Investigating individual privacy within CBDC: A privacy calculus perspective

Abstract

Central Bank Digital Currencies (CBDC) are a digital innovation based upon distributed ledger and smart contract technology. In this paper we examine how potential users of CBDC technology willingly disclose their personal information. The researchers conducted an online quantitative survey which investigates the privacy perceptions of consumers. Using the privacy calculus theory lens, this study looks at the potential benefits of CBDC and how these influence user perceptions towards privacy disclosure. While this research suggests that participants in the study had negative perceptions in relation to the disclosure of personal information, many were willing to offset these concerns if there are significant benefits in the usage of CBDC. Factors such as ease of use, convenience, availability, and credibility were viewed as key benefits in this scenario. Thus, future banking strategies and marketing approaches need to consider these components to foster CBDC adoption.

1. Introduction

The introduction of the blockchain has been a catalyst for disruption across multiple industries from supply chains to finance (Devine et al., 2021; Jabbar & Dani, 2020). This disruption is based on innovative technologies which have acted as the foundation for the development of Central bank Digital Currencies (CBDC). This is a fast moving area of research with Elsayed and Nasir (2022) providing a clear path for opportunities and challenges in the literature. It is within this context that we utilise the privacy calculus theory to explore the implications of Central Bank Digital Currencies (CBDC) on consumer privacy. There is a growing importance and need for a study in this field, as the continued popularity of online payments has prompted collection of large amounts of data creating privacy issues from multiple perspectives with industry, government and social

stakeholders all expressing concern (Jabbar et al., 2020). Currently companies have a high level of data centric business models which can create mistrust due to their data obligations: for example the Cambridge Analytica scandal (Ahnert, 2022).

This research suggests that the success or failure of CBDC adoption is not based on how great the technology is, but dependent on the delicate balance between perceived benefits and privacy concerns (Laboure, H.-P. Müller, et al., 2021). To investigate this balance, we utilize the theoretical approach known as Privacy Calculus Theory which proposes that when users disclose personal information, they evaluate the benefits of such disclosure against any potential risks (Kim et al., 2019). Using this theoretical approach, the authors can identify mechanisms and strategies to minimize consumer perceptions of risk and increase the benefits of CBDC usage. To investigate this, To investigate this a quantitative approach where more than 150 individuals were surveyed and asked their opinions on their privacy concerns in the context of CBDC adoption was utilized. The collected and analyzed data suggests two key contributions as part of this research. Firstly, perceived benefits are more influential than privacy concerns in the adoption of CBDC usage and, secondly, it was found that CBDC usage, ease of use and lifestyle convenience are crucial in gaining early user trust and adoption.

Thus, the focus on privacy comes at a time when world governments are actively pursuing or piloting a CBDC agenda. Some of these projects have been in the testing phases for several years but there has recently been a surge in government backed CBDC initiatives. Prominent examples include the sand dollar (a cryptocurrency version of the Bahamian dollar), the JAM-DEX (Jamaica's Digital Currency) and the e-CNY (China's Digital Yuan) to name a few. To better understand the implications of privacy and potential user adoption the paper is structured as follows. First, it focuses on the research context and identify the research gap. It then develops the hypothesises alongside a

privacy-based framework. Finally, the methods are outlined and the results highlighted before finally drawing out the key conclusions of the paper.

2. Research context

In the view of Elsayed and Nasir (2022) CBDCs are a form of digital currency based on and underpinned by the blockchain. Inspired by cryptocurrency such as Ethereum and Bitcoin, CBDCs are envisaged as a natural progression towards a digital cashless society. The key differentiator between CBDC and cryptocurrency is the concept of decentralization with no one entity having overall control (Renwick & Gleasure, 2021). A CBDC is centralized and is a representation of physical currency aka fiat money (Kyriazis et al., 2020). While, decentralization is defined as the equal delegation of functions and currency across all nodes within a network (Hegedűs, 2019). In essence it is a form of governance which is a technological innovation based on blockchain technology which removes intermediaries, thereby reducing cost and increasing transparency (Jabbar & Dani, 2020). If we apply decentralization into traditional governance structures then this would be viewed as the equal distribution of function and powers within all nodes of a network, thus removing all powers from a central authority and disseminating towards regional or local control (Drummer & Neumann, 2020; Prokofieva & Miah, 2019; Renwick & Gleasure, 2021).

For governments, this lack of control is highly unpalatable, most sovereign states control the money supply and have direct access over how money is printed, stored etc. (Adrian & Mancini-Griffoli, 2021). A CBDC provides a centralized alternative to a traditional blockchain scenario, allowing government banks to control the network (Zhang, 2022). A CBDC which can act as central reserve and as a legal tender brings many opportunities as discussed by Elsayed and Nasir (2022), however , there are also issues which need clear discussion and depth around the framing of such a currency

(Morgan, 2022). Creating a physical currency which can act as legal tender has created an environment where researchers are investigating different applications of this type of payment system (Adrian & Mancini-Griffoli, 2021).

Thus, the authors intend to develop the research in this paper which looks at the importance of privacy within the CBDC literature. It is highlighted as a neglected area (Table 1) and identifies that this is a significant research problem which relates to the potential implications of how the perceived benefits of CBDC may impact user perceptions and willingness to disclose privacy information. As privacy and data generation become more widespread, this study argues that this is an area of research which is taking on additional importance.

In identifying the gap in the research, the SCOPUS and Science Direct databases were surveyed and papers that looked at CBDC from March 2020 until today were searched for; 23 key papers that focused on CBDC research (Table 1) were identified. The March 2020 date was utilized as this was the date that the Bank of England published its discussion paper on CBDC (Bank of England, 2020). This pivot point becomes the official date wherein the UK starts to investigate the potential of CBDC in the context of the UK. In addition to the literature gap, our focus on privacy is supported by the bibliometric analysis of Bhaskar et al. (2022) who in their very resilient review identify privacy as a prestigious theme which requires additional research. To help focus the research, focus was given to articles which are published in peer reviewed journals, mainly the ABS list. To help organize the research the table was split into three key sections defined as CBDC technology, CBDC Digital Currency and CBDC applications. These three sections help to identify and manipulate the identified gap in the privacy research area.

