

**Table 1. Chi-square test on the regional conditioning of respondents' answers and its interpretation.**

	Question	$\chi^2$	p-value	Contingency coefficient	Interpretation
Q2	Respondent distribution according to their age	77.47	0.000	0.566	Significance of the regional factor
Q3	Evaluation of the income level of respondents	21.70	0.000	0.342	Significance of the regional factor
Q4	Is the difference in payment technologies considerable to you?	5.47	0.065	0.180	The impact of the regional factor is questionable
Q5	Are you familiar with the digital currency of central banks (CBDC)?	13.25	0.001	0.273	Significance of the regional factor
Q6	Do you know that the privacy level of transactions is dependent on the digital money design?	13.19	0.001	0.273	Significance of the regional factor
Q7	Is the implementation of the right to transaction privacy significant to you?	29.22	0.000	0.392	The cultural factor is important
Q8	Do you allow limitations on transaction privacy because of public interests?	1.88	0.392	0.107	The impact of the cultural factor is questionable
Q10	Do you reckon that transaction tracking decreases the digital money popularity?	0.55	0.760	0.058	There is no regional conditioning of answers. Possible explanations: there is a culture of conformity; a low level of trust in legal transaction forms; the problem of institutional trust; perception according to the scheme "benefits – losses" ("win-loss")
Q11	Do you consider that paper money ensures the highest degree of transaction anonymity?	4.65	0.097	0.166	There is no regional conditioning of answers. Possible explanations: there is a culture of conformity; a low level of trust in legal transaction forms; the problem of institutional trust; perception according to the scheme "benefits – losses" ("win-loss")
Q12	Would you like to sacrifice some aspect of the transaction anonymity for their convenience?	2.09	0.352	0.112	There is no regional conditioning of answers. Possible explanations: there is a culture of conformity; a low level of trust in legal transaction forms; the problem of institutional trust; perception according to the scheme "benefits – losses" ("win-loss")
Q13	Do you reckon that the payment service convenience is the main benefit of digital payment technologies?	0.45	0.799	0.052	The impact of the regional factor is questionable
Q14	Do you agree with the opinion that there has to be a distance among people (social classes) in society?	8.25	0.016	0.219	Significance of the regional factor
Q15	Do you agree that social inequality is acceptable?	1.62	0.445	0.099	The cultural factor is not statistically significant. However, this fact contradicts the result of question 14, where the role of the cultural factor is significant. This can be considered a certain behavioural anomaly. Inequality is tolerated, but a personal contribution to greater equality becomes more culturally sensitive
Q16	Would you like to spend part of your income to decrease inequality in society?	9.42	0.009	0.233	Significance of the cultural factor
Q17	Would you like to work for hierarchical organizations?	1.89	0.389	0.107	The impact of the cultural factor is questionable
Q18	Do you like relationships that provide for participant equality?	1.95	0.378	0.108	The impact of the cultural factor is questionable
Q19	Would you agree to work in more hierarchical organizations to increase your income?	1.25	0.537	0.087	The impact of the cultural factor is questionable
Q20	Would you accept the loss of the income part for the convenience of working in organizations with participant equality?	13.10	0.001	0.272	Significance of the cultural factor
Q21	Have you ever invested in cryptocurrency?	3.01	0.222	0.134	The impact of the regional factor is questionable

The presence of such a conflict raises the question of how stable the preferences of economic agents are. In other words, how consistent they are in answering questions across the entire sample of respondents. In order to see how consistent, the respondents' answers are not in the regional, but in the individual dimension, the Correspondence Analysis method was used to assess the density of the connection between binary variables (in this case, "yes" / "no"). Pearson's  $\chi^2$  test was calculated for each pair of responses. Depending on its value, the statistical significance of the corresponding connections was determined. The results of this test are presented in Appendix A (Table A1) in the form of a correlation matrix regarding all questionnaire questions. Appropriate pairs of questions are selected for analysis, which are designed to demonstrate economically significant relationships that are interpreted in the context of the logic of this study.

Based on Table A1, pairs of questions can be conventionally grouped into blocks: awareness; attitude to privacy; preferences regarding convenience vs. privacy; consistency in attitudes toward inequality and hierarchy as indirect evidence of attitudes toward privacy.

