Consumer Perceptions and Willingness to Adopt rCBDCs Before and After the e-HKD Pilot[*]

Marc Dordal i Carreras[†]   Kohei Kawaguchi[‡]   Si Yuan Jin[§]
Haicheng Guo[¶]

This version: May 16, 2024

Abstract

This study investigates the public's perception of retail central bank digital currency (rCBDC) and identifies the factors influencing its adoption. Conducted in collaboration with a prominent bank in Hong Kong, this research involved a hands-on experience with a prototype payment system making using of an e-HKD, being an rCBDC which could be implemented in Hong Kong. Participants' opinions on rCBDCs were assessed through surveys conducted before and after their engagement with the e-HKD pilot. Initially, participants displayed a broadly positive attitude towards rCBDC, although no single factor emerged as a decisive influence on their adoption decision. However, the pilot experience statistically significantly altered perceptions, particularly regarding security, ease of payment, and promotional functions, thereby impacting their willingness to adopt rCBDC. This study underscores the importance of understanding consumer perceptions and suggests that these perceptions are subject to change through exposure to regulatory information campaigns, prototype experiences, and initial models. Consequently, the study recommends a cautious approach to interpreting the reliability of existing survey findings in this domain.

Keywords: Central Bank Digital Currency, rCBDC, Consumer Perceptions, Digital Currency Adoption, Payment Methods, Financial Technology.

JEL codes: E41, E42.

1 Introduction

Gauging public perceptions of Central Bank Digital Currencies (CBDCs) is vital for policy-makers to effectively design and implement these new digital currencies. While extensive research Agur et al. (2022); Williamson (2022); Chiu et al. (2023) has focused on the adoption models of CBDCs, the nuanced understanding of how the public perceives various aspects of retail CBDCs (rCBDCs)[1] and how these perceptions influence adoption decisions is less explored. It is crucial to understand how rCBDCs differ from existing payment methods to assess their competitive impact. Additionally, the influence of direct experience with an rCBDC on survey responses warrants careful consideration. Given that rCBDCs are currently theoretical, consumers may lack a tangible understanding of them. Therefore, surveying consumers' present perceptions without practical exposure may not yield accurate predictions of their future attitudes.

This study seeks to address the following questions: (1) What are participants' general perceptions towards an rCBDC? (2) Which specific features of rCBDC are influential in shaping these perceptions? (3) Does the hands-on experience of the rCBDC prototype modify these perceptions? (4) If so, does such experience influence individuals' willingness to adopt rCBDCs?

Our pre-pilot survey conducted on the campus of The Hong Kong University of Science and Technology (HKUST) reveals a predominantly positive perception of the general concept of rCBDCs among respondents. However, it is noteworthy that prior to direct interaction with the pilot's prototype rCBDC, no particular characteristic was found to statistically significantly impact the adoption choices of the participants. Turning into participant heterogeneity, individuals reluctant to disclose residential information exhibit lower adoption rates of rCBDC, suggesting privacy concerns. In contrast, participants from Mainland China and other Asian regions are more willing to adopt rCBDCs than those from the Hong Kong SAR, indicating cultural and regional influences.

To examine the potential for modifying perceptions through experience, we collaborated with the Hongkong and Shanghai Banking Corporation Limited (HSBC) and introduced a prototype of e-HKD, a rCBDC that could be potentially implemented in Hong Kong, and enabled students and staff to use them for actual transactions with selected campus merchants. We evaluated the changes in perception and adoption decisions post-pilot. Our results demonstrate a statistically significant shift in participant perceptions, particularly

---

[1]CBDCs are categorized into two primary types: retail and wholesale. Retail CBDCs are designed for public use, enabling individuals and businesses to conduct daily transactions digitally, thereby mirroring the functions of physical cash. In contrast, wholesale CBDCs are tailored for financial institutions engaged in high-value transactions, such as interbank transfers and securities settlements. While retail CBDCs aim to enhance the efficiency and inclusivity of the payment system for the general population, wholesale CBDCs focus on improving the operational efficiency and security of financial transactions within the banking sector.

regarding transaction rewards and ease of history retrieval. After accounting for individual fixed effects and survey-round fixed effects, our analysis indicates that changes in factors such as security, ease of payment, and promotional functions substantially influence willingness to adopt.

In the context of CBDC adoption, scholars surveyed public attitudes towards the introduction of CBDC in different regions such as the Netherlands Bijlsma et al. (2021), Austria Abramova et al. (2022), and India Sandhu et al. (2023). Their collective findings underscore the need for CBDC designs to be empirically grounded and tailored to the specific needs and preferences of the populations. Similarly, our study adopts a user-centric approach, investigating consumers' specific perceptions of payment methods that influence adoption decisions. However, in response to the call for exploring CBDC designs empirically Abramova et al. (2022), we introduced a prototype of rCBDC and the hands-on experience can shift perception and adoption decisions. Our data on taste and perception provides new insights into not only whether individuals would use a rCBDC, but also why and under what conditions they would do so. By evaluating the impact of the pilot on perceptions, we demonstrate how a user's experience can shift perceptions and adoption willingness. These detailed insights into user-reported factors driving adoption can guide the practical development and rollout plan of CBDCs to promote their uptake. More broadly, this experiment's results can also contribute to our understanding of demand, challenges, and potential solutions for adopting new digital currencies in the retail sector.

2 Study Design

In the context of the Hong Kong Monetary Authority's (HKMA) e-HKD Pilot Programme Phase I intended to explore the commercial viability of potential use cases for an rCBDC, Hong Kong Monetary Authority (2023),[2] our study involved a pilot test of a prototype rCBDC payment system for real transactions on campus. The project was executed in partnership with HSBC[3] and supported by the HKMA through the programme. The workflow of the pilot

---

[2]In 2021, the HKMA initiated Project e-HKD, marking the commencement of its journey towards the potential introduction of a rCBDC in Hong Kong, commonly referred to as the e-HKD. This project follows a three-rail approach designed to facilitate the potential implementation of the rCBDC.In November 2022, as a critical component of this strategy, the HKMA inaugurated the Phase I of the e-HKD Pilot Programme. This programme represents a collaborative effort between the HKMA and various industry stakeholders, aiming to investigate and assess the commercial feasibility of numerous applications for the e-HKD. The first phase of the programme concentrated on examining a broad spectrum of domestic and retail applications, categorized into six distinct areas: comprehensive payment solutions, programmable payments, offline payment capabilities, tokenized deposit systems, settlement mechanisms for Web3 transactions, and the settlement of tokenized assets. This phase saw the involvement of 16 select firms, spanning the financial, payment, and technology sectors. For further details on the e-HKD Pilot Programme, please refer to the HKMA's official website: `https://www.hkma.gov.hk/eng/news-and-media/press-releases/2023/10/20231030-3`.

[3]We extend our gratitude to HSBC for their provision of the essential hardware and software infrastructure, as well as technical support, that facilitated the execution of this pilot.

is depicted in Figure 1. The Secretariat of Human and Artefacts Research Ethics Committee of HKUST approved the study under protocol number HREP-2023-0213 in conformity with the Declaration of Helsinki principles. Recruitment of participants from our Business School was conducted via email campaigns and posted notices. The following criteria were established for participant eligibility: (1) Participants must have been at least eighteen years of age and hold valid identification. (2) They should have been actively enrolled or employed at the HKUST. (3) Physical presence on the HKUST campus was required for the trial's duration. (4) A compatible mobile device running Android or iOS was necessary.[4]

2.1 Hypothetical e-HKD Pilot

The pilot study was conducted from September 16th to September 22nd, 2023, and entailed participant registration for an e-HKD digital wallet, devised and maintained by HSBC.[5] This wallet was initially credited with a balance of one hundred hypothetical e-HKD tokens, and provided free of charge to the group of eligible participants.[6] Participants had the opportunity to use this digital currency for transactions at five pre-determined merchants on the HKUST campus. The study included two promotional days, during which participants received varying e-HKD cashback rewards from merchants for their first two eligible transactions (details on the cashback reward structure are provided in Appendix B). The e-HKD wallets and the digital currency were subject to specific constraints:[7] (1) The e-wallets did not permit additional top-ups or cash-outs. (2) e-HKD tokens were non-transferable among students and staff participants nor outside the e-HKD system.[8] (3) Any remaining e-HKD balance was unusable and could not otherwise be cashed out at the end of the pilot.

After the pilot, participants were invited to fill out a voluntary survey to provide feedback on their experience and perspectives regarding the hypothetical e-HKD. To incentivize participation, those who successfully completed the post-pilot survey received a fifty fiat HKD e-Gift voucher, redeemable at a major Hong Kong retail chain.

The pilot targeted a maximum sample size of two hundred participants. In the initial stage of the pilot, 329 individuals expressed interest in participating, comprising 274 students and

---

[4]The minimum Operating System (OS) requirements for the mobile devices were Android OS 10 or above, or iOS 16 or above. Devices operating on alternatives, such as Huawei's HarmonyOS, or outdated OS were excluded due to their incompatibility with the e-HKD digital wallet mobile app used in the Pilot.

[5]The digital wallet is formally referred to the 'HSBC Open Wallet App' in the communications with pilot participants and the presentation slides on SI Section S3.

[6]These e-HKD tokens held an equivalent purchasing power to one hundred Hong Kong Dollars (HKD) at selected campus merchants.

[7]These restrictions were outlined to participants during the information sessions and pre-pilot communications.

[8]During the initial phase of the pilot program, tokens were transferable between HSBC wallets and customer wallets, primarily for the purpose of token distribution. Subsequently, throughout the pilot's duration, the transferability of tokens extended to transactions between customer and merchant wallets. At the conclusion of the pilot, the tokens were transferable between merchant wallets and HSBC settlement wallets.
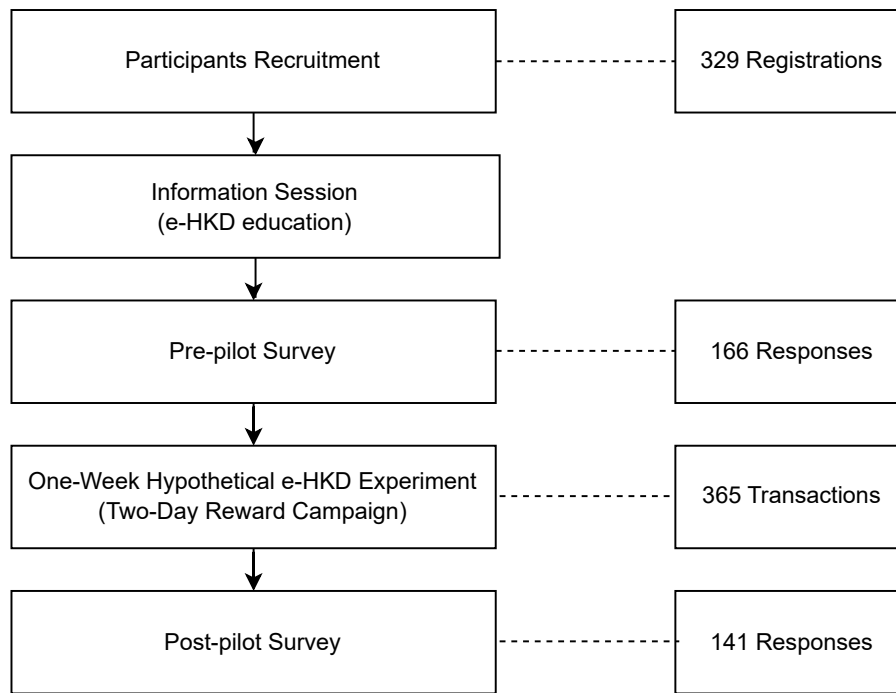
Figure 1: Pilot workflow.