Table 1: Previous CBDC research

Studies	Po	Inf	Cry	Ps	Pay	Prv	Key findings & knowledge gap
CBDC Technology							
Allen et al. (2022)	*	x	√	x	√	x	Most of the research in this section is quite general and is a look at the road ahead.
Scharnowski (2022)	x	*	√	x	*	x	The focus is on Fintech, Blockchain and the difference between centralization and
Laboure, H.-P. Müller, et al. (2021)	√	*	*	√	√	*	decentralization. While privacy is discussed most of the work is on policy or reviews.
CBDC Digital Currency							
Agur et al. (2022)	*	x	x	x	√	*	From the papers surveyed this section was the richest in terms of literature and
(Keister & Monnet, 2022)	√	x	x	√	*	x	research. The body of research that looks at Price Stability and Payment systems is
Morgan (2022)	*	x	√	x	√	x	already very robust. However, while the focus is on payment systems the research
(Pelagidis & Kostika, 2022)	√	x	√	x	√	x	around privacy and infrastructure is neglected. However, the paper of Tronnier and
Tronnier et al. (2022)	x	x	*	x	√	√	her co-authors provides a rich background into the importance of credibility and
(van Oordt, 2022)	x	x	x	√	√	x	image influence privacy concerns and the intention to adopt. This differs from our
Wang et al. (2022)	x	x	x	√	√	x	paper significantly as we are interested in investigating delicate balance between
Wilkins (2022)	√	x	x	x	x	*	perceived benefits and privacy concerns through the privacy calculus theory.
(Davoodalhosseini, 2022)	√	x	x	√	√	*	
Bian et al. (2021)	x	x	x	x	√	x	
Williamson (2021)	√	x	x	√	√	x	
CBDC Applications							
Bhaskar et al. (2022)	*	*	*	*	*	*	Again, we find that research around privacy is scarce when discussing the
Castrén et al. (2022)	*	*	*	√	√	*	applications of CBDC. Most of the research is focused on policy and payment system
Chen and Siklos (2022)	√	x	x	√	√	x	approaches. Elsayed and Nasir discuss the importance of privacy as a future issue
(Cheng, 2022)	√	x	x	x	√	*	which further highlights the need to understand this phenomenon. We also find that
Ding et al. (2022)	x	√	*	*	√	x	the work of Borgonovo discusses the importance of anonymity when considering the
Elsayed and Nasir (2022)	√	*	*	√	√	*	appeal of a payment medium. In CBDC scenarios full anonymity is not guaranteed as
Ferrari Minesso et al. (2022)hhh	√	x	x	√	*	x	opposed to cash.
Borgonovo et al. (2021)	*	x	x	x	*	√	
Cullen (2021)	√	*	*	√	√	x	

Policy (Po); Infrastructure (INF); Crypto (Cry); Price Stability (PS); Payment system (Pay); Privacy (Prv); × for none, √ for Yes, and * for "Yes, but not enough".

Table 1 highlights the key research in this area and helps the authors illustrate the notion of privacy and its importance as a research element within CBDC. The work of Tronnier et al. (2022) and Borgonovo et al. (2021) highlight the need for our research and illustrate the potential for confusion around CBDC and the privacy research area. Tronnier et al. (2022) argues for the need to have credible systems which have a strong image to allay concerns and increase adoption, while the research of Borgonovo et al. (2021) outlines the importance of anonymity when users are considering payment systems. It is at this key area that this paper investigates the delicate balance between perceived benefits and privacy concerns. Is there an appetite for users to willing forego privacy such as anonymity as discussed by Borgonovo et al. (2021) for additional benefits such as image and credibility as discussed by Tronnier et al. (2022).

3. Theoretical background and hypotheses

3.1 Privacy calculus theory

The privacy calculus theory has been widely studied to investigate user privacy perceptions and behaviours (Dinev & Hart, 2006; Kehr et al., 2015; Vimalkumar et al., 2021). Within this theoretical approach, privacy is not viewed as an absolute but is based on a risk-benefit estimation. The model can be used to comprehend the key components which influence consumers when making decisions on personal information disclosure. The outcome of the calculation can help researchers to understand the disclosure benefits and privacy concerns in a particular information-disclosure setting. This is a popular function used by researchers to understand privacy disclosure. Previously this model has been used to investigated the need to understand location-based advertising for mobile phones (Gutierrez et al., 2019), hotel booking (Ozturk et al., 2016), payment applications (Yang et al., 2020) and IOT services (Kim et al., 2019)

For the purposes of this paper, it is assumed that perceived privacy concerns are the extent to which individuals believe there is a risk of loss linked with the disclosure of personal information (Culnan & Armstrong, 1999). In contrast, perceived benefits relate to the benefits received in exchange for personal information such as convenience in conducting financial transactions, usability, ease of use and anonymous transactions (Attié & Meyer-Waarden, 2022; Borgonovo et al., 2021; Chen, 2013; Geebren et al., 2021). Thus, in this paper the privacy calculus theory is viewed as a perfect mechanism to research the balance between privacy concerns and perceived benefit.

3.2 Privacy and convenience

As with all new innovations individuals tend to be cautious about accepting new technology, particularly in the financial sector and payment systems (Johnson et al., 2018). The advantages around CBDC have been well documented with research extolling the virtues of the decrease in cost and the eradication of risks in handling physical cash (Kshetri & Loukoianova, 2022). However, the challenges around CBDC hinge on the perception of privacy and how data is safeguarded and consumed. Currently, blockchain has a negative perception in the eyes of the public with many viewing it as a haven for money laundering, tax evasion and illicit activities (Schlecht et al., 2021). Thus, privacy and data keeping have been identified by many industrial sources as the biggest potential challenge to the widespread acceptance and adoption of CBDC (Bilotta & Botti, 2021).

There is always a need to balance privacy and creating easy to use, secure systems against illegal access and tampering (Auer & Böhme, 2020). Numerous studies have looked at antecedents of perceived benefits to explain how individuals observe the incentives to accept, adopt, or use a specific technology or system (Ma et al., 2021; Shibchurn & Yan, 2015). Within the context of CBDC to be considered as an effective alternative payment tool, it needs to be convenient, accessible, ubiquitous, anonymous,

and secure, while also having a strong image with a credible supporting brand (Tronnier et al., 2022). Hence we propose that utilitarian-oriented benefits such as convenience and ease of use can motivate people to disclose personal information. Convenience has been shown to be one of the most important factors that affect peoples' attitudes and behavior towards technological innovations (Mombeuil & Uhde, 2021). In essence, the more convenient a new technology seems to users, the more likely it is that the users will accept it and subsequently adopt it. Therefore, the following hypothesis is proposed:

H1: Convenience is positively related to the perceived benefits of personal information disclosure via CBDC.

3.3 Privacy and ease of use

Convenience is one crucial component which can be significantly supplemented with ease of use in creating a positive experience around CBDC systems. It is proposed that the investigation of both convenience and ease of use can enhance the willingness of individuals to disclose personal information. For the purposes of this paper, ease of use is viewed as a mechanism to measure the degree in which a user believes that using a specific system would be free of effort and make their lives easier (Venkatesh, 2000). In this regard it can also be argued that effort of use is a part of the overall costs of using information systems from the user's perspective (Chen, 2013). What is not clear is the impact of effort of use on overall system cost. A lot of research has been conducted which investigates the influence of ease of use and how this enhances the users utilitarian experience (Caffaro et al., 2020; Kucukusta et al., 2015) for example making fast, efficient, and reliable payments when using CBDC. Therefore, the following is hypothesized:

H2: Ease of use is positively related to the perceived benefits of personal information

disclosure via CBDC.

