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Central Bank Credibility, Central Bank Digital Currency Adoption, and Financial Literacy: A Pilot Randomized Controlled Trial

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ABSTRACT

Central banks across the globe are exploring the potential implementation of Central Bank Digital Currencies (CBDCs). In this context, this study aspires to evaluate the effect of information treatment to improve consumers' perspective on CBDC and the Central bank's credibility. The study also aims to explore consumers' potential incentives for CBDC adoption and further investigate if financial literacy is associated with CBDC adoption and central bank credibility. The study was conducted in Bloomington, Indiana, as a pilot study in 2023 by employing randomized controlled trial (RCT) and linear regression to analyze the outcomes.

The study found that information intervention increased central banks' credibility and CBDC adoption in the treatment group. Our results indicate that potential incentives of CBDCs, such as interest rate advantage, transaction convenience, and security features can boost the adoption of CBDC. Furthermore, the study found that the central bank's communication among higher financially literate participants generates more credibility gains and CBDC adoption compared to lower levels of financial literacy.

Keywords: Central Bank Digital Currency, CBDC Adoption, financial literacy, randomized control trial, Central Bank credibility.

INTRODUCTION

A digital currency issued and regulated by the central bank is known as central bank digital currency (CBDC). It refers to the electronic version of the conventional national currencies such as the pound, dollar, or euro. The primary purpose of CBDC is to serve as a means of payment in transactions like physical cash or traditional bank deposits (1).

Research interest in the CBDC is on the rise, transitioning from mere academic curiosity to a prominent policy consideration. This shift has been driven by various factors including rise of cryptocurrencies as foundational elements for digital payment systems, the expressed interest of major tech companies in entering the payment markets, and the ongoing transition of consumer preferences from cash to digital payment methods in retail transactions (2). Globally, central banks are curious and continuously exploring the feasibility of adopting a CBDC. A recent survey conducted by BIS (Bank of International Settlements) revealed that 60% of the 65 central banks were actively collecting evidence to assess the potential implementation of CBDC (3).

In recent years, many nations have undergone digital transformation, aiming to leverage the capabilities of digital technologies to improve economic inclusivity, especially in the payment systems and financial sector (4,5). This transformation goes beyond reshaping global trade and finance; it also involves redefining the nature of money and changing the dynamics of how people engage with it (6). A notable component of this digital evolution is the advancement of CBDC, which is also a form of digital currency. However, the central bank's capabilities might impact the CBDC's mandate, adoption, and credibility. Importantly, credibility is a crucial element for central banks, as it not only improves their responsibility but has also been recognized as a key factor in anchoring inflation expectations and facilitating the effective execution of various central bank policies and mandates (7).

The effectiveness of implementing the CBDC heavily depends on the level of consumer motivation to adopt this innovative digital representation of public currency. Therefore, the pilot RCT aimed to determine whether providing supplementary information from the central bank on CBDC and central bank policies can augment the adoption of CDBC and enhance the credibility of the central bank. Further, this study aimed to

identify potential incentives for consumers' acceptance of CBDC and to assess whether the gains in credibility vary among different population subgroups, particularly concerning varying levels of financial literacy.

LITERATURE REVIEW

Regarding the inquiry on whether central bank communication can impact respondents' beliefs, an increasing number of studies employ randomized control trials (RCTs). These studies revealed that central banks had the potential to influence inflation expectations through various communication strategies, such as discussing the inflation target (8,9), sharing the central bank's inflation forecasts (9), or informing about the future trajectory of interest rates (9).

Further inquiry revolves around whether the central bank can instill confidence in its ability to fulfill its mandate, thereby bolstering its credibility. Credibility holds significance for central banks as it contributes to their responsibility. A study highlighted that credibility plays a crucial role in anchoring inflation expectations and achieving other policy goals of central banks (7), while also promoting macroeconomic stabilization. Policymakers often cite credibility as a primary goal of central bank communication with people (10). Accordingly, our pilot RCT aimed to investigate the extent to which central bank communication can enhance credibility regarding the fulfillment of central banks' mandate of price stability and CBDC adoption.