55 staff members. From this group, we randomly selected two hundred individuals to invite to various educational information sessions. We implemented a rolling recruitment strategy, inviting new participants if initial invitees failed to register by a predefined deadline or attend their scheduled session. Additionally, we accommodated walk-in participants when space permitted. In total, 166 individuals attended the information sessions and completed the pre-pilot survey. The pilot recorded 365 transactions, with 149 participants registering an e-HKD digital wallet and 141 engaging in at least one transaction. At the conclusion of the pilot, we gathered survey responses from 141 participants. Online Appendix Table A.1 provides demographic details of these participants, alongside benchmark data from the overall Hong Kong population for comparative purposes. It is important to acknowledge that our sample, consisting of students and staff, is not representative of the broader Hong Kong population.

2.2 e-HKD Educational Information Session

Participants selected for the study were required to sign up for and attend one of several educational information sessions offered two weeks prior to the pilot's commencement. The purpose of these sessions was twofold: firstly, to impart knowledge about rCBDCs and their hypothetical principal attributes; secondly, to satisfy the informed consent prerequisites of the pilot study by providing a comprehensive briefing on the study's objectives, methodology, anticipated advantages and risks, and instruction in the utilization of the pilot's mobile app interface and e-HKD digital wallet.

The educational content of our sessions, detailed in the SI Section S3, systematically covers various aspects of CBDCs in general. The presentation is organized into distinct segments:

- **What are CBDCs?:** This segment offers a detailed overview of CBDCs as digital currencies issued by central banks. It introduces retail CBDCs (rCBDCs) as a new type of digital central bank money, accessible to the general public. The discussion compares rCBDCs with traditional central bank forms, such as coins, notes, and electronic reserves used by financial institutions. The segment also contrasts rCBDCs with commercial bank money, like bank deposits, focusing on differences in liability and credit risk. It clarifies that, unlike commercial bank money, rCBDCs, similar to coins and notes, are central bank liabilities and carry the same level of guarantee Ozili (2023).

- **Benefits of CBDCs - Liquidity and Accessibility:** This section examines the role of CBDCs in improving liquidity and financial accessibility. It emphasizes the real-time processing and settlement capabilities of rCBDCs, their potential to lower transaction costs, and facilitate cross-border transactions, particularly between Hong Kong and the Greater Bay Area.[9] The ease of payment, mirroring existing methods, is highlighted, along with its cost-effectiveness for merchants in terms of operational costs and potential savings.

- **Benefits of CBDCs - Traceability and Security:** This segment addresses the traceability and security advantages of CBDCs. It focuses on their potential use of Distributed Ledger Technologies (DLTs) like blockchains, which enhance the security and immutability of transaction data. The immutable nature of blockchain transactions strengthens protection against unauthorized changes. Additionally, the transparent nature of blockchain aids in auditing, enhancing transparency and aiding in Anti-Money Laundering (AML) efforts. The segment also discusses data privacy in the CBDC environment, ensuring compliance with existing data protection laws.

- **Benefits of CBDCs - Programmability:** This part explores the potential programmable nature of CBDCs, demonstrating how they can foster innovative financial services and applications through smart contracts. Various use cases are presented, including loyalty programs, targeted distribution of government subsidies, fraud prevention in cash-on-delivery transactions, efficient aid distribution, and the creation of complex financial instruments through integration with digital assets. Each application underscores the potential of CBDCs to improve transaction efficiency, reduce fraud, and enhance service delivery.

Each segment was crafted to offer a thorough understanding of CBDCs, their hypothetical benefits, and potential applications, ensuring a comprehensive educational experience for

---

[9]The Greater Bay Area in China refers to a significant economic and technology region encompassing cities like Hong Kong, Macau, and Guangzhou.

the participants. After each session, participants were asked to complete a pre-pilot survey to collect baseline data, including demographic information, perceptions, and preferences regarding rCBDC features, and their willingness to adopt such currencies. Participants who failed to attend any of the available information sessions or complete the pre-pilot survey were subsequently excluded from the pilot.

3 Descriptive Analysis

3.1 Payment Method Rating

In the pre-pilot survey (see pre- and post-pilot questionnaires in SI Section S1 and SI Section S2, respectively), we inquired about the participants' preferred payment methods for transactions below and above the threshold of 200 HKD. The findings (illustrated in Figure 2a and 2b) reveal that for transactions up to 200 HKD, the Octopus card is the most preferred method of payment (29%), followed by e-Wallets (20%). In contrast, for transactions exceeding 200 HKD, credit cards are predominantly chosen (42%), with e-wallets again being the second preference (22%). Interestingly, the data indicates a marked lack of preference for cash and Hong Kong's Faster Payment System (FPS) in retail transactions.[10] These results underscore that payment methods, viewed as 'differentiated products', significantly influence user experience and that preferences vary according to the transaction context.

3.2 Consumer Preferences in Payment Methods

The pre-pilot survey quantitatively assessed participant concerns regarding various payment method characteristics (as depicted in Figure 3). The scale ranged from +2 (indicating 'extremely concerned'), through +1 ('very concerned'), 0 ('moderately concerned'), -1 ('slightly concerned'), to -2 ('not at all concerned'). The majority of participants expressed to be 'extremely' or 'very' concerned about these features, emphasizing their significance as selection criteria.

In terms of specific concerns, 'ease of payment' is paramount, with 63% of participants indicating extreme concerns. This is followed by concerns regarding data privacy (55%), security (50%), ease of refunds (46%), and data usage by service providers (45%). Notably, 'market adoption by customers' elicits the least concern (25%), suggesting a lower emphasis on peer-to-peer payment convenience. However, 'market adoption by merchants' is deemed more crucial, with 35% extremely and 38% very concerned, pointing to the significance of the merchant-customer network effects Agur et al. (2022).

---

[10]The FPS in Hong Kong, introduced by the HKMA in 2018, is a real-time platform for instant monetary transfers and bill payments. Operating 24/7, it allows cross-bank and e-wallet transactions in Hong Kong dollars and Renminbi, using mobile numbers or email addresses for transaction identification.
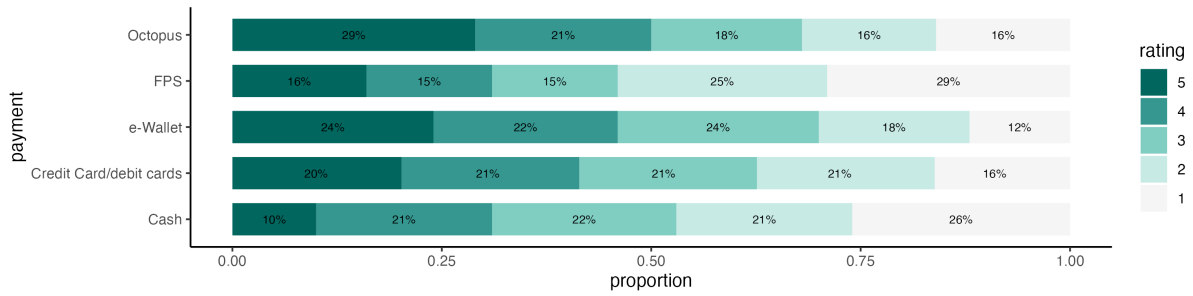
(a) Less than or equal 200 HKD
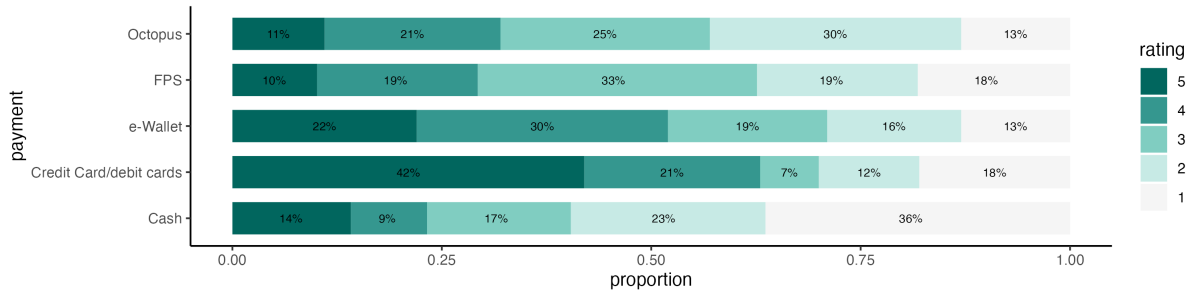
(b) More than 200 HKD

Figure 2: Payment method ratings.

3.3 Public Perception of a Hypothetical e-HKD

In both pre- and post-pilot surveys, we systematically evaluated participant perceptions regarding the proposed features of the hypothetical e-HKD. Initially, the pre-pilot perceptions were shaped through an informative one-hour session conducted by one of the authors (see SI Section S3 for an overview of the presentation slides.). Post-pilot perceptions, in contrast, were informed not only by the educational information session but also by participants' direct experience from the pilot. This approach was designed to assess the changes in perceptions attributable to hands-on interaction with the hypothetical e-HKD. Figure 4 presents these perceptions: the left panel depicts the results from the pre-pilot survey, while the right panel illustrates the findings from the post-pilot phase. In interpreting the responses, a score of +2 denotes 'Very Good', +1 indicates 'Good', 0 signifies 'Neutral', -1 implies 'Bad', and -2 equates to 'Very Bad'.

Pre-pilot Survey: In the pre-pilot survey, a minority of participants express negative opinions ('Bad' or 'Very Bad') about the features of the hypothetical e-HKD. The aspect receiving the highest incidence of 'Very Bad' or 'Bad' ratings is its market adoption rate by merchants, highlighting participant concerns regarding widespread merchant acceptance of the e-HKD as a payment method.