3.4 Perceived privacy risk and benefits

A big issue for many users is the general fear and mistrust of unethical businesses who may gain access to personal information for which they are not authorized (Barth & De Jong, 2017; Geebren & Jabbar, 2021). There have been numerous examples where unethical organizations gain access to trusted data and sell this to third parties for profit, in many cases without the knowledge or permission of the data owners or holders - a crime also known as data theft (Raddatz et al., 2021). As shown by Facebook's policies around user privacy, data retention and security, many customers are now hesitant to share personal information, media and content, and have in essence stopped using the service (Unnava & Aravindakshan, 2021). Hence, if users perceive a substantial risk of privacy invasion when using CBDC their propensity to disclose private information decreases rapidly. This research argues that one of the main challenges faced by CBDC systems is the potential misuse of this information. Therefore, the utilization of personal information must be carefully managed so that individuals can perceive a high level of potential benefits associated with the acceptance and use of CBDCs. This will create an environment where users are willing to disclose their personal information when using CBDC systems. As a result, the following two hypotheses are proposed: (Fig1).

H3: Perceived benefits are positively associated with willingness to disclose personal information via CBDC.

H4: Perceived privacy concerns are negatively associated with the willingness to disclose personal information via CBDC.

As a result, the following research model is proposed. In addition to the four hypotheses, the impact of ease of use and convenience on the dimensions of perceived

benefits were also considered and compared. This approach was undertaken to better understand the key fundamental factors which require additional focus when attempting to develop mainstream marketing strategies for CBDC adoption. Thus, the following hypothesis was formulated:

H5: Ease of use has a greater influence on the perceived benefits of personal information disclosure via CBDC than convenience

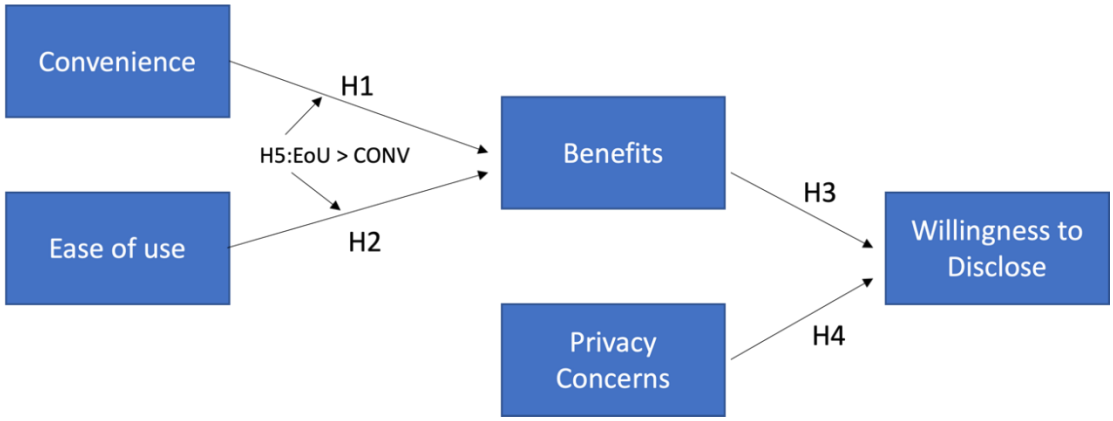

Figure 1. Research model

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4. Methodology

4.1 Questionnaire design

The quantitative research strategy is the most appropriate strategy for this study for many reasons. Quantitative research is an effective research strategy for making predictions and confirming or testing a theory or hypothesis (Bryman & Bell, 2015). In addition, the purpose of the data collection procedure in this study is to gather opinions from potential CBDC users. Thus, it is rational to use a large sample size to be representative of the entire research population (Ghauri et al., 2020). Quantitative methods such as survey questionnaires deal with collecting a large amount of data. Also, the quantitative approach is viewed as scientifically objective and rational as it provides accurate data and significant statistical results that can enhance the quality of the study findings and increase generalisability (Bryman & Bell, 2015).

To evaluate the research model, the authors employed an online survey to collect the necessary data. Using online surveys is becoming increasingly common in business research due to the widespread use of email and social networking sites (Petrovčič et al., 2016). Also, the online survey enabled the researchers to collect large-scale data in relatively short period of time as it offers convenience for respondents. In comparison to other survey methods, the online survey is a systematic, cost-effective and fast way to collect data from the target audience. Furthermore, in the case of the questionnaire used in the present study it is especially useful for administering questions with multiple response formats.

Pre-existing measurement items were utilized to establish the validity and reliability of the model. Existing scales were adapted as necessary to the CBDC context. The study's unit of analysis is the prospective CBDC user. The questionnaire was split into three

sections; in the first section the researchers discussed the research's purpose and context. In the second part, the respondents were instructed to provide their opinions on each of the measuring items, considering the sequence of questions pertaining to the different constructs (Churchill, 2005) and, for the third part, the researchers concluded the questionnaire by asking demographic questions.

In the design of the study model, the researchers utilised three constructs, namely perceived benefits, perceived privacy concerns, and willingness to disclose. In addition, the model includes two subconstructs as dimensions for benefits, namely convenience, ease of use. All items on the questionnaire were adapted from previously validated and published research and measured on a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). For this paper, the perceived benefits construct was viewed as a second-order construct having two dimensions (convenience and ease of use), which are considered as first-order constructs. The items of these dimensions were adapted from research by (Liao & Cheung, 2002) and (Venkatesh, 2000) respectively. Perceived privacy concerns were examined with items adapted from (Wirtz & Lwin, 2009)) and (Son & Kim, 2008) whilst willingness to disclose was examined with items adapted from (Schoenbachler & Gordon, 2002)) and (Zhao et al., 2012). The questionnaire items are detailed in Table 2 below.

Table 2. A summary of the questionnaire items.

Construct	Items	Source
Convivence	**CONV1:** I expect that the CBDC system will allow me to access it at anytime. **CONV2:** I expect that the CBDC system will allow me to access it from anywhere. **CONV3:** I expect that the CBDC system will offer a wide variety of services readily accessible.	(Liao & Cheung, 2002)

Ease of Use	**EoU1:** My interaction with the CBDC system will be clear and understandable. **EoU2:** Interacting with the CBDC system will not require a lot of mental effort. **EoU3:** I expect the CBDC system to be easy to use. **EoU4:** I expect that it will be easy to get the CBDC system to do what I want it to do.	(Venkatesh, 2000)
Privacy Concerns	**PRI1:** I would be concerned about giving information to the CBDC system. **PRI2:** I would be concerned that the information I give to the CBDC system could be misused. **PRI3:** It would bother me if the CBDC system asked me for personal information. **PRI4:** I would be concerned that my personal information provided for CBDC purposes could be misused.	(Wirtz & Lwin, 2009); (Son & Kim, 2008)
Willingness to Disclose	**WILL1:** I am willing to provide my personal information when asked by the CBDC system. **WILL2:** I am willing to disclose even sensitive personal information to the CBDC system. **WILL3:** I am willing to be truthful in revealing my personal information to the CBDC system.	(Schoenbachler & Gordon, 2002); (Zhao et al., 2012)

4.2 Pre-testing the questionnaire

To evaluate the internal consistency of the measurement items the authors employed Cronbach's alpha. This helped the researchers to determine that there was no ambiguity in the questions and the amount of time allotted to complete the questionnaire was sufficient. The size of the sample consisted of 12 participants and values for all constructs exceed 0.70 as shown in Table 3. This indicates that, as mentioned by Tavakol and Dennick (2011), all items measure their respective constructs accurately.