In the context of potential incentives for CBDC adoption among consumers, the literature highlights several key findings. Bijlsma (2) found better knowledge of CBDC, along with trust in depository banks including the central bank, and price incentives attract CBDC adoption (11). Additionally, it was demonstrated that providing proper and ample information can increase public interest in CBDC, and many central banks actively required specialized knowledge and expertise in electronic currency before the issuance of a CBDC. Engert and Fung (12) highlighted the effectiveness of a CBDC in facilitating retail payments is contingent on specific attributes, such as whether it yields interest or not.

Vukovic (13) emphasized that the introduction of CBDC is essential for addressing the issue of financial exclusion, given the significant number of unbanked individuals globally. CBDCs could contribute to the promotion of financial inclusion by enhancing the accessibility of digital financial platforms and minimizing current transaction charges (14).

In realm of financial literacy, individuals with higher financial literacy were found more likely to adopt CBDC and trust financial institutions, aligning with the central bank's goals (15,16).

The paper contributes to the body of research by demonstrating that communicating information about the central bank's monetary policy objectives and CBDC enhances the central bank's credibility in fulfilling its mandate and CBDC adoption, particularly among those who are financially literate.

METHODS

Study Design, Setting, and Participants

This parallel, randomized controlled trial (RCT) was conducted in Bloomington, Indiana, as a pilot study in 2023. The study was conducted among graduate students of the economics department of Indiana University, Bloomington. Graduate students from the second and third years were recruited for either the treatment or control group. A total of ten participants, five in each group (treatment and control), were randomly recruited.

This study consisted of three parts. The first part investigated the perceived central bank credibility in maintaining price stability and CBDC adoption. The second part covered the consumers' perspectives on digital currency, CBDC security, price incentives, and convenience. The third part consisted of questions on financial literacy which included degree of financial knowledge.

Randomization

Participants were randomly assigned to either the treatment or control group with a ratio of 1:1. Randomization was performed using Qualtrics software. Allocation concealment was done by using a Qualtrics randomizer in the survey flow process. The intervention segment of the study tool was nested under the Qualtrics randomizer. The first part of this study was considered for intervention, and the second and third parts of the study were not considered as intervention. For the first part of the study, the treatment group received detailed information materials and the control group did not receive any information. For the second and third part of the study, we did not provide any information for either group.

Intervention procedures to measure credibility and adoption.

The control group received the research tools without getting additional information about the role of monetary policy and the advantage of CBDC. In contrast, the treatment group received the research tools with a detailed description of the role of the Fed's monetary policy and the advantages of CBDC as follows:

"Central Banks utilize monetary policy to achieve price stability and manage economic fluctuations. The Federal Reserve Bank in the United States executes monetary policy with a dual mandate to achieve price stability and maximize employment.

Moreover, CBDCs are issued and regulated by the central bank i.e., this is highly secured. Unlike privately issued digital currencies, the major motive behind the CBDC is transaction convenience, cheaper transaction fees, financial stability, and financial inclusion. CBDC serves as a tool for government to exercise control over illicit activities, the level of transparency, and monetary and fiscal policies."

The information provided emphasizes (1) the central banks' monetary policy objectives which include managing economic fluctuation, achieving price stability, and maximizing employment (in the case of the Federal Reserve), and (2) the advantage of CBDCs which include highly secured, transactional convenience, cheaper transaction fees, financial stability financial inclusion, transparency, control of illicit activities, and fiscal/monetary policies. The purpose of the RCT design is to examine whether this information can change consumers' perceptions about the Fed's credibility and CBDCs acceptance. By conducting RCT to measure the impact of this information treatment, we show evidence of perceived credibility and the willingness of CBDC adoption relative to that of the control group that does not receive any information.

The intervention contents were designed based on existing literature (17). Relevancy, applicability, and acceptability of the intervention contents were discussed with two experts, and three graduate students who were not included in the study. Amendments were made after receiving feedback. All the information was delivered through Qualtrics.

Measures

Demographic information including age, sex, occupation, household income, and education was collected.