Participants show a notable preference for certain features: 34% rate the ease of transaction history retrieval and settlement time as 'Very Good', and 30% give similar ratings for security. These responses reflect a positive reception of the underlying technology of the hypothetical
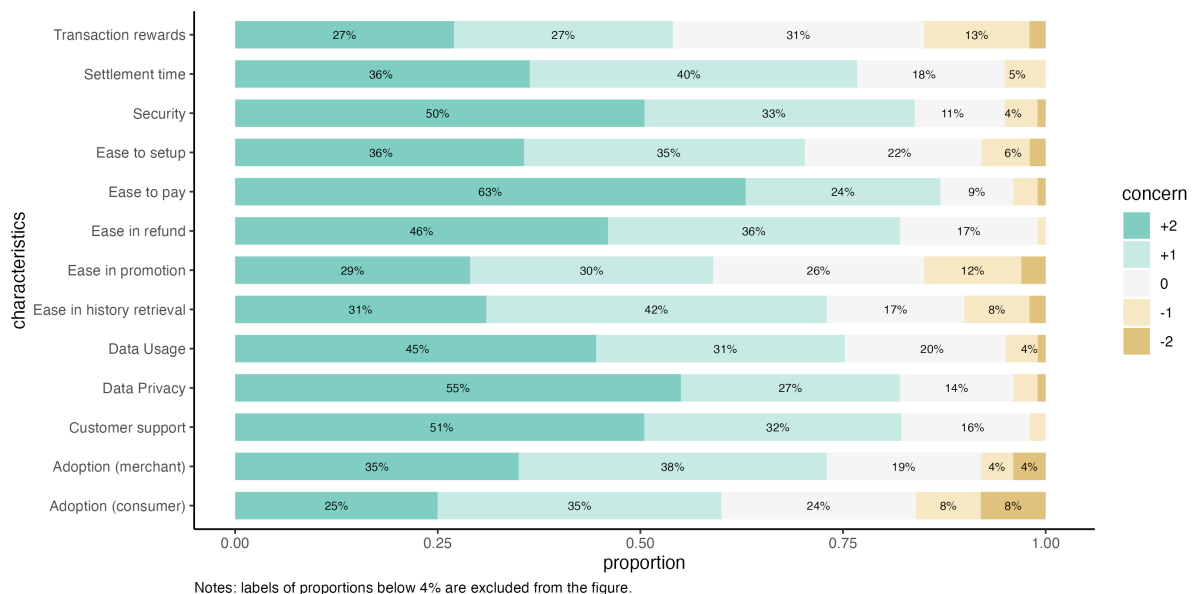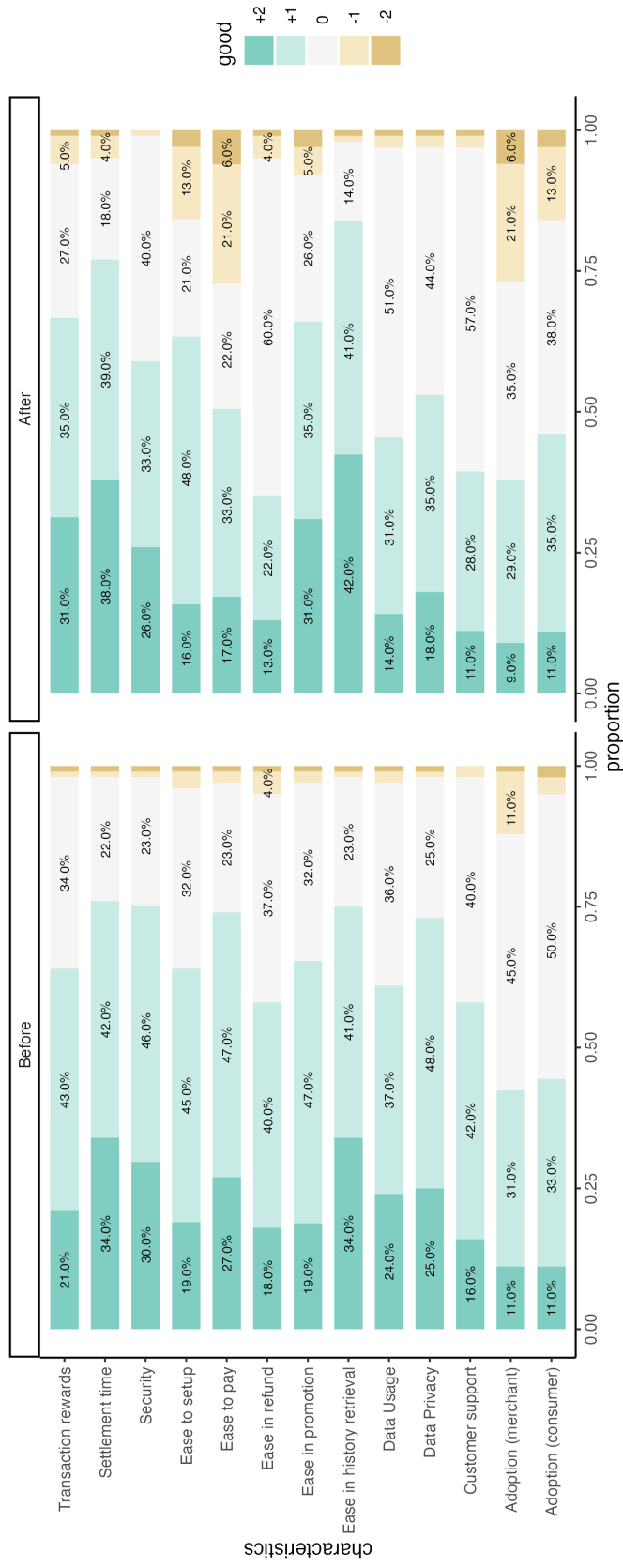
Notes: labels of proportions below 4% are excluded from the figure.

Figure 3: Taste for payment method characteristics.

e-HKD. Additionally, the ease of payment is well-received (27% rating it 'Very Good' and 47% 'Good'). While 19% of participants rate the ease of accessing promotions as 'Very Good' and 47% as 'Good', these figures are comparatively lower than those for other features.

Post-pilot Survey: Following the campus hands-on pilot with the hypothetical e-HKD prototype, there is a significant improvement in participant perceptions of certain features. Notably, 32% of participants rate transaction rewards and ease of accessing promotions as 'Very Good', and 34% as 'Good'. This suggests that the direct experience of automatic rewards during the pilot positively influenced their views. Additionally, the perception of ease in accessing transaction history saw a post-pilot increase, likely due to the convenience of instantly checking reward points within the transaction history.

Conversely, we observe a decline in perceptions regarding the ease of payment and setup, attributed to issues in the current implementation. During the pilot, unstable internet connections led to some participants being inadvertently logged out of the app, necessitating repeated logins and re-entering of one-time passwords. The process to download and use experimental apps – involving receiving an invitation, waiting for a registration code, downloading the app, and completing registration and login – was also seen as cumbersome [11]. These are areas identified for future improvement.

---

[11]TestFlight (for iOS) and Google Beta (for Android) are platforms designed for the distribution of beta and experimental applications. These services enable developers to release early versions of their apps to a select group of users for testing purposes. The registration process for these platforms can be more cumbersome compared to accessing finished products, as these services often require users to follow specific steps to download the beta app, such as accepting email invitations or joining a beta program.

Figure 4: Hypothetical e-HKD perception.

Notes: labels of proportions below 4% are excluded from the figure.

10

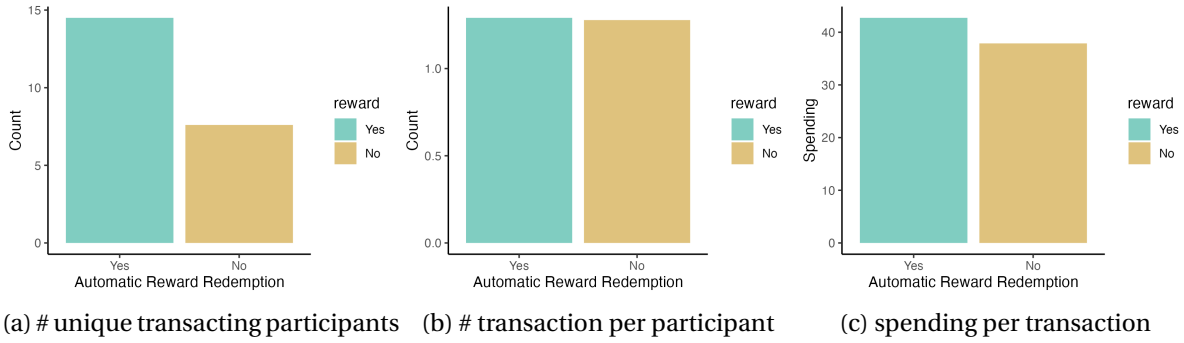(a) # unique transacting participants   (b) # transaction per participant   (c) spending per transaction

Figure 5: Comparison - reward day or normal day.

3.4 Time-Bound Cashback Rewards

The influence of automatic reward redemption on total spending is explored across three distinct margins, as illustrated in Figure 5. This figure compares spending metrics between reward days and regular, non-reward days. The data reveals a marked increase in total spending during automatic reward redemption days compared to normal days. This uptick in spending is attributed to two key factors: an increase in the number of participants making purchases and a rise in the average transaction amount. While this analysis does not juxtapose the impact of automatic reward redemption against traditional promotion methods, it does provide evidence supporting the effectiveness of the automatic reward redemption system in attracting price-sensitive participants.

3.5 Adoption Decisions

Online Appendix Table A.2 reports participants' adoption choices regarding the hypothetical e-HKD in both pre- and post-pilot surveys. In these surveys, identical questions were used to gauge shifts in intended adoption resulting from the participants' experiences with the hypothetical e-HKD payment system tested during the pilot. Notably, a minimal number of participants express outright refusal to adopt the hypothetical e-HKD. In the pre-pilot survey, a preference for adopting the hypothetical e-HKD is evident, with 32% of respondents affirming adoption ('Yes') and 52% considering it a possibility after experiencing the e-HKD features ('Possible'). Contrary to expectations, the post-pilot survey reveals remarkably stable proportions, with 'Yes' at 30% and 'Possible' at 52%. However, the proportion of outright rejections ('No') increases from 2% to 11%, while indecisiveness ('Do not know') decreases from 13% to 6%. These shifts suggest a reduction in participant uncertainty following their interaction with the hypothetical e-HKD system. We analyze the reasons later in the regression models.