Table 3. Results of the Pilot Study

Construct	Items	Cronbach's alpha

Convenience	3	0.92
Ease of Use	4	0.91
Perceived Privacy Concerns	4	0.89
Willingness to Disclose	3	0.84

4.3 Data collection procedure

To collect the data the researchers employed JISC online surveys. Participants were primarily recruited via email with over one hundred potential participants receiving an email containing a link to the online survey. To increase response rates, the survey's link was posted on the authors' LinkedIn profiles for two weeks to invite more individuals to participate in the study. The targeted population were individuals with an interest in CBDC aged 18 years and older. The potential respondents were briefed about the study beforehand and the aims of the research were made clear and the confidentiality and privacy issues, and the voluntary nature of participation in the survey were highlighted. Table 4 shows the demographic information of the respondents.

Table 4. Participant Profile (n = 125)

Variables	**Range**	**Frequency**	**%**
Gender	Male	69	55.2
	Female	55	44
	Prefer not to respond	1	0.8
Age	18-24	16	12.8
	25-34	41	32.8
	35-44	32	25.6
	45-54	23	18.4
	55-65	8	6.4
	65 or older	5	4
Highest Level of Education	Primary	2	1.6
	Secondary	12	9.6
	Undergraduate degree	62	49.6

	Post-graduate or above	49	39.2
Occupation	Unemployed	2	1.6
	Student	14	11.2
	Private sector	46	36.8
	Government employee	54	43.2
	Retired	3	2.4
	Other	6	4.8

4.4 Data Analysis and Findings

For the data analysis process, the authors analyzed the structural equation modelling (SEM) technique with partial least squares (PLS) and the Smartpls4 software. The PLS-SEM can simultaneously and systematically estimate the measurement and structural model (Hair, Hult, et al., 2017), thus allowing for a certain degree of reliability and validity. This approach also opens up other options when attempting to appraise and validate relationships between constructs. In addition, comparing to covariance-based SEM, PLS-SEM is an effective technique in dealing with small sample sizes and both normally and non-normally distributed data (Hair et al., 2019).

4.4.1 Measurement model

To test the measurement model, a four-phase assessment of the data was conducted. In the first phase, the indicator reliability was assessed by testing the factor loadings of the items on their assigned constructs. The results in Table 5 and figure 2 indicate that these are all above the acceptable level of 0.70 (Hair et al., 2019). In the second phase, the internal consistency reliability was evaluated by assessing Cronbach's alpha and composite reliability (CR). Table 5 also illustrates that all values are above the acceptable threshold of 0.7 (Hair et al., 2019). In the third phase, the convergent reliability of the constructs was examined by assessing the average variance extracted (AVE). As shown in Table 5, all the AVE values are greater than the suggested threshold of 0.5 (Hair, Hult,

et al., 2017).

Table 5. Measurement model results

Construct/Items	Mean	Std. Dev.	Factor Loadings	AVE	Composite Reliability	Cronbach's alpha
Convenience				0.666	0.857	0.749
CONV1	6.168	0.865	0.859			
CONV2	6.292	0.839	0.869			
CONV3	5.648	1.060	0.717			
Ease of Use				0.719	0.911	0.869
EoU1	5.304	1.498	0.860			
EoU2	5.296	1.590	0.882			
EoU3	5.664	1.152	0.848			
EoU4	5.568	1.335	0.800			
Privacy Concerns				0.809	0.944	0.921
PRI1	3.960	1.755	0.892			
PRI2	3.648	1.698	0.885			
PRI3	3.736	1.744	0.903			
PRI4	3.704	1.678	0.917			
Willingness to Disclose				0.761	0.905	0.843
WILL1	5.176	1.187	0.884			
WILL2	4.448	1.572	0.835			
WILL3	5.096	1.394	0.898			

In the fourth and final phase investigated the discriminant was investigated using the HTMT (heterotrait–monotrait ratio) criteria. Table 6 clearly shows that the HTMT ratio for each pair of constructs yielded values less than the 0.90 threshold as proposed by (Henseler et al., 2015). This is an indicator of no discriminant validity issues in the measurement model.

Table 6. Discriminant validity test

Construct	Convenience	Ease of Use	Privacy Concerns	Willingness to Disclose
Convenience				
Ease of Use	0.782			
Privacy Concerns	0.288	0.564		
Willingness to Disclose	0.651	0.769	0.644	

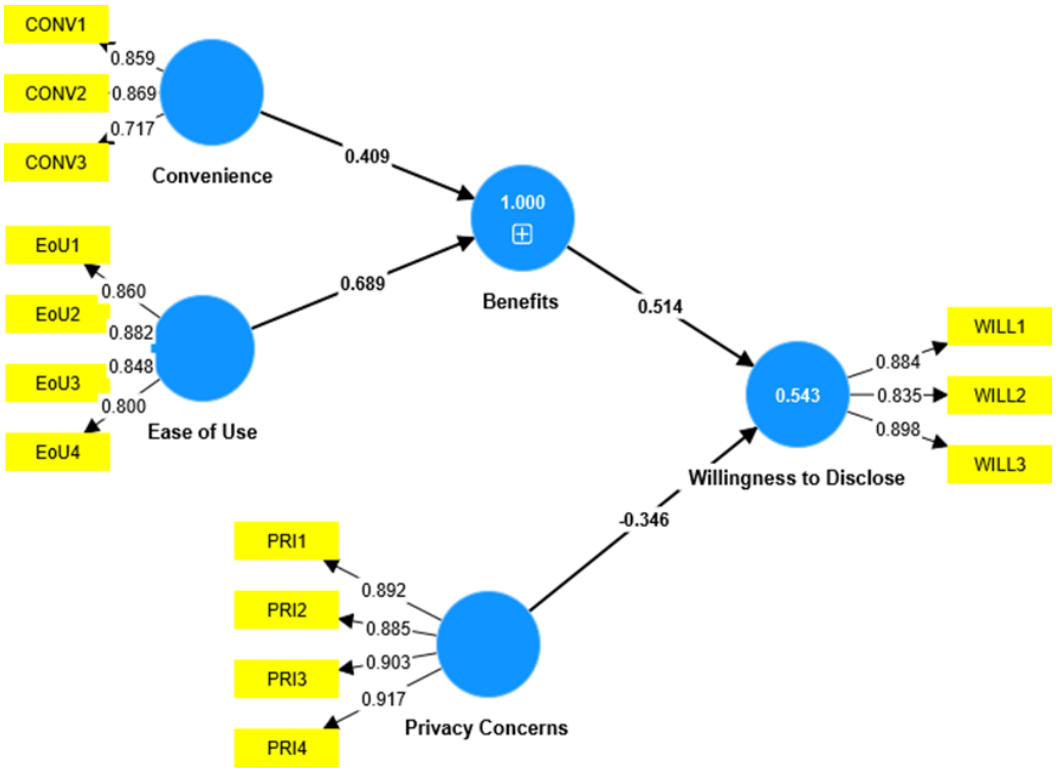

Figure 2 Results of the measurement model analysis

4.4.2 Structural model

The quality of this research's structural model and its associated hypotheses were assessed using the collinearity issues test, path coefficients, coefficient of determination (R2), predictive relevance (Q2) (Hair, Sarstedt, et al., 2017). Table 7 demonstrates that

all VIF values for all constructs are within the range of 1.25 to 2.11 and are below the collinearity test threshold of 5, indicating that there is no indication of multicollinearity issues that could lead to bias in the path coefficients (Hair, Sarstedt, et al., 2017). Table 7 further reveals that the R2 value for the dependent variable (willingness to disclose) in the model is 0.54, indicating that 0.54 of the variances in willingness to disclose is explained by perceived benefits and perceived privacy concerns (Hair et al., 2019). In addition, the willingness to disclose value for Q2 is 0.40. From these results this paper argues that it's proposed model has a high degree of predictive power (Hair, Hult, et al., 2017).