Credibility and CBDC adoption

We evaluated the Fed's ability to effectively communicate its primary target of preserving price stability in the United States and the respondents' openness to using CBDC as a substitute for conventional currency using the following two questions*: (1) "What is the probability in your opinion, that the Federal Reserve will successfully maintain price stability in the US economy in the coming year?";* and (2) *"Once the CBDC is launched, how likely do you think that you will use it?"*. The answers to both questions ranged from 0% to 100%. The first question specifically focused on assessing the Fed's credibility in achieving price stability within the next year. The respondents are invited to share their perceptions on the probability of achieving price stability, associated with their subjective interpretation of price stability. Therefore, this question is designed to extract their perception which is expected to influence their economic behavior. The second question asks for trust in the adoption of the CBDC. Digital currencies have gained significant public attention due to the unique benefit provided by blockchain technology, however, a large portion of the general population lacks sufficient knowledge about the fundamental and potential features of CBDC (2). Therefore, this second question is needed to ascertain the relationship between the provided information and the extent of trust, and the justification for acceptance and adoption of CBDC.

Consumers' perspectives on digital currency, CBDC security, price incentives, and convenience

To test the respondents' general information about CBDC and to examine potential incentives for the adoption of CBDC we posed six questions. These six questions ranged enquiring from general knowledge of CBDC to reveling the potential incentives for CDBC adoption which are security, interest, ease of payment, and transaction fee. Response to these six questions ranged from 0 to 100%.

Financial literacy

Financial literacy was measured using four questions (Appendix detailed questions) designed by Ehrmann and colleagues (17). Out of four questions, three questions were used to collect basic financial knowledge and one question collected intensive knowledge related to returns. We grouped the participants into high and low financial literacy groups to estimate the treatment effects on credibility. High financial literacy was considered when the participant correctly answered three or all four questions and low literacy was considered when the participant correctly answered two or fewer questions.

Statistical analyses

We perform descriptive and inferential analysis. To test whether the intervention affects the Fed's credibility and CBDC adoption, we estimated the outcome using the following regression equation:

$y_i = \alpha_0^y + \alpha_1^y D_{1,i} + \varepsilon_i^z$ and $zi = \alpha_0^z + \alpha_1^y D_{1,i} + \varepsilon_i^z$

Where y_i and z_i denote the dependent variables (the reported likelihood for central bank credibility and CBDC adoption) for respondent *i*, α_0^y and α_0^z are fixed effects, $D_{1,i}$ is the dummy variable for the treatment group (i.e., if a specific respondent receives the information, $D_{1,i}$ is set to one for this respondent). The regressions are computed using ordinary least squares, with consideration given to robust standard errors. We applied a similar equation to assess the link of financial literacy with price stability and CBDC future adoption.

A descriptive analysis was performed for consumers' perspectives on digital currency, CBDC security, price incentives, and convenience for all the participants.

RESULTS

Central Bank credibility and CBDC adoption

Table 1 in the appendix shows the Central Banks' credibility and CBDC adoption among the treatment and control groups. To interpret the estimated values, it is important to note that respondents in the control group, on average evaluated the probability of the Fed fulfilling its mandate at 45.8% and their willingness to adopt CBDC at 30.0%. The calculated treatment effect indicates the extent to which respondents in the treatment group, in comparison to the control group, adjust these probabilities. Since the estimated coefficients are positive, the primary implication is that the information treatment enhances the probability of the Fed gaining higher credibility and people showing greater willingness to use CBDC in the future, and this effect is statistically significant. This underscores the potential advantages of disseminating information about monetary policy and central bank-regulated digital currency to the broader public, provided that such communication effectively reaches consumers. The treatment leads to an 2.91% increase in Fed credibility likelihood and a 3.75% increase in CBDC acceptance, signifying a notable rise compared to the control group.

Consumers' perspectives on digital currency, CBDC security, price incentives, and convenience

The participants' average understanding of digital currency was nearly 42.10% and CBDC was 19.11%. Among the incentives of CBDC, the lower transaction fees offered compared to current payment methods is the

feature attracting the most to the respondents, with an average willingness to use CBDC at nearly 62.30%, followed by the ease of payment in the daily transactions at around 59.20%, while the features of interest payment benefit and safety are comparatively less attractive to the public for CBDC adoption (data not shown).

Financial literacy

The individuals who exhibit higher level of financial literacy tend to be more responsive to the information treatments. For this group, the treatment effect is positive and statistically significant, with coefficients often notably larger than those observed for individuals with lower financial literacy. When provided with information about the role of monetary policy and the advantages of CBDC, the perceived probabilities of the Fed achieving price stability and CBDC adoption in the future increase by approximately 3.75% and 5.75%, respectively, among respondents with high financial literacy.