We subsequently analyzed the shift in participants' adoption decisions following the hypothetical e-HKD pilot. As detailed in Online Appendix Table A.3, the findings reveal that 42%

of respondents who initially indicate 'Yes' in the pre-pilot survey modify their choice to 'Possible' post-pilot. Conversely, 23% of those who select 'Possible' in the pre-pilot alter their response to 'Yes' post-pilot. These findings suggest that participants' perspectives on the hypothetical adoption of a rCBDC are malleable and susceptible to influence by their initial experiences with real-payment transactions. This indicates a potential for significant shifts in attitudes towards the hypothetical e-HKD adoption based on practical use experiences.

4 Regression Analysis

4.1 Principal Components Analysis

This section details the Principal Component Analysis (PCA) conducted for three distinct sets of variables: perception variables, taste variables, and perception-taste interaction variables. The resulting loadings from this analysis are reported in Online Appendix Table A.4 (taste variables), Online Appendix Table A.5 (perception variables), and Online Appendix Table A.6 (perception-taste interaction variables).

To investigate the relationship between these principal components and adoption decisions, we employ the following regression model:

$$y_i = \beta_0 + \sum_{k=1}^{3} \beta_k \times PC_k + \epsilon_i \,,$$

where y_i represents the adoption decision of individual i in the pre-pilot survey phase, and PC_k denotes the kth principal component.

The findings, as detailed in Online Appendix Table A.7, reveal a positive correlation between the first perception principal component and the adoption decision in the pre-pilot survey following the informative sessions. This principal component encapsulates the general perception of the hypothetical e-HKD before the pilot, suggesting that participants generally harbor a positive attitude towards it. However, the other two principal components do not exhibit a significant relationship with the adoption decision, indicating that no other characteristics are notably influential in shaping participants' adoption choices prior to the pilot.

4.2 Two-Way Fixed Effects

We study how the changes in the perception through the hands-on experience of the hypothetical e-HKD are associated with the pre- and post-pilot adoption decisions. Our models account for both individual-specific and survey-round-specific fixed effects, as captured by

the following equation:

$$y_{it} = \alpha_i + \gamma_t + \sum_k \beta_i \times x_{ikt} z_{ik} + \epsilon_{it},$$

where y_{it} denotes the adoption decision of individual i in survey round t. α_i and γ_t represent individual and time-fixed effects, respectively. The term x_{ikt} indicates the perception of individual i regarding feature k in survey round t, while z_{ik} reflects the taste preference of individual i for feature k.

The empirical findings, outlined in Online Appendix Table A.8, identify changes in three taste-weighted perceptions —security, ease of payment, and ease of receiving promotions— as having a significant impact on the willingness to adopt. This suggests that shifts in these specific perceptions are important in influencing changes in adoption decisions.

4.3 Other Factors

Demographic Features

We explore the connection between demographic characteristics and the propensity to adopt the hypothetical e-HKD in the pre-pilot survey in Online Appendix Table A.9. The analysis indicates that, in comparison to residents of Hong Kong SAR, individuals from other parts of Asia exhibit a higher likelihood of adopting the hypothetical e-HKD as reported in the surveys conducted following the pre-pilot informative sessions. Notably, 13% of respondents opt not to disclose their residential information, a higher proportion compared to those withholding gender (5%) or origin (3%), suggesting a heightened sensitivity regarding this type of data. This reluctance to share residential details may reflect underlying privacy concerns related to the use of e-HKD, as discussed in Garratt and Van Oordt (2021). This aspect underscores the importance of addressing privacy issues in the development and promotion of retail digital currencies.

Payment Method Rankings

We study the relationship between participants' rankings of various payment methods without e-HKD and their inclination to adopt the hypothetical e-HKD, as indicated in the pre-pilot survey following the informative sessions. As detailed in Online Appendix Table A.10, the findings demonstrate that for transactions below two-hundred HKD, a preference for e-wallets over card payments correlates positively with the willingness to adopt a hypothetical e-HKD, which suggests that the common features shared between e-wallets and rCBDCs may be influential in shaping adoption decisions.

5 Conclusions

This study contributes to the research on public perceptions of rCBDCs by exploring the public views on various hypothetical features. It examines the influence of these perceptions on the decision to adopt such currencies and the shift in attitudes and willingness to adopt following direct exposure to a prototype rCBDC, the so-called hypothetical e-HKD system, during a pilot involving actual retail transactions.

We find a generally positive attitude toward rCBDCs among participants, noting that cultural and regional factors significantly influence adoption. The pilot at the HKUST campus demonstrates that perceptions and adoption rates are dynamic, responding to targeted interventions such as regulatory information campaigns, prototype experiences, and initial model introductions. Likewise, we find that consumer perceptions can evolve through exposure to rCBDC's attributes, such as security, payment convenience, and promotional functions, which are key factors influencing adoption willingness.

Our analysis suggests that participants compare e-HKD against existing payment methods, expecting it to have the convenience akin to e-wallets, the merchant acceptance akin to e-wallets, the security and protection akin to commercial bank products, and the promotional benefits similar to those offered by credit cards. If the design of rCBDCs can integrate these advantages, there appears to be a greater likelihood of widespread adoption.

The study's findings offer several actionable insights for the development of rCBDCs. Paramount among these are prioritizing security, facilitating ease of payment, and integrating promotional features. The favorable response to time-limited promotional incentives also highlights the potential of programmable payment features. The observed regional and cultural variations in adoption willingness suggest the necessity for tailored marketing and engagement strategies. Additionally, incorporating familiar aspects of existing payment systems could ease the transition for users to rCBDCs. This research provides a preliminary understanding of user preferences and perceptions, serving as a valuable reference for product developers, researchers, and policymakers in evolving rCBDC prototypes and other digital currencies in retail markets into practical, user-centric applications for broad adoption. Future research should further explore design trade-offs and refine rCBDC platforms to continually align with evolving user requirements.

6 Limitations

We recognize several limitations in our study that warrant attention. Firstly, our participant pool consisted exclusively of students and staff from a single university in Hong Kong (namely, HKUST). This specific demographic might not accurately represent the wider population of Hong Kong, potentially limiting the external validity of our findings. Additionally,

the pilot was a hypothetical exercise in nature, where participants interacted with a tokenized digital currency developed for the occasion rather than an actual legal tender. It is important to note that behaviors and attitudes observed in this experimental environment might not fully correspond to the real-world adoption and utilization of a rCBDC system. Despite efforts to simulate a realistic scenario, including on campus real-payment purchases, factors such as long-term technology familiarity and the impact of tangible financial incentives are likely to significantly influence genuine adoption decisions and usage patterns.

To validate and extend the applicability of our conclusions, further research involving larger and more diverse participant groups, along with wider real-world pilot implementations, is essential. Nonetheless, this study offers preliminary insights into crucial perceptions, preferences, and design elements relevant to CBDCs. These findings can serve as a foundational guide for subsequent research and practical pilots in the ongoing development and rollout of CBDC systems.

References

Abramova, S., Böhme, R., Elsinger, H., Stix, H., and Summer, M. (2022). What can CBDC designers learn from asking potential users? Results from a survey of Austrian residents. Technical report, Working Paper.

Agur, I., Ari, A., and Dell'Ariccia, G. (2022). Designing central bank digital currencies. *Journal of Monetary Economics*, 125:62–79.

Bijlsma, M., van der Cruijsen, C., Jonker, N., and Reijerink, J. (2021). What triggers consumer adoption of cbdc? Working Paper 709, De Nederlandsche Bank.

Chiu, J., Davoodalhosseini, S. M., Jiang, J., and Zhu, Y. (2023). Bank market power and central bank digital currency: Theory and quantitative assessment. *Journal of Political Economy*, 131(5):1213–1248.

Garratt, R. J. and Van Oordt, M. R. (2021). Privacy as a public good: a case for electronic cash. *Journal of Political Economy*, 129(7):2157–2180.

Hong Kong Monetary Authority (2023). e-HKD Pilot Programme Phase 1 Report. Technical report, Hong Kong Monetary Authority. Avaiable at https://www.hkma.gov.hk/eng/news-and-media/press-releases/2023/10/20231030-3/.

Ozili, P. K. (2023). Central bank digital currency research around the world: a review of literature. *Journal of Money Laundering Control*, 26(2):215–226.

Sandhu, K., Dayanandan, A., and Kuntluru, S. (2023). India's CBDC for digital public infrastructure. *Economics Letters*, 231:111302.

Williamson, S. (2022). Central bank digital currency: Welfare and policy implications. *Journal of Political Economy*, 130(11):2829–2861.

7 Additional information

Author Contribution: M.D.C. and K.K. led the conceptualization and design; M.D.C. and K.K. led the data collection, S.Y.J. and H.G. contributed; K.K. and S.Y.J. led the data analysis, H.G. assisted; S.Y.J. led the preparation of the original draft; M.D.C. and S.Y.J. led the review and editing of the draft, K.K. contributed; M.D.C. and K.K. led the funding acquisition; M.D.C. and K.K. led the supervision and mentorship; M.D.C. and K.K. led the project administration, H.G. assisted.

A Variables

Variable	Description
y_{it}	Adoption decision of individual i at survey round t.
y_i	Adoption decision of individual i at pre-pilot survey.
z_{ik}	Taste of individual i for feature k.
x_{ikt}	Perception of individual i for feature k at survey round t.
PC_k	k^{th} principal component perception of pre-pilot survey data.

B Hypothetical e-HKD Reward Scheme

During our designated Reward Days, we provide a range of cashback incentives to the pilot participants, varying according to the value of their transactions. The precise cashback amounts corresponding to different transaction levels are detailed in the following table:

Transaction Amount	Cashback Amount
20 - 34.99 HKD	4 HKD
35 - 49.99 HKD	9 HKD
50 - 100 HKD	15 HKD

Supplementary Information

A   Tables

Table 1: Participant Demographic Information.

Gender	Count	Proportion	Benchmark
Male	93	56%	47%
Female	63	38%	53%
Other	2	1%	0%
Prefer not to say	8	5%	0%

Origin	Count	Proportion	Benchmark
Hong Kong SAR	97	58%	89%
Mainland China	35	21%	1%
Rest of Asia	21	13%	8%
Other	8	5%	2%
Prefer not to say	5	3%	0%

Residence	Count	Proportion	Benckmark
Dormitory	41	25%	0%
Public house	18	11%	46%
Private house	81	49%	53%
Other	5	3%	1%
Prefer not to say	21	13%	0%

Age	Count	Proportion	Benchmark
0 - 4	0	0%	3.1%
5 - 9	0	0%	3.9%
10 - 14	0	0%	3.9%
15 - 19	33	20%	3.6%
20 - 24	59	36%	4.4%
25 - 29	15	9%	6.2%
30 - 34	10	6%	7.1%
35 - 39	5	3%	7.9%
40 - 44	2	1%	7.9%
45 - 49	3	2%	7.9%
50 - 54	1	1%	7.8%
55 - 59	2	1%	8.5%
60 - 64	0	0%	8.3%
65 - 70	1	1%	6.6%
70 - 74	0	0%	5.0%
75 - 79	0	0%	2.7%
80 - 84	0	0%	2.2%
Prefer not to say	35	21%	3.1%

Note: The tables provide detailed demographic information of the participants, including gender, origin, type of residence, and age collected in the pre-pilot survey.