Table 7. Structural model results

Constructs	VIF	R^2	Q^2
Convivence	1.66		
Ease of Use	2.11		
Privacy Concerns	1.37		
Willingness to Disclose	1.25	0.54	0.40

The hypothesized paths in the structural model were analyzed using path coefficients derived from a bootstrapping procedure in SmartPLS employing 5,000 subsamples (Hair, Hult, et al., 2017). The hypotheses test results are displayed in Figure 3 and Table 8. Regarding the dimensions of perceived benefits, the results showed that both convenience and ease of use have significant influences on perceived benefits (β= .409, t = 12.938 and β= .689, t = 20.885 respectively), supporting H1 and H2. In addition, the findings revealed that perceived benefits have a significant positive influence on willingness to disclose (β= 0.514, t = 6.445) whereas perceived privacy concerns has a significant negative influence on willingness to disclose (β= -0.346, t = 3.644), supporting H3 and H4.

The effects of convenience and ease of use on perceived benefits of personal information disclosure via CBDC were also compared to test H5. compared the path coefficients of both relationships were compared and it was found that ease of use has a greater impact on perceived benefits than convenience ($\beta = .689$, $t = 20.885$) > ($\beta = .409$, $t = 12.938$). This result demonstrates that ease of use has a greater impact than convenience on perceived benefits. Hence, H5 was supported.

Table 8. Hypothesis testing results

Hypotheses	**t-value**	**p-value**	**Remarks**
H1 Convenience is positively related to the perceived benefits of personal information disclosure via CBDC.	12.938	<0.001(***)	Supported
H2 Ease of use is positively related to the perceived benefits of personal information disclosure via CBDC.	20.885	<0.001(***)	Supported
H3 Perceived benefits are positively associated with willingness to disclose personal information via CBDC.	6.445	<0.001(***)	Supported
H4 Perceived privacy concerns are negatively associated with the willingness to disclose personal information via CBDC.	3.644	<0.001 (***)	Supported
H5 Ease of use has a greater influence on the perceived benefits of personal information disclosure via CBDC than convenience.	EoU → PB > CONV → PB		Supported

Based on the above data the following framework which shows the clear results of the structural model assessment was created. Fig. 3 brings together the key results of this research and highlights the results of the hypotheses developed earlier in the paper. What is clear from these results is that the dimensions showcased are crucial in CBDC privacy concerns.

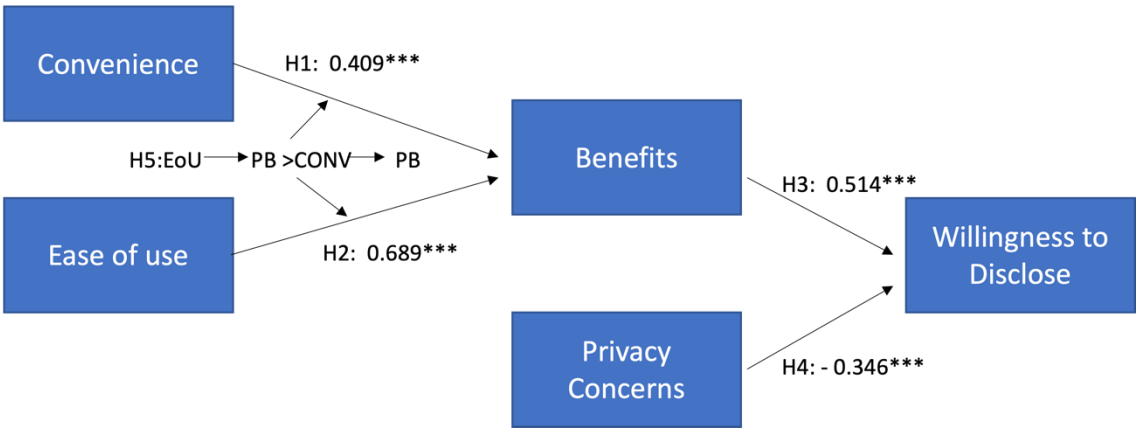

Figure 3. Results of the structural model assessment

Figure 3 brings together the key results of this research and highlights the results of the hypotheses developed earlier in the paper. What is clear from these results is that the dimensions showcased are crucial in CBDC privacy concerns.

5. Discussion and implications

This research aimed to investigate the balance between perceived benefits and the willingness to provide privacy information. To ascertain the factors which influence individuals' willingness to disclose their own personal information the privacy calculus theory was applied in the context of CBDC. The findings suggest that the balance between perceived benefits and the willingness to provide privacy information can be easily skewed based on several factors. This work through the privacy calculus theory differs significantly from previous privacy studies such as the digital euro in Germany (Tronnier et al., 2022), money, privacy and anonymity (Borgonovo et al., 2021) and entrepreneurial directions (Gutierrez et al., 2019). This study's analysis finds that perceived benefits is a significant motivator in the disclosure of personal information for CBDC usage. This finding differs from the work Borgonovo et al. (2021) who in their research argue that anonymity is a key component in privacy discussion. This paper's findings tend to support

the work of Tronnier et al. (2022) in so far as that adoption of CBDC will require a significant brand such as the bank of England and it must be easy to use. However, the role of convenience at this point can also not be underestimated. While there is a demand for credibility and ease of use, any such implementation of CBDC must take into account convenience as a key benefit in its adoption. Any new implementation of a payment system must be accessible and become quickly embedded as a lifestyle choice.

While most of the research discusses the blockchain as a technical marvel, using Bitcoin (a payment method that sits on the blockchain) is difficult with poor uptake and is highly inconvenient to use with high fees (Aysan et al., 2020). Thus, for CBDC to move past these negative stereotypes, convenience and ease of use are critical. While the blockchain is known for its high privacy features, there is the perception that in many cases blockchain payments are made for illicit activities (Yu et al., 2019). To combat this the analysis of the research finds that, for any CBDC to succeed, convenience is an important dimension of individuals' perceptions of the benefits that they can gain in exchange for disclosing their personal data via the CBDC system. Thus, the results of this research indicate that the higher the levels of convenience the more likely it is that consumers will disclose their personal information. Additional results from our data indicate that the convenience benefits of the CBDC system are closely linked to the customer perceptions of the system's availability and the variety of trustworthy services available. As part of this it was found that ease of use demonstrated a positive and statistically significant correlation with perceived benefits of personal information disclosure via CBDC. This finding is aligned with other studies that found easy to use systems influence the opinions of users in relation to their attitudes and behavior in various information technology settings (Ozturk et al., 2016; Venkatesh, 2000). This

analysis also indicates that ease of use is the most salient element of the overall benefits perceptions in the CBDC context.