In the conditional block "awareness" there is no clear consistency of answers. For instance, there is not a close relationship between affirmative answers to questions about the importance of payment technologies for the respondent, on the one hand, and awareness of CBDC as well as the dependence of transaction privacy on the design of digital money. It should hardly be reduced to a behavioural anomaly. Most likely, it should be said that the respondents do not have a complete set of information about the details that make up the essential composition of the digital world, including the reaction of central banks to its expansion.

Pairs of responses to the "attitude towards privacy" block show a mixed picture. Thus, there is a significant relationship between the answers to the question about the conditionality of transaction privacy by the design of digital money and the importance of transaction privacy (questions 5 and 6). The same applies to the readiness that privacy may be limited when using digital money (questions 5 and 7). But in a couple of questions 6-7 and 7-8, the consistency weakens. The relationship between the importance of transaction privacy and the willingness to sacrifice it for public purposes is weak. This may indicate that privacy is still a priority. And already between this readiness and agreement with the fact that privacy restrictions reduce the popularity of digital money, the connection becomes statistically significant. At the same time, no connection can be traced in pairs 6-8: the importance of transaction privacy does not correspond to the agreement that restrictions on it reduce the popularity of digital money. This indicates that preferences regarding privacy are strong, but this does not mean that it cannot become the subject of a compromise (in the case of a reaction to the appropriate stimuli) or guarantee the avoidance of behavioural distortions in a complexly organized information environment.

Regarding the preference for "convenience vs. privacy", the situation is also not clear-cut. There is a close relationship between pairs 8-9, 9-10 and 9-11. That is, the tight connection in the pair 8-9 indicates that the cautions about anonymity are significant, and the untraceability of fiat money is recognized as a fact. And these answers are not regionally conditioned. But the close connection in pair 9-10 rather confirms the opinion that despite the importance of privacy, there is a certain willingness to sacrifice it for convenience. The same is confirmed in the case of pair 9-11: the advantage of fiat money is combined with the realization that convenience is the main virtue of digital money. At the same time, the respondents demonstrate a specific sequence (this is not a correspondence of one-way communication in the answers to a unidirectional direction in several questions, but a lack of connection between the answers to multidirectional directions in a number of questions). There is no tight connection in pairs 8-10 and 8-11. That is, the awareness that the traceability of transactions reduces the popularity of digital money does not mean that respondents are ready to sacrifice anonymity for convenience. However, the lack of a tight connection in pair 10-11 can be interpreted in favour of digital money convenience: the willingness to sacrifice a part of anonymity for the sake of convenience does not correspond to the recognition of convenience as its greatest advantage. It is also important to note that in the aspect of preference for convenience over privacy, there was no regional conditioning (Table 1). That is, cultural factors do not affect it so much, even if the culture does affect the attitude to privacy. In a broader sense, the anonymity of transactions continues to be a virtue of money, but under a certain set of incentives it can be a subject of compromise, and this fact is most likely not based on cultural ground.

Regarding consistency in attitudes toward inequality and hierarchy as indirect evidence of attitudes toward privacy, a mixed picture can also be seen. Thus, the answers to the direct question about the attitude to hierarchies are closely related only to the answers to the question about the readiness to limit the privacy of transactions for the sake of public interest (pair 7-12). This is fully consistent with the theoretical assumptions of the economics of culture. Tolerance of hierarchies is a cultural prerequisite for the dominance of the public over the private. The same was shown in the test on the conditioning of the answers by the region of origin of the respondents and in the test on the correspondence of one-way answers (Table 1). However, the toleration of social inequality corresponds closely exclusively to the recognition that convenience is the greatest virtue of digital money (pair 11-13). This can be explained only by a peculiar perception of

digital services elitism. However, there is a lack of sufficient empirical ground for this. At the same time, there is no tight connection in pair 12-13. Just as it is absent between answers to direct questions about attitudes to hierarchies (12) and social inequality (13), on the one hand, and answers to questions that characterize the alternative "privacy vs convenience". This confirms the opinion expressed above those cultural patterns are not traceable among the selection criteria in favour of privacy at the expense of convenience or vice versa.

There is a certain cultural consistency in attitudes towards hierarchies. Readiness to work in hierarchical structures confirms this (pair 12-15). But monetary incentives regarding adherence to hierarchies should correspond to attitudes toward them (pair 12-17, pair 15-17). That is, monetary incentives can distort cultural attitudes. Extrapolating to the privacy vs convenience choice, this means that if culture determines attitudes towards privacy, this does not necessarily apply to the convenience of digital money. Under certain incentives, privacy can be a compromise.