Table 2: Hypothetical e-HKD adoption.

Adoption Decision	Pre Count	Pre Proportion	Post Count	Post Proportion
Yes	53	32%	43	30%
Possible	87	52%	74	52%
No	4	2%	16	11%
Do not know	22	13%	8	6%

Note: The table details the intended adoption decisions of pilot participants, including their choices in both the pre-pilot and post-pilot surveys.

Table 3: Hypothetical e-HKD adoption change.

Pre Adoption Decision	Post Adoption Decision	Count	Proportion
Yes	Yes	19	50%
Yes	Possible	16	42%
Yes	No	3	8%
Yes	Do not know	0	0%
Pre Adoption Decision	**Post Adoption Decision**	**Count**	**Proportion**
Possible	Yes	16	23%
Possible	Possible	46	66%
Possible	No	3	4%
Possible	Do not know	5	7%
Pre Adoption Decision	**Post Adoption Decision**	**Count**	**Proportion**
No	Yes	0	0%
No	Possible	1	33%
No	No	2	67%
No	Do not know	0	0%
Pre Adoption Decision	**Post Adoption Decision**	**Count**	**Proportion**
Do not know	Yes	5	26%
Do not know	Possible	6	32%
Do not know	No	5	26%
Do not know	Do not know	3	16%

Note: The tables illustrate changes in adoption decisions in the post-pilot survey, conditional on the decisions made in the pre-pilot survey.

Table 4: Principal Component Loading for Taste.

	zPC1	zPC2	zPC3	zPC4	zPC5	zPC6	zPC7	zPC8	zPC9	zPC10	zPC11	zPC12	zPC13
Security	-0.200	-0.444	-0.124	0.332	0.056	0.353	0.097	0.299	0.624	-0.035	-0.030	-0.017	-0.134
Settlement time	-0.264	0.013	-0.312	0.318	0.305	0.451	-0.372	-0.283	-0.405	-0.218	-0.029	0.058	0.018
Transaction rewards	-0.231	0.398	0.237	0.386	0.283	-0.090	0.257	0.161	0.059	0.129	-0.322	0.241	0.470
Ease to pay	-0.315	0.130	-0.349	0.140	-0.260	-0.174	-0.237	-0.102	0.071	0.733	-0.057	-0.157	-0.084
Ease to setup	-0.275	0.194	-0.291	0.205	-0.429	-0.421	0.020	-0.072	0.143	-0.602	-0.071	0.048	-0.055
Data privacy	-0.296	-0.421	-0.164	-0.019	0.154	-0.294	0.223	0.036	-0.194	0.009	0.497	-0.178	0.479
Data usage	-0.306	-0.361	-0.048	-0.242	0.297	-0.304	0.198	-0.056	-0.192	0.047	-0.452	0.298	-0.400
Consumer adoption	-0.271	0.221	-0.231	-0.362	-0.200	0.324	0.151	0.657	-0.292	-0.040	-0.065	-0.063	0.005
Merchant adoption	-0.252	0.234	-0.147	-0.512	0.130	0.258	0.256	-0.499	0.401	-0.042	-0.024	-0.091	0.168
Ease in promotion	-0.311	0.318	0.307	0.186	0.185	-0.003	0.264	-0.020	-0.059	0.008	0.470	-0.177	-0.560
Ease in history retrieval	-0.296	0.078	0.230	-0.302	0.219	-0.181	-0.674	0.232	0.266	-0.080	0.203	0.230	0.051
Customer support	-0.272	-0.196	0.362	0.003	-0.543	0.267	0.073	-0.213	-0.123	0.102	0.161	0.531	0.083
Ease in refund	-0.292	-0.182	0.491	-0.010	-0.160	0.037	-0.154	-0.070	-0.090	-0.112	-0.376	-0.642	0.097

Note: The table presents the loading coefficients for thirteen distinct taste variables collected in the pre-pilot survey.

Table 5: Principal Component Loading for Perception.

	xPC1	xPC2	xPC3	xPC4	xPC5	xPC6	xPC7	xPC8	xPC9	xPC10	xPC11	xPC12	xPC13
Security	0.271	-0.068	-0.486	-0.094	0.108	0.141	-0.295	-0.459	-0.221	0.458	-0.167	0.223	0.110
Settlement time	0.281	0.091	0.053	-0.537	-0.314	0.190	0.092	0.341	-0.571	-0.095	0.031	0.131	-0.096
Transaction rewards	0.275	0.352	0.068	0.480	0.073	0.144	0.037	0.351	-0.104	0.528	0.290	-0.126	-0.160
Ease to pay	0.265	0.093	0.060	0.192	-0.800	-0.142	-0.087	-0.340	0.091	-0.057	0.143	-0.192	0.169
Ease to setup	0.279	0.220	-0.116	0.026	0.035	-0.378	0.721	-0.038	0.101	0.059	-0.298	0.274	0.129
Data privacy	0.254	-0.520	-0.224	0.257	-0.100	-0.288	-0.083	0.235	-0.092	-0.080	-0.322	-0.162	-0.499
Data usage	0.293	-0.469	-0.100	-0.078	0.150	-0.187	0.010	0.288	0.061	0.029	0.413	-0.080	0.597
Consumer adoption	0.255	0.001	0.544	-0.280	0.002	-0.101	-0.318	0.148	0.351	0.333	-0.432	0.007	0.079
Merchant adoption	0.259	-0.018	0.478	0.037	0.370	-0.330	-0.023	-0.447	-0.411	-0.137	0.205	-0.085	-0.142
Ease in promotion	0.273	0.399	-0.137	0.279	0.174	-0.006	-0.399	0.194	-0.070	-0.536	-0.247	0.108	0.278
Ease in history retrieval	0.278	0.293	-0.324	-0.425	0.188	-0.042	0.009	-0.071	0.337	-0.104	0.152	-0.548	-0.251
Customer support	0.272	-0.238	0.168	0.157	0.092	0.684	0.326	-0.161	0.012	-0.145	-0.267	-0.308	0.141
Ease in refund	0.340	-0.124	0.058	0.013	0.005	0.229	-0.034	-0.068	0.416	-0.198	0.346	0.599	-0.341

Note: The table presents the loading coefficients for thirteen distinct perception variables collected in the pre-pilot survey.

21

Table 6: Principal Component Loading for Interaction.

	zxPC1	zxPC2	zxPC3	zxPC4	zxPC5	zxPC6	zxPC7	zxPC8	zxPC9	zxPC10	zxPC11	zxPC12	zxPC13
Security	0.124	-0.515	-0.109	-0.321	0.049	0.435	0.114	0.064	-0.312	-0.492	0.224	0.062	-0.042
Settlement time	0.371	0.056	-0.009	-0.217	-0.045	-0.391	0.549	0.020	-0.066	0.071	0.126	-0.237	-0.524
Transaction rewards	0.321	0.199	0.102	0.525	0.096	0.226	-0.012	-0.256	-0.332	-0.100	0.187	-0.520	0.140
Ease to pay	0.273	0.112	-0.115	-0.481	0.398	0.078	-0.379	0.332	-0.038	0.341	0.037	-0.334	0.140
Ease to setup	0.251	-0.033	-0.474	0.063	0.274	0.146	0.480	-0.204	0.342	0.152	-0.044	0.164	0.411
Data privacy	0.184	-0.336	-0.324	0.464	0.105	-0.212	-0.331	0.249	0.198	0.050	0.416	0.145	-0.264
Data usage	0.259	-0.421	0.029	0.011	0.126	-0.550	-0.172	-0.215	-0.240	-0.135	-0.472	-0.014	0.249
Consumer adoption	0.364	0.348	0.037	-0.088	-0.281	-0.176	-0.042	0.108	-0.352	0.004	0.323	0.525	0.331
Merchant adoption	0.194	0.133	-0.398	-0.245	-0.385	0.094	-0.393	-0.574	0.162	-0.067	-0.030	-0.055	-0.224
Ease in promotion	0.365	0.330	0.009	0.159	0.210	0.225	-0.070	0.262	0.089	-0.351	-0.512	0.262	-0.321
Ease in history retrieval	0.221	-0.007	0.562	-0.154	0.178	-0.095	-0.086	-0.192	0.573	-0.308	0.297	0.009	0.122
Customer support	0.277	-0.204	0.048	0.067	-0.649	0.113	0.059	0.418	0.284	0.010	-0.186	-0.292	0.248
Ease in refund	0.277	-0.314	0.396	0.056	-0.031	0.346	-0.021	-0.217	-0.077	0.600	-0.100	0.278	-0.211

Note: The table presents the loading coefficients for thirteen distinct taste×perception variables collected in the pre-pilot survey.

Table 7: First Three Principal Components and Adoption Decision.