In contrast, the treatment effect is generally modest and statistically insignificant for individuals with lower financial literacy. Overall, the results highlight another crucial advantage: investment in financial literacy can contribute to enhancing the credibility gains achieved through central bank communication (refer to Table 2 in the appendix).

DISCUSSION

Our pilot study revealed that targeted communication with a tailored message delivered from the central bank improved the perceived credibility of the central bank and CBDC adoption. Lower transaction fees and easiness of payment have a positive impact on the adoption of CBDC. An increased level of financial literacy can enhance the credibility and CBDC adoption.

Randomized information provided to the treatment group revealed that additional information provided by the central bank about its policy and objective had significant positive effects on perceived credibility and CBDC adoption. Similar results were highlighted by a European Central Bank's working paper on "credibility gains from communicating with the public: evidence from the ECB's new monetary policy strategy" (17). Central banks can impact the expectations of their customer by providing tailored messages such as inflation targets, forecasts (18), and future interest rates (9). However, a significant level of impact might not remain for a long time. Therefore, it is very important to consider that improved or targeted tailored information delivered by central banks to their

customers might help to increase the trust and credibility of the banks (19). Central banks should develop culturally acceptable, simple, and applicable messages for their customer to enhance their credibility and trust (18,20).

Overly estimated and wrong information from the central bank could lead to a loss of trust and credibility in the bank (21). Financial literacy is crucial for maintaining constant trust and credibility. Our study revealed a high level of financial literacy was more likely to have a higher level of perceived credibility and CBDC adoption, consistent with existing literature (16). This pilot study showed central banks' intervention might be impacted by the level of financial literacy of their customers. Simple, fact-based, and tailored messages about central banks' policies and objectives enhanced the credibility and adoption of CBDC among those who were financially literate. The research suggests that central banks would benefit from proactively engaging with their less financially literate customers and implementing tailored interventions can significantly enhance credibility and foster better understanding.

The paper possesses strengths and weaknesses. This pilot study involved randomly allocated participants and applied a thorough outcome analysis. The intervention information and measurement tools were validated by experts which increased its reliability. However, certain limitations should be acknowledged. The characteristics of our study population, including socio-demographic features, were not consistent with other general populations as our participants are highly educated. Therefore, the results cannot be generalizable broader audience. This study sample size was small limiting its statistical significance and power. Subgroup analyses performed in this pilot study were hard to validate due to the small sample size. Nonetheless, this is a pilot study to understand the potential benefits of the intervention to apply in the future large-scale study.

CONCLUSION

The additional information or intervention provided to the treatment group improves consumers' perspectives on CBDC, and credibility and adoption. This pilot intervention can be expanded to be utilized in future research with large sample size and routine services. The study highlights that communication with the public through tailored messages potentially enhances the credibility and CBDC adoption.

Our study also indicates that respondents are willing to adopt CBDC with the proper incentive mainly the ease of payment, and lower transaction fee. Our study revealed a high level of financial literacy has a higher level of perceived central bank credibility and CBDC adoption compared to a low level of financial literacy.

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APPENDIX

Table 1: Effect on Fed's credibility and CBDC adoption

	Likelihood that the Fed will deliver price stability	Likelihood that CBDC will be used in the future
Information Provision	2.917* (1.088)	3.750* (1.569)
Constant	45.833*** (6.878)	30.000* (9.922)
Observations	10	10
R-squared	0.4734	0.4167

Notes: Standard errors are shown in brackets. ***, **, and * define the statistical significance at 1%, 5%, and 10% level.

Table 2: Effect on Fed's credibility and CBDC adoption by financial literacy levels

	High Level		Low Level	
	Likelihood that the Fed will deliver price stability	Likelihood that CBDC will be used in the future	Likelihood that the Fed will deliver price stability	Likelihood that CBDC will be used in the future
Information Provision	3.750* (1.357)	5.750* (2.181)	2.083 (1.563)	1.750 (1.981)
Constant	35.000* (8.580)	30.000 (13.794)	56.667* (9.884)	30.000 (12.528)
Observations	5	5	5	5
R-squared	0.718	0.698	0.372	0.207

Note: Standard errors are shown in brackets. ***, **, and * define the statistical significance at 1%, 5%, and 10% level.