A similar picture can be found in the case of attitudes towards inequality. There is an obvious lack of consistency in preferences. The strong connection in pairs 16-17 (readiness for greater rewards in hierarchy contrary to a preference for more equal relationships) can be qualified as monetary incentives being important. And at the same time, the strong connection in pair 17-18 denies this. Similarly, the attitude toward inequality does not show persistence in conditions of monetary incentives presence (pair 14-18 and 16-18 with a strong connection, indicating a potential willingness to be more egalitarian, contrary to the result of pair 16-17). This contradiction is more pronounced than the inclination to hierarchies. However, regarding the attitude to privacy, the picture is also ambiguous. The strong connection in pairs 6-13 and 6-14 indicates that the importance of privacy is combined with a stronger tolerance of inequality and vice versa. Similarly, the willingness to sacrifice privacy for the sake of the public interests is combined with tolerance of hierarchies and tolerance of more equal relationships (pairs 7-15 and 7-16). Nor does the tendency toward hierarchies negate the recognition that the traceability of transactions reduces the attractiveness of digital money (pair 8-16). That is, the unclear consistency in the attitude towards inequality in the extrapolation to digital money confirms that the role of culture is not so clear, especially in situations where privacy can become a compromise under the influence of certain incentives.

## DISCUSSION

The obtained results of empirical testing confirm the previously expressed hypothesis that despite the obvious value of privacy/anonymity in the field of monetary transactions, the willingness to sacrifice a part of them for the sake of convenience takes place, and it is more related to institutional factors than to culture (Koziuk et al., 2022). Such conclusions do not contradict the results of behavioural experiments described in (Borgonovo et al., 2021) regarding the instability of preferences concerning liquidity, anonymity, and convenience. At the same time, we recognize that the sample of respondents did not cover developed countries. Surveys in Europe, as already noted, have shown that privacy is a key requirement for the digital euro (European Central Bank, 2021). If we assume the results of such a survey as a fact, it is not completely consonant with the results obtained in (Koziuk et al., 2022). In a broader context, this means that there is unlikely to be a universal approach to optimal CBDC design. This is due to the fact that both cultural and institutional factors influence privacy/anonymity preferences. At the same time, in a situation where cultural factors do not strictly determine the choice regarding the "privacy vs. convenience" alternative, economic incentives can obviously bias the choice in favour of convenience. Such a choice will be more pronounced where the institutional factors of trust in centralized fiat money are weak. Evidence that centralized digital money does not have a trust bonus in countries with inflationary experiences and weak central banks supports this (Koziuk, 2021a).

Such findings are important for central banks. Firstly, the CBDC launch must be based on well-researched consumer preferences, as they will determine the extent to which the design of centralized digital money will become a demand factor for it. There will also be the problem of ex-post design changes. If the demand for CBDC turns out to be low at first, further changes in the design may affect the change in the consumer base, but not guarantee their increase due to the problem of trust that arises from the appearance of dynamic inconsistency. In this case, it can be described as follows. In the long term, the central bank aims to produce the most socially acceptable CBDC, but in the short term, it can offer a design that will cause expectations of future changes. On the other hand, the study of preferences is not typical for central banks. After all, the question of their sequence regarding the study of preferences in many other issues of the money circulation organization will arise. Studying preferences, rather than conducting policy, will undermine trust in central banks as policymakers endowed with authority, the delegation of which rests on a certain legitimacy. Secondly, when developing the CBDC design, central banks will have to consider the fact of society's attitude to the problem of privacy/anonymity. The question will arise: what is the most legitimately acceptable way for this to happen? Is it trust in the central bank leadership or the key institutional requirements for the CBDC determined by the representative power? It is possible that

such a dilemma will undermine the independence of central banks in the digital world. Whatever the procedure for determining CBDC design requirements, the heterogeneity of societies regarding the privacy vs. convenience alternative will determine that CBDC design may vary significantly across countries. Thirdly, projects regarding the multilateral exchange of one CBDC to another should include caveats about how the problem of diversity in approaches to the design of central banks' digital currencies is resolved.

## CONCLUSIONS

The increasing digitization of money has brought to light the importance of privacy and anonymity. Simultaneously, people's views on privacy and anonymity are often shaped by cultural factors. It is crucial to explore whether these cultural factors can influence the design of Central Bank Digital Currencies (CBDCs), presenting a practical concern.