5.1 Implications

Through their research and analysis, the authors identify several managerial and policy implications which can provide adoption challenges and act as key factors for success. The literature review illustrated that blockchain technology and the proliferation of cryptocurrency has created significant interest in the narrative around digital cash and online payments. This interest provides implications for marketing departments, tactical strategy, and policy implications. For managers making strategic decisions which look at CBDC implementation holistically is imperative in building trust and a clear credible CBDC proposition. Additional implications also include thinking of and developing a clear unique proposition strategy (UPS). From a managerial tactical perspective this should allow central banks to form strategic value propositions for potential adopters of CBDC. From a policy perspective there is potential to create a regulatory framework which governs the use of privacy data in the development of organizational strategy. Considering that individuals are willing to incur a degree of risk in exchange for benefits, central banks should make additional efforts to promote and distinguish these benefits through effective marketing strategies. Therefore, as discussed by Tronnier et al. (2022), one of the key implications is to create a strong and credible brand which creates a natural home for tentative users of CBDC. As part of these marketing strategies, central banks should incentivize individuals to share personal information for fast, reliable, and resilient services like current Fintech banks.

From a regulatory perspective there is also the implication that CBDCs need to be financially stable. This stability stems from system design, network infrastructure and how quickly people adopt this technology. Thus, from an ease of use perspective, and in

the development of systems and features, it is imperative that CBDCs are scalable, convenient, and easy to implement. It was found that ease of use has a bigger impact than convenience when investigating perceived benefits. This finding is important on several levels and can provide banks and CBDC organizations with a clear competitive advantage in this area. Thus, as part of this contribution it is argued that when initially developing CBDC technology the focus needs to be on ease of use to build trust between customers and the institution. From a policy perspective this would require comprehensive legal and governance frameworks alongside strong data privacy. This trust then forms the basis of a relationship to minimize any privacy issues. In addition to this, software design which considers the importance of making products that are easy to use and consume can also be the source of cost savings and efficient service provision. This dimension, if implemented correctly, can reduce the resources required in customer services and the provision of the service, creating seamless, trustworthy trades.

6. Conclusions

In conclusion during the conduct of the study the researchers' key contribution could be viewed as a double-edged sword from potential users' perspectives. Their proposed model provides a unique perspective on privacy disclosure within a CBDC context. The other key contribution identifies the balance between perceived benefits and privacy release. In the development of these contributions the results suggest that participants in the study had negative perceptions in relation to the disclosure of personal information. This is a relatively recent technology and while there are significant benefits in terms of ease of use and convenience there is naturally a healthy dose of skepticism and trepidation. This was, to a large extent, offset by the benefits mentioned such as availability, ease of use, convenience, credibility, and a variety of fast and reliable

services which outweigh the privacy concerns. Thus, while most individuals tend to view CBDC use as beneficial the findings of this study indicate that the provision of helpful services is a crucial element in the creation of value in CBDC.

In addition to this the key factors that impact user willingness to provide privacy information in the adoption of CBDC technology was investigated. Using the privacy calculus theory, the impact of perceived benefits on willingness to disclose personal information was examined. The data suggests that perceived benefits play a significant role in motivating consumers to disclose their personal information. To develop this paper, a theoretical model that explains the importance of willingness to disclose personal information through the CBDC system was developed and proposed. The analysis of the collected data verifies that the proposed the research model demonstrated good explanatory power and can be used as a foundation for future research in this new research area.

However, this study is subject to several limitations, and we identify multiple future research areas. As part of this study, the authors initially looked at multiple dimensions to help shape and develop this work. To help structure the research on how perceived benefits are associated with personal information disclosure, two key dimensions were predominantly investigated, namely convenience and ease of use. Thus, while this approach to investigation may be suitable when developing the initial research phase, as the technological approach gains traction and widespread adoption there is scope for researchers to expand their research aims to include investigation of perceived benefits to include other factors such as usefulness and service quality.

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This research also presents the view that privacy is a very scarcely researched area in CBDC adoption so there is scope to look at developing the proposed model which also looks at privacy concerns as a main independent variable. Through the development of this model, the authors were aware that there is significant scope to investigate government legislation and regulatory frameworks. Future research should consider expanding on these factors to structure privacy risks and how they are associated with personal information disclosure from a multiple stakeholder perspective. One area in which there is future promise is the discussion and research around information sensitivity, security, and cyber security resilience.

References

Adrian, T., & Mancini-Griffoli, T. (2021). The rise of digital money. *Annual Review of Financial Economics, 13*, 57-77.

Agur, I., Ari, A., & Dell'Ariccia, G. (2022). Designing central bank digital currencies. *Journal of Monetary Economics, 125*, 62-79. https://doi.org/10.1016/j.jmoneco.2021.05.002

Ahnert, T. H., Peter; Monnet, Cyril. (2022). The Digital Economy, Privacy, and CBD, European Central Bank. *ECB Working Paper No. 2022/2662*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4109696

Allen, F., Gu, X., & Jagtiani, J. (2022). Fintech, Cryptocurrencies, and CBDC: Financial Structural Transformation in China. *Journal of International Money and Finance, 124*. https://doi.org/10.1016/j.jimonfin.2022.102625

Attié, E., & Meyer-Waarden, L. (2022). The acceptance and usage of smart connected objects according to adoption stages: an enhanced technology acceptance model integrating the diffusion of innovation, uses and gratification and privacy calculus theories. *Technological Forecasting & Social Change, 176*. https://doi.org/10.1016/j.techfore.2022.121485

Auer, R., & Böhme, R. (2020). The technology of retail central bank digital currency *BIS Quarterly Review* 85-100. https://go.exlibris.link/G43QwWyf

Aysan, A. F., Sadriu, B., & Topuz, H. (2020). Blockchain futures in cryptocurrencies, trade and finance: A preliminary assessment. *Buletin Ekonomi Moneter dan Perbankan, 23*(4), 525-541. https://doi.org/10.21098/BEMP.V23I4.1240

Bank of England. (2020). *Central Bank Digital Currency: opportunities, challenges and design*. https://www.bankofengland.co.uk/paper/2020/central-bank-digital-currency-opportunities-challenges-and-design-discussion-paper

Barth, S., & De Jong, M. D. (2017). The privacy paradox–Investigating discrepancies between expressed privacy concerns and actual online behavior–A systematic literature review. *Telematics and informatics, 34*(7), 1038-1058.

Bhaskar, R., Hunjra, A. I., Bansal, S., & Pandey, D. K. (2022). Central Bank Digital Currencies: Agendas For Future Research. *Research in International Business and Finance, 62*. https://doi.org/10.1016/j.ribaf.2022.101737

Bian, W., Ji, Y., & Wang, P. (2021). The crowding-out effect of central bank digital currencies: A simple and generalizable payment portfolio model. *Finance Research Letters, 43*. https://doi.org/10.1016/j.frl.2021.102010

Bilotta, N., & Botti, F. (2021). *The (Near) Future of Central Bank Digital Currencies*. Peter Lang International Academic Publishing Group. https://doi.org/10.3726/b18087

Borgonovo, E., Caselli, S., Cillo, A., Masciandaro, D., & Rabitti, G. (2021). Money, privacy, anonymity: What do experiments tell us? *Journal of Financial Stability, 56*. https://doi.org/10.1016/j.jfs.2021.100934

Bryman, A., & Bell, E. (2015). *Business research methods* (Fourth ed.). Oxford University Press.