	(1)	(2)	(3)	(4)	(5)
(Intercept)	1.163***	1.163***	1.163***	1.163***	1.163***
	(0.052)	(0.051)	(0.052)	(0.051)	(0.052)
zPC1	0.009				-0.003
	(0.026)				(0.027)
zPC2	0.010				0.013
	(0.039)				(0.040)
zPC3	-0.042				-0.045
	(0.041)				(0.041)
xPC1		0.071***		0.065**	
		(0.021)		(0.022)	
xPC2		0.023		0.028	
		(0.047)		(0.047)	
xPC3		-0.069		-0.067	
		(0.049)		(0.050)	
zxPC1			0.058+	0.021	0.060+
			(0.030)	(0.032)	(0.031)
zxPC2			-0.033	-0.034	-0.035
			(0.041)	(0.040)	(0.042)
zxPC3			-0.003	-0.002	-0.007
			(0.043)	(0.042)	(0.044)
Num. Obs.	166	166	166	166	166
R2	0.007	0.079	0.026	0.085	0.035
AIC	347.1	334.7	343.9	339.5	348.5
BIC	362.7	350.3	359.4	364.4	373.4
Log. Like.	-168.551	-162.361	-166.943	-161.760	-166.251
F	0.402	4.614	1.466	2.473	0.947
RMSE	0.67	0.64	0.66	0.64	0.66

Note: The table presents regression analysis results assessing the influence of various principal components on adoption decisions. These components include those related to pre-pilot perception, taste, and intersection, with the first three principal components selected for each category. $^+ p < 0.1,$ $^* p < 0.05,$ $^{**} p < 0.01,$ $^{***} p < 0.001.$

Table 8: Taste Weighted Perception and Adoption Decision - Two Way Fixed Effects.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
x security × z security	0.101+ (0.059)												
x settlement time × z settlement time		0.084 (0.057)											
x transaction rewards × z transaction rewards			0.104 (0.066)										
x ease to pay × z ease to pay				0.062+ (0.035)									
x ease to setup × z ease to setup					-0.038 (0.053)								
x data privacy × z data privacy						0.043 (0.058)							
x data usage × z data usage							-0.017 (0.069)						
x consumer adoption × z consumer adoption								0.049 (0.058)					
x merchant adoption × z merchant adoption									0.016 (0.043)				
x ease in promotion × z ease in promotion										0.159** (0.058)			
x ease in history retrieval × z ease in history retrieval											-0.027 (0.060)		
x customer support × z customer support												0.080 (0.066)	
x ease in refund × z ease in refund													0.003 (0.058)
Num. Obs.	296	296	296	296	296	296	296	296	296	296	296	296	296
R2	0.022	0.017	0.019	0.024	0.004	0.004	0.000	0.005	0.001	0.055	0.001	0.011	0.000
R2 Adj.	-1.237	-1.249	-1.243	-1.233	-1.278	-1.277	-1.286	-1.274	-1.284	-1.161	-1.283	-1.261	-1.287
AIC	414.8	416.5	415.7	414.4	420.2	420.2	421.3	419.8	421.1	404.7	421.0	418.1	421.4
BIC	422.2	423.9	423.1	421.7	427.6	427.5	428.7	427.2	428.5	412.1	428.4	425.5	428.8
RMSE	0.48	0.49	0.49	0.48	0.49	0.49	0.49	0.49	0.49	0.48	0.49	0.49	0.49

Note: The table presents the results of a two-way fixed effects regression analysis, focusing on the impact of interaction variables between tastes and both pre- and post-pilot perceptions on adoption decisions. The model incorporates controls for both individual fixed effects and survey-round fixed effects, enabling an examination of how changes in these variables influence shifts in adoption decisions. $^+ p < 0.1$, $^* p < 0.05$, $^{**} p < 0.01$, $^{***} p < 0.001$.

24

Table 9: Demographic Features and Adoption Decision.

	(1)	(2)	(3)
(Intercept)	1.082***	1.258***	1.198***
	(0.068)	(0.069)	(0.074)
Origin - Mainland China	0.175		
	(0.132)		
Origin - Rest of Asia	0.298+		
	(0.161)		
Origin - Other	-0.082		
	(0.246)		
Origin - Prefer not to say	0.318		
	(0.307)		
Gender - Female		-0.210+	
		(0.109)	
Gender - Other		0.242	
		(0.477)	
Gender - Prefer not to say		-0.383	
		(0.246)	
Residence - Dormitory			0.095
			(0.128)
Residence - Public house			-0.198
			(0.174)
Residence - Other			0.002
			(0.308)
Residence - Prefer not to say			-0.293+
			(0.164)
Num. Obs.	166	166	166
R2	0.033	0.034	0.036
R2 Adj.	0.009	0.017	0.012
AIC	344.8	342.5	344.3
BIC	363.5	358.1	363.0
Log. Like.	-166.417	-166.257	-166.139
F	1.355	1.926	1.495
RMSE	0.66	0.66	0.66

Note: The table presents regression analysis results, examining the impact of demographic characteristics on adoption decisions reported in the pre-pilot survey. In this analysis, Hong Kong SAR is utilized as the control group for origin, male gender as the control group for gender, and private house ownership as the control group for type of residence. $^{+}p < 0.1,$ $^{*}p < 0.05,$ $^{**}p < 0.01,$ $^{***}p < 0.001.$

Table 10: Payment Method Rating vs. Adoption Decision.

	(1)	(2)
(Intercept)	1.824***	2.029***
	(0.159)	(0.113)
Cash rating - Small	-0.235	
	(0.275)	
FPS rating - Small	0.251	
	(0.238)	
Octopus rating - Small	0.301	
	(0.207)	
E-wallet rating - Small	0.426*	
	(0.216)	
Cash rating - Large		-0.321
		(0.222)
FPS rating - Large		0.089
		(0.254)
Octopus rating - Large		0.024
		(0.243)
E-wallet rating - Large		0.160
		(0.191)
Num. Obs.	166	166
R2	0.050	0.025
R2 Adj.	0.026	0.000
AIC	452.0	456.3
BIC	470.7	475.0
Log. Like.	-220.007	-222.165
F	2.102	1.015
RMSE	0.91	0.92

Note: The table reports regression analysis results that investigate the influence of demographic characteristics on adoption decisions reported in the pre-pilot survey, using credit/debit card users as the control group. $^{+}p < 0.1,$ $^{*}p < 0.05,$ $^{**}p < 0.01,$ $^{***}p < 0.001.$

B Pre-Pilot Survey Questionnaire

Consumer Survey Before Experiment

Demographic questions

1. How old are you?
   a. Enter age in the text box:
   b. Prefer not to say
2. To which gender do you most identify? Please select the option(s) that best describe you.
   a. Male
   b. Female
   c. Other
   d. Prefer not to say
2. Where are you originally from?
   a. Hong Kong SAR
   b. Mainland China
   c. Rest of Asia
   d. Other
   e. Prefer not to say
3. Which type of residence do you live?
   a. Dormitory
   b. Public house
   c. Private house
   d. Other
   e. Prefer not to say
   f. Questions about preferred payment methods
4. Suppose that all the following payment methods are accepted by the merchant. When the transaction value is as specified, which payment methods would you use? Please rank them by your preference.

	< 200 HKD	>200 HKD
Cash		
Octopus		
FPS		
Credit/debit cards		
e-Wallet (Alipay, WeChat Pay, Payme etc)		
Other (please specify):		

5. On a scale of 1 to 5, where 5 denotes the highest degree of satisfaction, how would you rate the ease of payment of the following payment methods (ie tap and pay, QR code, etc)?

Cash	/5
Octopus	/5

FPS	/5
Credit/debit cards	/5
e-Wallet (Alipay, WeChat Pay, Payme etc)	/5
Other (please specify):	/5

6. How much do you care about the following features and characteristics of a payment method?

	Extremely Concerned	Very Concerned	Moderately Concerned	Slightly Concerned	Not at all Concerned
Security subject to theft, counterfeit, and fraud					
Settlement time (i.e., the time until the funds are received by your account)					
Transaction rewards					
Ease to pay					
Ease to setup					
Data privacy					
How my data is stored and used by service providers					
Market adoption by consumer front					
Market adoption by merchant front					
Ease in enjoying promotion					
Ease in retrieving or enquiring transaction history					
Loyalty programs/reward points					
Customer support in case or fraud or transaction dispute					

	Very good	Good	Neutral	Bad	Very bad
Ease in refund and dispute resolution					

Hypothetical e-HKD Questions

7. How do you rate the following features and characteristics of hypothetical e-HKD?

	Very good	Good	Neutral	Bad	Very bad
Security subject to theft, counterfeit, and fraud					
Settlement time (i.e., the time until the funds are received by your account)					
Transaction rewards					
Ease to pay					
Ease to setup					
Data privacy					
How my data is stored and used by service providers					
Market adoption by consumer front					
Market adoption by merchant front					
Ease in enjoying promotion					
Ease in retrieving or enquiring transaction history					
Loyalty programs/reward points					
Customer support in case or fraud or transaction dispute					
Ease in refund and dispute resolution					

8. If the hypothetical e-HKD is launched, will you consider regularly using hypothetical e-HKD as one of your payment method options?
   a. Yes.
   b. Possible, if my concerns in the previous question are addressed.
   c. No.
   d. Do not know.

9. During this program, you can enjoy a cashback reward for paying with hypothetical e-HKD. You can enjoy this reward **automatically** when the transaction is completed. Compared to other existing reward/discount programs you have experienced in the past, how important is it for you to enjoy **automatically** these rewards?
   a. Very important
   b. Important
   c. Neutral

PUBLIC

d. Not important
e. Not very important

10. If you cannot enjoy this automatic reward of the hypothetical e-HKD, will you change your decision of using hypothetical e-HKD?
    a. If the answer was to adopt or possibly adopt:
        i. Yes, I will change the decision and will not adopt.
        ii. No, I will not change the adoption decision and will adopt.
        iii. Do not know / uncertain
    b. If the answer was not to adopt:
        i. Yes, I will change the decision and will adopt
        ii. No, I will not change the adoption decision and will not adopt
        iii. Do not know / uncertain

11. From the wider community's perspective, how do you rate the usefulness of the following potential use cases of the hypothetical e-HKD?

	Very useful	Moderately Useful	Neutral	Not very useful	Not useful at all
Cash-on-delivery (i.e., secure e-commerce payment upon good/service delivery)					
Age-bounded fare (e.g., student discounts)					
Government consumption voucher scheme					
Salary payments					
Cross-border retail payment between HK and the Greater Bay Area					

12. From your consumer's perspective, what are the other potential use cases for hypothetical e-HKD that you anticipate might be most relevant?
    a. Open questions

PUBLIC

C   Post-Pilot Survey Questionnaire

Consumer Survey – After Experiment

Your answer before the pilot experiment was as presented. Did any of your answers change after the pilot experiment?

Hypothetical e-HKD Questions

1. How do you rate the following features and characteristics of hypothetical e-HKD?

	Very good	Good	Neutral	Bad	Very bad
Security subject to theft, counterfeit, and fraud					
Settlement time (i.e., the time until the funds are received by your account)					
Transaction rewards					
Ease to pay					
Ease to setup					
Data privacy					
How my data is stored and used by service providers					
Market adoption by consumer front					
Market adoption by merchant front					
Ease in enjoying promotion					
Ease in retrieving or enquiring transaction history					
Loyalty programs/reward points					
Customer support in case or fraud or transaction dispute					
Ease in refund and dispute resolution					

2. If the hypothetical e-HKD is launched, will you consider regularly using it as one of your payment method options?
   a. Yes.
   b. Possible, if my concerns in the previous question are addressed.
   c. No.
   d. Do not know.
3. During this program, you should have enjoyed a cashback reward for paying with hypothetical e-HKD. You enjoyed this reward **automatically** when the transaction was completed. Compared to

other existing reward/discount programs you have experienced in the past, how important is it for you to enjoy **automatically** these rewards

      a. Very important
      b. Important
      c. Neutral
      d. Not important
      e. Not very important

4. If you cannot enjoy this automatic reward of hypothetical e-HKD, will you change your decision of using hypothetical e-HKD?

      a. If the answer was to adopt or possibly adopt:
            i. Yes, I will change the decision and will not adopt.
            ii. No, I will not change the adoption decision and will adopt.
            iii. Do not know / uncertain
      b. If the answer was not to adopt:
            i. Yes, I will change the decision and will adopt
            ii. No, I will not change the adoption decision and will not adopt
            iii. Do not know / uncertain

5. From the wider community's perspective, how do you rate the usefulness of the following potential use cases of the hypothetical e-HKD?