Our method involved empirical testing survey results from respondents across three global regions. The findings suggest that there is no established approach to achieving optimal CBDC design. Notably, the regional variations in responses regarding the trade-off between privacy and convenience, along with trust in fiat money for privacy reasons, indicate that cultural factors may not play a significant role when institutional factors governing trust in the monetary system are at play.

This was further confirmed through cross-tabulation analysis of individual responses. While respondents generally emphasize the importance of privacy, our analysis revealed that monetary incentives can compromise this privacy. The convenience of digital currency transactions serves as an incentive, leading individuals to consider sacrificing some privacy. This tendency is most prominent in situations where the influence of cultural factors is less rigid.

A lack of trust in a centralized monetary system emerges as a significant factor driving individuals to prioritize convenience over privacy. Interestingly, the prioritization of privacy over convenience does not consistently align with attitudes towards hierarchies and inequality, despite the logical connection between privacy and tolerance of hierarchies.

The inconsistency in the link between cultural attitudes, attitudes towards hierarchies/inequality, privacy, and compromising the privacy of monetary transactions suggests that the convenience of digital transactions provides opportunities for digital money to challenge certain social preferences. However, this is more likely to occur in situations where the role of cultural factors in the choice between privacy and convenience is less pronounced.

The research presented in the article opens avenues for further exploration in several directions. The study's focus on the interplay of cultural, behavioural, and institutional factors in shaping CBDC privacy preferences could be extended to include a wider range of countries and cultures, allowing for a more comprehensive understanding of the global landscape of CBDC privacy preferences. Additionally, future research could delve deeper into the specific behavioural biases that influence privacy choices, potentially employing experimental methods to gain more precise insights into the decision-making processes involved. The role of trust in institutions could also be further examined, exploring how different levels of trust impact the willingness to compromise on privacy and the potential implications for CBDC adoption and usage. Finally, the study's findings could inform the development of more nuanced and context-specific CBDC designs that cater to the diverse privacy preferences of individuals across different cultures and institutional settings.

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## ADDITIONAL INFORMATION

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### AUTHOR CONTRIBUTIONS

*All authors have contributed equally.*

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### CONFLICT OF INTEREST

*The Authors declare that there is no conflict of interest.*

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### **ПРЕФЕРЕНЦІЙНІ ФАКТОРИ ЩОДО АНОНІМНОСТІ ЦИФРОВОЇ ВАЛЮТИ ЦЕНТРАЛЬНОГО БАНКУ: ПОВЕДІНКОВІ, КУЛЬТУРНІ ЧИ ІНСТИТУЦІЙНІ**

Центральнобанківські цифрові валюти (CBDC) пропонують модель грошового порядку, яка потенційно зменшує соціальні витрати, пов'язані з обігом грошей, порівняно з приватними криптовалютами, що є енергоємними. Однак успіх CBDC залежить від вибору дизайну, який може суперечити цілям політики та вподобанням споживачів. Ключовим викликом є баланс між конфіденційністю / анонімністю транзакцій і зручністю / функціональністю платежів. Уподобання щодо конфіденційності / зручності залежать від культурних установок, поведінкових факторів і довіри до інституцій. Це дослідження спрямоване на розв'язання таких питань: 1) Як культурні та поведінкові фактори взаємодіють, формуючи вподобання щодо анонімності / конфіденційності CBDC? 2) Наскільки поведінкові упередження пом'якшують культурні обмеження? 3) Чи існує кореляція між таким пом'якшенням і рівнем довіри? Було проведено опитування (Google Forms, 19 питань) 164 респондентів зі Східної Європи, Азії та Африки. Аналіз показує, що регіональна однорідність відповідей свідчить про культурно обумовлені вподобання. Однак переважання анонімності над зручністю значною мірою залежать від інституційних факторів, що виходять за рамки культури. Культура не є вирішальним фактором у питаннях довіри. У випадках меншої довіри до грошових установок зручність переважає анонімність. Дослідження приходять до висновку, що успішний дизайн CBDC залежить від конкретних умов окремих країн. Центральні банки повинні розуміти вподобання споживачів у своїх країнах, щоб вибрати оптимальний дизайн CBDC. Однак надмірна увага до «маркетингу» вподобань споживачів може підірвати роль центрального банку як розробника політик, водночас вибір правильного дизайну є вирішальним для успіху CBDC.

**Ключові слова:** цифрові гроші, цифрова валюта Центрального банку (CBDC), культурні установки, анонімність, приватність грошей, установи, культура

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