Caffaro, F., Micheletti Cremasco, M., Roccato, M., & Cavallo, E. (2020). Drivers of farmers' intention to adopt technological innovations in Italy: The role of information sources, perceived usefulness, and perceived ease of use. *Journal of rural studies, 76*, 264-271. https://doi.org/10.1016/j.jrurstud.2020.04.028

Castrén, O., Kavonius, I. K., & Rancan, M. (2022). Digital currencies in financial networks. *Journal of Financial Stability, 60*. https://doi.org/10.1016/j.jfs.2022.101000

Chen, H., & Siklos, P. L. (2022). Central bank digital currency: A review and some macro-financial implications. *Journal of Financial Stability*, *60*. https://doi.org/10.1016/j.jfs.2022.100985

Chen, R. (2013). Member use of social networking sites - An empirical examination. *Decision Support Systems*, *54*(3), 1219-1227. https://doi.org/10.1016/j.dss.2012.10.028

Cheng, P. (2022). Decoding the rise of Central Bank Digital Currency in China: designs, problems, and prospects. *Journal of Banking Regulation*. https://doi.org/10.1057/s41261-022-00193-5

Churchill, G. A. (2005). *Marketing research : methodological foundations* (9th ed. / Gilbert A. Churchill, Jr., Dawn Iacobucci.. ed.). Mason, Ohio : South-Western.

Cullen, J. (2021). "Economically inefficient and legally untenable": constitutional limitations on the introduction of central bank digital currencies in the EU. *Journal of Banking Regulation*, *23*(1), 31-41. https://doi.org/10.1057/s41261-021-00162-4

Culnan, M. J., & Armstrong, P. K. (1999). Information Privacy Concerns, Procedural Fairness, and Impersonal Trust: An Empirical Investigation. *Organization science (Providence, R.I.)*, *10*(1), 104-115. https://doi.org/10.1287/orsc.10.1.104

Davoodalhosseini, S. M. (2022). Central bank digital currency and monetary policy. *Journal of Economic Dynamics and Control*, *142*, 104150.

Devine, A., Jabbar, A., Kimmitt, J., & Apostolidis, C. (2021). Technological Forecasting & Social Change Conceptualising a social business blockchain : The coexistence of social and economic logics. *Technological Forecasting & Social Change*, *172*(June), 120997-120997. https://doi.org/10.1016/j.techfore.2021.120997

Dinev, T., & Hart, P. (2006). An Extended Privacy Calculus Model for E-Commerce Transactions. *Information systems research*, *17*(1), 61-80. https://doi.org/10.1287/isre.1060.0080

Ding, S., Cui, T., Wu, X., & Du, M. (2022). Supply chain management based on volatility clustering: The effect of CBDC volatility. *Research in International Business and Finance*, *62*. https://doi.org/10.1016/j.ribaf.2022.101690

Drummer, D., & Neumann, D. (2020). Is code law? Current legal and technical adoption issues and remedies for blockchain-enabled smart contracts. *Journal of information technology*, *35*(4), 337-360. https://doi.org/10.1177/0268396220924669

Elsayed, A. H., & Nasir, M. A. (2022). Central bank digital currencies: An agenda for future research. *Research in International Business and Finance*, *62*. https://doi.org/10.1016/j.ribaf.2022.101736

Ferrari Minesso, M., Mehl, A., & Stracca, L. (2022). Central bank digital currency in an open economy. *Journal of Monetary Economics*, *127*, 54-68. https://doi.org/10.1016/j.jmoneco.2022.02.001

Geebren, A., & Jabbar, A. (2021). Factors That Influence Customer Trust and Satisfaction in Mobile Banking: A Problematization Approach. *International Journal of E-Business Research (IJEBR)*, *17*(3), 66-82.

Geebren, A., Jabbar, A., & Luo, M. (2021). Examining the role of consumer satisfaction within mobile eco-systems: Evidence from mobile banking services. *Computers in human behavior*, *114*, 106584. https://doi.org/10.1016/j.chb.2020.106584

Ghauri, P., Grønhaug, K., & Strange, R. (2020). *Research methods in business studies*. Cambridge University Press.

Gutierrez, A., O'Leary, S., Rana, N. P., Dwivedi, Y. K., & Calle, T. (2019). Using privacy calculus theory to explore entrepreneurial directions in mobile location-based advertising: Identifying intrusiveness as the critical risk factor. *Computers in human behavior*, *95*, 295-306. https://doi.org/10.1016/j.chb.2018.09.015

Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage publications.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2-24. https://doi.org/10.1108/EBR-11-2018-0203

Hair, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. (2017). *Advanced issues in partial least squares structural equation modeling*. SAGE.

Hegedűs, P. (2019). Towards Analyzing the Complexity Landscape of Solidity Based Ethereum Smart Contracts. *Technologies (Basel)*, *7*(1), 6. https://doi.org/10.3390/technologies7010006

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115-135. https://doi.org/10.1007/s11747-014-0403-8

Jabbar, A., Akhtar, P., & Dani, S. (2020). Real-time big data processing for instantaneous marketing decisions: A problematization approach. *Industrial marketing management*, *90*, 558-569. https://doi.org/10.1016/j.indmarman.2019.09.001

Jabbar, A., & Dani, S. (2020). Investigating the link between transaction and computational costs in a blockchain environment. *International Journal of Production Research*, *58*(11), 3423-3436. https://doi.org/10.1080/00207543.2020.1754487

Johnson, V. L., Kiser, A., Washington, R., & Torres, R. (2018). Limitations to the rapid adoption of M-payment services: Understanding the impact of privacy risk on M-Payment services. *Computers in human behavior*, *79*, 111-122. https://doi.org/10.1016/j.chb.2017.10.035

Kehr, F., Kowatsch, T., Wentzel, D., & Fleisch, E. (2015). Blissfully ignorant: the effects of general privacy concerns, general institutional trust, and affect in the privacy calculus. *Information Systems Journal*, *25*(6), 607-635.

Keister, T., & Monnet, C. (2022). Central bank digital currency: Stability and information. *Journal of Economic Dynamics and Control*, *142*, 104501.

Kim, D., Park, K., Park, Y., & Ahn, J.-H. (2019). Willingness to provide personal information: Perspective of privacy calculus in IoT services. *Computers in human behavior*, *92*, 273-281. https://doi.org/10.1016/j.chb.2018.11.022

Kshetri, N., & Loukoianova, E. (2022). Data Privacy Considerations for Central Bank Digital Currencies in Asia–Pacific Countries. *Computer*, *55*(03), 95-100.