	Very useful	Moderately Useful	Neutral	Not very useful	Not useful at all
Cash-on-delivery (i.e., secure e-commerce payment upon good/service delivery)					
Age-bounded fare (e.g., student discounts)					
Government consumption voucher scheme					
Salary payments					
Cross-border retail payment between HK and the Greater Bay Area					

6. From your consumer's perspective, what are the other potential use cases for hypothetical e-HKD that you anticipate might be most relevant?

      a. Open questions

D Hypothetical E-HKD Educational Slides

Hypothetical e-HKD Pilot Overview
Student/Staff Briefing Session

September 2023

1

Briefing session overview
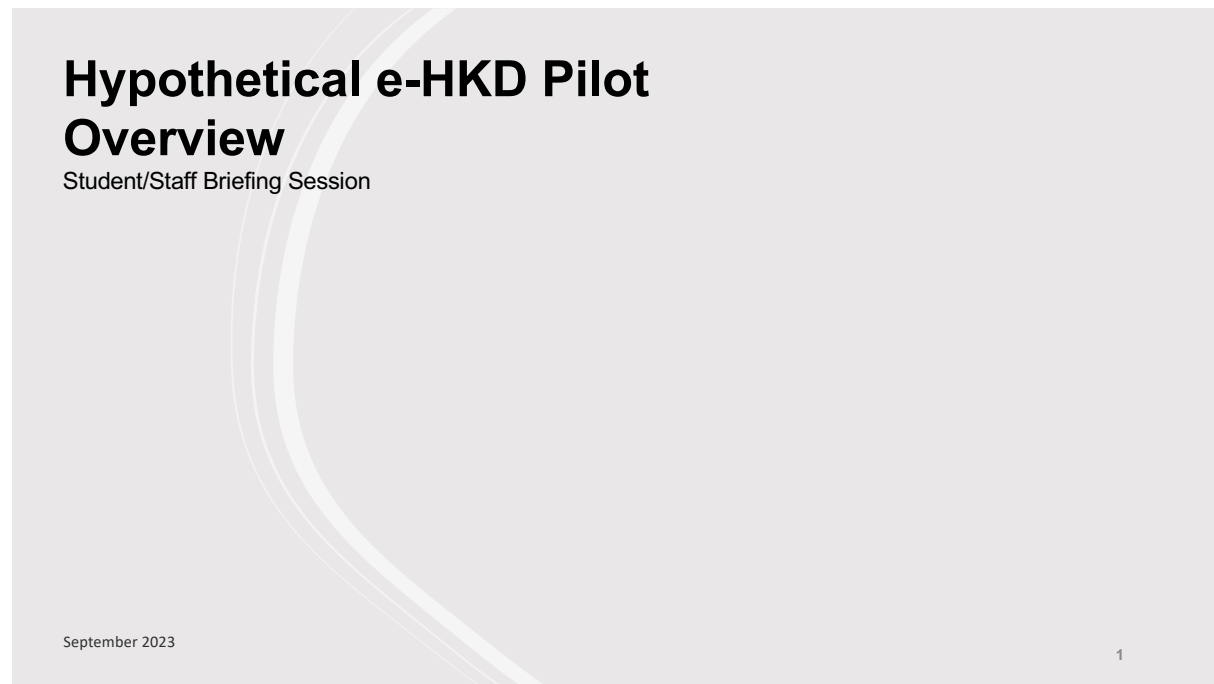
Today's briefing session will cover the following topics

1 Overview of the Hypothetical e-HKD Pilot

2 Pilot key dates and engagement

3 CBDCs 101

4 Overview of the mobile experience and explanation of how to complete features

5 Consent Form & Pre-Pilot Survey

The Hypothetical e-HKD Pilot will be delivered in a partnership between HKUST and HSBC to validate retail CBDC benefits

Objective

- Build a Hypothetical e-HKD payment ecosystem, enabled by HSBC developed solutions at HKUST to validate the following e-HKD benefits:
    1. **Cost savings / lower fees** – CBDCs allow efficiency & cost gains for the merchant that drive cost savings for customers
    2. **Better customer experience** – allow for an efficient discount and reward mechanism which will provide a more seamless experience for customers and merchants
    3. **Programmable money** – CBDCs and programmable money allow money to be transferred and used only under defined terms and conditions

Scope

- 200 on-campus 'customer' testers (university students and staff) and 5 on-campus merchants will participate in this experiment.
- Pilot will run for one week from Saturday 16th September to Friday the 22nd.
- Once registered in the HSBC Open Wallet App, each 'customer' will receive 100 Hyp. e-HKD tokens to spend during the pilot at the participating merchants.
- In addition, we need your help to complete:
    - Briefing and pre-Pilot survey (today!)
    - Post-Pilot survey (for which there will be a 50-HKD completion reward!)
- Pilot functionality and related technology (app / blockchain) is specifically tailored for these research purposes (e.g., no peer-to-peer or top-up functionality; no integration with bank accounts/systems)
- Hypothetical e-HKD tokens are not legal tender in Hong Kong. The HSBC Open Wallet App and Hyp. e-HKD tokens will only be valid during this one-week pilot, and any tokens not used in that time will be forfeit.

Hypothetical e-HKD Ecosystem

For this pilot, HSBC will create the Hyp. e-HKD tokens and distribute to all 'customer' participants to spend at the eligible merchants

---
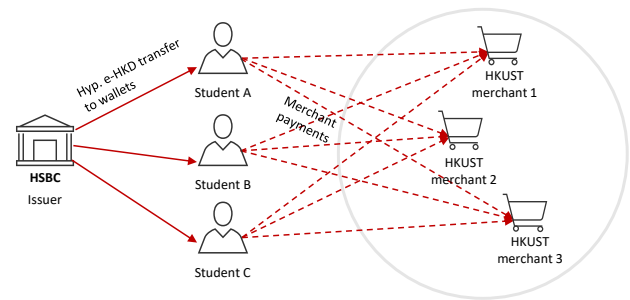
Participating Merchants and App Store Restrictions

Participating Merchants (anonymous)

- Merchant 1
- Merchant 2
- Merchant 3
- Merchant 4
- Merchant 5

App Store Restrictions

- To download and access the HSBC Open Wallet app, your smartphone must be compatible with either the Google Play Store (for Android devices) or the Apple App Store (for iOS devices). Phones not compatible with Google Play or Apple App Store will not be able to participate in this trial.
- If you use the Google Play Store, we will need the email address associated with your account as part of the pre-trial survey following the information session.

Pilot participants will be closely engaged throughout the 1-week pilot period

★ **16 Sep: Begin e-HKD pilot** ★ **22 Sep: End e-HKD pilot**

4 Sep to 8 Sep			16 Sep			22 Sep		
Pre-trial survey			**e-HKD pilot official start announcement**			**e-HKD pilot official end announcement**		
Format	Online form		**Format**	Email		**Format**	Email	

w/c 4 September   **w/c 11 September**   **w/c 18 September**   **Post-pilot wrap-up**

4 Sep to 8 Sep			15 Sep		20 Sep		22 Sep to 24 Sep	
Pre-trial customer structure interview			**HSBC e-HKD app download available**		**Reminder – 3 days before pilot is over**		**Post-trial survey**	
Format	In-person (selected individuals)		**Format**	Email	**Format**	Email	**Format**	Online form

Note – see appendix for detailed dates for customer and merchant users

---

What are CBDCs?

Definition

The Hypothetical e-HKD is a simulation of retail Central Bank Digital Currencies (CBDCs). CBDCs are digital currencies that would be issued by a central bank.

How do CBDCs Compare with Other Forms of Money?

- Currently there are two types of central bank money:
  - **Notes -** which are **physical** and **can be used by the public**
  - **Central Bank Reserves** - which are **electronic** but **can only be used by certain financial institutions** with a clearing account at the central bank
- **CBDCs** would be a **new form** of central bank money that can be a) **used by the public and is b) digital**
- As well as central bank money, there is **commercial money** (the deposits you make into your bank account), which are also **digital and used by the public**. The key difference between commercial money and a CBDC is around liability:
  - For a CBDC, liability sits at the Central Bank and is free of any credit risk from participating depository institutions
  - For Commercial Money, liability sits with the depository institution and has credit risk in case of closure of that institution
- For more information, see: hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/e-HKD_A_Policy_and_Design_Perspective.pdf

Key Motivations for Central Banks to Consider CBDCs
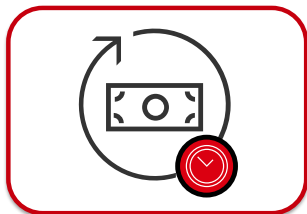
Enhanced Efficiency	Financial Inclusion	Payment System Modernization
Addressing Consumer Preferences	Innovation and Technological Advancements	Cross-Border Payments and Financial Stability

6

## Benefits of CBDCs - Liquidity and Accessibility

Fast and Cost-Effective Transactions

Real-Time Settlement

CBDC transactions offer **real-time processing and settlement**, and do not require intermediaries to settle the transactions like existing payment methods. This provides efficiencies which could potentially **enhance liquidity management** and **reduce transaction costs.**

This benefit may also enhance cross border transactions, providing an opportunity to streamline payments between HK and the Greater Bay Area.
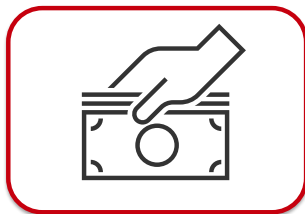
Ease of Payment

The CBDC payment experience can be structured to mimic today's payment journeys (e.g., PayMe, FPS) for a **more intuitive user experience with a minimal learning curve.** The exact details will depend on final design and implementation.
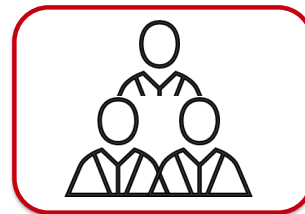
Merchant Market Adoption

Cost-effective alternative for merchants to receive payments and conduct promotional campaigns, leading to **reduced operational costs** and potential cost savings to merchants.