Kucukusta, D., Law, R., Besbes, A., & Legohérel, P. (2015). Re-examining perceived usefulness and ease of use in online booking: The case of Hong Kong online users. *International journal of contemporary hospitality management*, *27*(2), 185-198. https://doi.org/10.1108/IJCHM-09-2013-0413

Kyriazis, N., Papadamou, S., & Corbet, S. (2020). A systematic review of the bubble dynamics of cryptocurrency prices. *Research in International Business and Finance*, *54*, 101254. https://doi.org/10.1016/j.ribaf.2020.101254

Laboure, M., H.-P. Müller, M., Heinz, G., Singh, S., & Köhling, S. (2021). Cryptocurrencies and CBDC: The Route Ahead. *Global policy*, *12*(5), 663-676. https://doi.org/10.1111/1758-5899.13017

Laboure, M., H.-P. Müller, M., Heinz, G., Singh, S., & Köhling, S. (2021). Cryptocurrencies and CBDC: The Route Ahead. *Global policy*, *12*(5), 663-676. https://doi.org/10.1111/1758-5899.13017

Liao, Z., & Cheung, M. T. (2002). Internet-based e-banking and consumer attitudes: an empirical study. *Information & management*, *39*(4), 283-295. https://doi.org/10.1016/S0378-7206(01)00097-0

Ma, X., Qin, Y., Chen, Z., & Cho, H. (2021). Perceived ephemerality, privacy calculus, and the privacy settings of an ephemeral social media site. *Computers in human behavior*, *124*, 106928. https://doi.org/10.1016/j.chb.2021.106928

Mombeuil, C., & Uhde, H. (2021). Relative convenience, relative advantage, perceived security, perceived privacy, and continuous use intention of China's WeChat Pay: A mixed-method two-phase design study. *Journal of retailing and consumer services*, *59*. https://doi.org/10.1016/j.jretconser.2020.102384

Morgan, J. (2022). Systemic stablecoin and the defensive case for Central Bank Digital Currency: A critique of the Bank of England's framing. *Research in International Business and Finance*, *62*. https://doi.org/10.1016/j.ribaf.2022.101716

Ozturk, A. B., Bilgihan, A., Nusair, K., & Okumus, F. (2016). What keeps the mobile hotel booking users loyal? Investigating the roles of self-efficacy, compatibility, perceived ease of use, and perceived convenience. *International Journal of Information Management*, *36*(6), 1350-1359.

Pelagidis, T., & Kostika, E. (2022). Investigating the role of central banks in the interconnection between financial markets and cryptoassets. *Economia e politica industriale*, *49*(3), 481-507. https://doi.org/10.1007/s40812-022-00227-z

Petrovčič, A., Petrič, G., & Manfreda, K. L. (2016). The effect of email invitation elements on response rate in a web survey within an online community. *Computers in human behavior*, *56*, 320-329.

Prokofieva, M., & Miah, S. J. (2019). Blockchain in healthcare. *Australasian Journal of Information Systems*, *23*, 1-22. https://doi.org/10.3127/ajis.v23i0.2203

Raddatz, N., Coyne, J., Menard, P., & Crossler, R. E. (2021). Becoming a blockchain user: understanding consumers' benefits realisation to use blockchain-based applications. *European Journal of Information Systems*, 1-28.

Renwick, R., & Gleasure, R. (2021). Those who control the code control the rules: How different perspectives of privacy are being written into the code of blockchain systems. *Journal of information technology*, *36*(1), 16-38. https://doi.org/10.1177/0268396220944406

Scharnowski, S. (2022). Central bank speeches and digital currency competition. *Finance Research Letters*, *49*. https://doi.org/10.1016/j.frl.2022.103072

Schoenbachler, D. D., & Gordon, G. L. (2002). Trust and customer willingness to provide information in database-driven relationship marketing. *Journal of interactive marketing*, *16*(3), 2-16. https://doi.org/10.1002/dir.10033

Shibchurn, J., & Yan, X. (2015). Information disclosure on social networking sites: An intrinsic–extrinsic motivation perspective. *Computers in human behavior*, *44*, 103-117. https://doi.org/10.1016/j.chb.2014.10.059

Son, J.-Y., & Kim, S. S. (2008). Internet Users' Information Privacy-Protective Responses: A Taxonomy and a Nomological Model. *MIS quarterly*, *32*(3), 503-529. https://doi.org/10.2307/25148854

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International journal of medical education*, *2*, 53.

Tronnier, F., Harborth, D., & Hamm, P. (2022). Investigating privacy concerns and trust in the digital Euro in Germany. *Electronic Commerce Research and Applications*, *53*. https://doi.org/10.1016/j.elerap.2022.101158

Unnava, V., & Aravindakshan, A. (2021). How does consumer engagement evolve when brands post across multiple social media? *Journal of the Academy of Marketing Science*, *49*(5), 864-881.

van Oordt, M. R. C. (2022). Discussion of "Central bank digital currency: Stability and information". *Journal of economic dynamics & control*, *142*. https://doi.org/10.1016/j.jedc.2022.104503

Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information systems research*, *11*(4), 342-365.

Vimalkumar, M., Sharma, S. K., Singh, J. B., & Dwivedi, Y. K. (2021). 'Okay google, what about my privacy?': User's privacy perceptions and acceptance of voice based digital assistants. *Computers in human behavior*, *120*, 106763.

Wang, Y., Lucey, B. M., Vigne, S. A., & Yarovaya, L. (2022). The Effects of Central Bank Digital Currencies News on Financial Markets. *Technological Forecasting and Social Change*, *180*. https://doi.org/10.1016/j.techfore.2022.121715

Wilkins, C. A. (2022). Discussion of "designing central bank digital currency" by Agur, Ari and Dell'Ariccia. *Journal of Monetary Economics*, *125*, 80-84. https://doi.org/10.1016/j.jmoneco.2021.09.009

Williamson, S. D. (2021). Central bank digital currency and flight to safety. *Journal of Economic Dynamics and Control*. https://doi.org/10.1016/j.jedc.2021.104146

Wirtz, J., & Lwin, M. O. (2009). Regulatory Focus Theory, Trust, and Privacy Concern. *Journal of service research : JSR*, *12*(2), 190-207. https://doi.org/10.1177/1094670509335772

Yang, Q., Gong, X., Zhang, K. Z. K., Liu, H., & Lee, M. K. O. (2020). Self-disclosure in mobile payment applications: Common and differential effects of personal and proxy control enhancing mechanisms. *International Journal of Information Management*, *52*, 102065-102020. https://doi.org/10.1016/j.ijinfomgt.2019.102065

Yu, J. H., Kang, J., & Park, S. (2019). Information availability and return volatility in the bitcoin Market: Analyzing differences of user opinion and interest. *Information Processing and Management*, *56*(3), 721-732. https://doi.org/10.1016/j.ipm.2018.12.002

Zhang, T. (2022). Impacts of Digital Currency Electronic Payment (DCEP) on China's Banking System. *Proceedings of the 2021 3rd International Conference on Economic Management and Cultural Industry (ICEMCI 2021)*, *203*(Icemci), 3242-3246. https://doi.org/10.2991/assehr.k.211209.529

Zhao, L., Lu, Y., & Gupta, S. (2012). Disclosure intention of location-related information in location-based social network services. *International Journal of Electronic Commerce*, *16*(4), 53-90.