Benefits of CBDCs - Traceability and Security

Secure and Transparent Transactions

Security & Immutability

- CBDCs are built on distributed ledger technology (DLTs) like blockchains, supporting the integrity and security of data. **Transactions recorded on blockchains cannot be altered**, providing broad protection against unauthorized changes or hacks.

Transparent Transaction History

- Blockchain's accessible nature allows for **easy retrieval and auditing of transaction history**, promoting **transparency and accountability** thereby assisting regulatory authorities monitor and detect suspicious activities, aiding in AML efforts.
- This transparency can also aid customer service and dispute resolution cases

Data Privacy

- Treatment of user data within a CBDC environment would be handled in compliance with existing data protection laws as per the respective jurisdiction. Such controls could include a) encryption or b) the storage of data points off-chain.

Benefits of CBDCs - Programmability

Key functionality of Programmability

Conditional Execution of Payments

CBDCs can **automatically execute transactions through smart contracts based on predefined conditions**, reducing manual intervention and reliance on separate systems to execute.

Key Use Cases for Retail CBDC Programmability that Support Social and Economic Benefits to Individuals
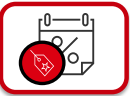
Loyalty/Rewards Programs

Merchants can design and implement customized rewards structures embedded within the CBDC, offering customers incentives such as discounts or cashback, fostering customer loyalty and encouraging future purchases.

Targeted Distribution of Government Subsidies based on Specific Eligibility Criteria

CBDCs can be used to distribute benefits and government subsidies (e.g., HK consumption voucher scheme) directly to eligible individuals' digital wallets based on pre-defined criteria. These could include their citizenship status or access to senior citizen or public health programs. This would **improve the accuracy and efficiency of distribution** thereby increasing and accelerating individual access to essential services.

Fraud Prevention through Cash on Delivery Functionality

CBDCs can automate an agreement between buyer and seller, ensuring payment is received by a seller when buyer confirms the receipt of goods. This benefits both consumers and merchants as it builds trust, simplifies transactions, and aligns payments with a successful delivery.

Benefits of CBDCs - Programmability

Key functionality of Programmability

Conditional Execution of Payments

CBDCs can **automatically execute transactions through smart contracts based on predefined conditions**, reducing manual intervention or reliance on separate systems to execute.

Other Use Cases for CBDC Programmability

Targeted Distribution of Aid / Relief Fund Distributions to Recipients

Using CBDCs for aid/relief fund disbursement ensures that timely support reaches the intended recipients quickly and effectively, with reduced a) administrative burdens related to manual processes of distribution and b) potential for corruption, as the direct disbursement of funds leaves less room for fraud or misallocation of resources

Integration with Digital Assets to Create Complex Financial Instruments with Programmable Conditions

CBDCs can be integrated with other digital assets, enabling the creation of complex financial instruments with programmable conditions that are potentially more efficient and cost-effective than traditional financial instruments.

Hypothetical e-HKD Reward Promotion Programmed into Smart Contract

- A promotional reward feature will run during the pilot on 19 Sep (Tue) and 21 Sep (Thu)
- Customer testers will receive Reward tokens (like 'cashback' awards) for the first 2 Hypothetical e-HKD purchases they make on those days, per the Reward Details table below.
- Reward tokens will automatically transfer from Merchant Wallets to Customer Wallets a few minutes after the purchase is completed.
- Both the eligible transaction and the reward will be separately itemized in your App's "transaction history" for easy confirmation and reconciliation.
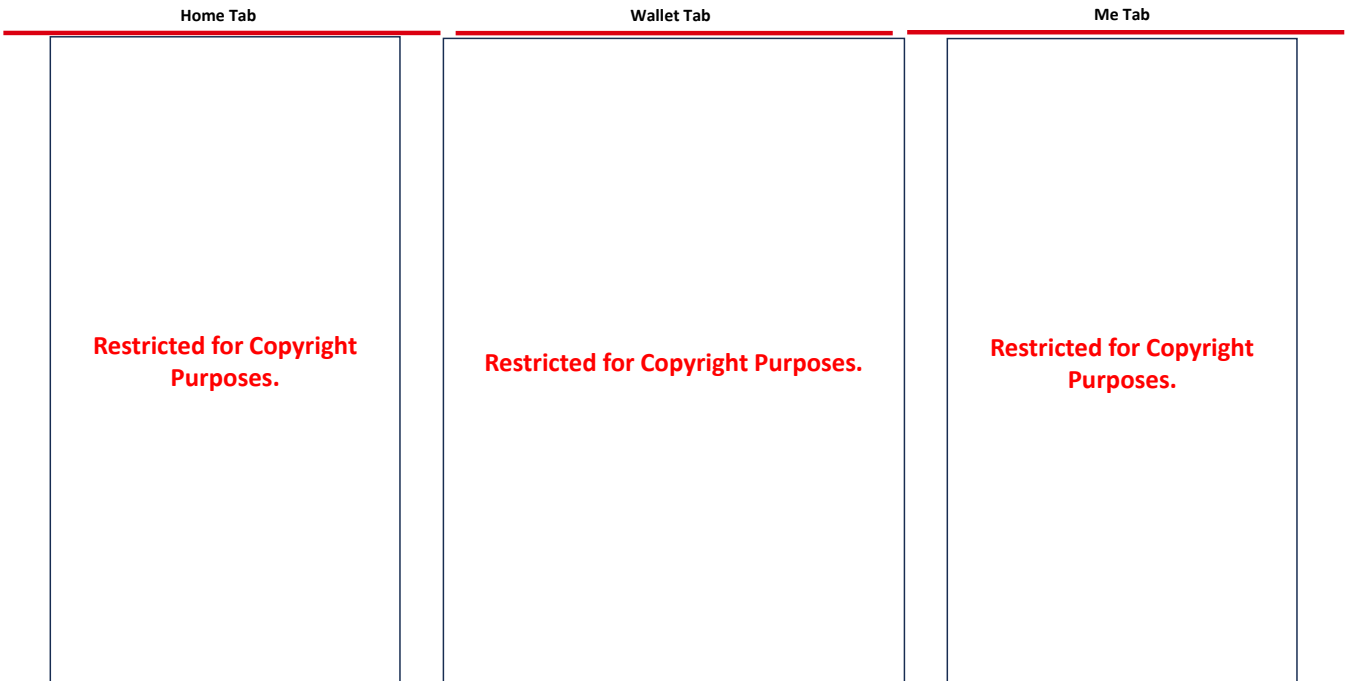
Reward Details

Eligibility: The first two transactions made by customers that meet the spending amount outlined in the table below.

(in Hypothetical e-HKD)	Spending Amount per Transaction	Reward
Tier 1	20 – 34.99	4
Tier 2	35 – 49.99	9
Tier 3	50 – 100	15

RESTRICTED

App Main Screens

Home Tab	Wallet Tab	Me Tab
Restricted for Copyright Purposes.	Restricted for Copyright Purposes.	Restricted for Copyright Purposes.

RESTRICTED

App Registration Journey – 3 Step Identity Verification (Customer and Merchant[1])

1. Set-Up Username and Password

Create a username and password[2] to register with the email addresses and phone numbers provided in the **pre-determined whitelist**

2. Two Additional Identity Verifications

OTPs are generated to verify users' email addresses and phone numbers

3. Accept T&Cs and Notices & Policies

Accept **Terms & Conditions** and **Applicable Notices and Policies** (incl. PICS) to complete registration

Restricted for Copyright Purposes.
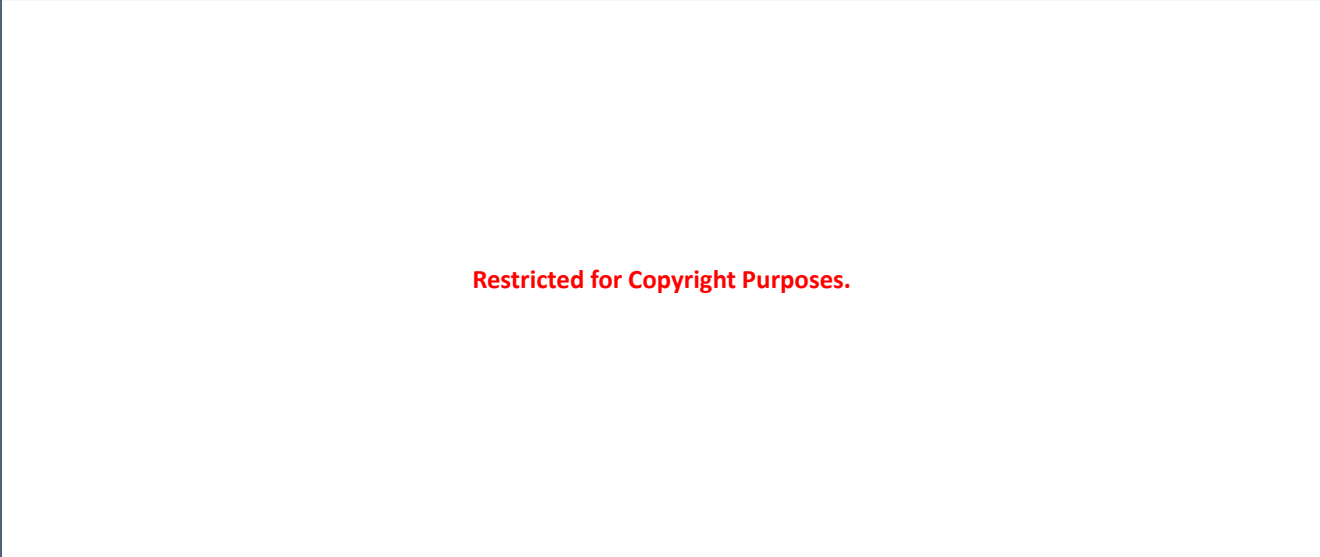
Note 1 – Each merchant can set up one wallet with a maximum of 5 cashier user profiles linked to that wallet.
Note 2 – Username must be 6-30 characters. Password must be 8-20 characters and must have at least three of the four of the following character types: upper/lower letters, number or symbols.
RESTRICTED

App Log-On Journey – 2 Step Identity Verification for (Customer and Merchant)

1. Log-On with Username and Password

Once registered, users can log on with their previously registered username and password through **App log-on page**

2. One Additional Verification

Verify **registered email <u>or</u> phone number OTP** for log-on. By logging on, users are reminded of the App T&Cs.

3. View Hyp. e-HKD Balance at Log-In[1]

View **e-HKD wallet balance** with options to **pay** (Customer only) or **receive** (Merchant only) transactions on the landing Wallet page

Restricted for Copyright Purposes.
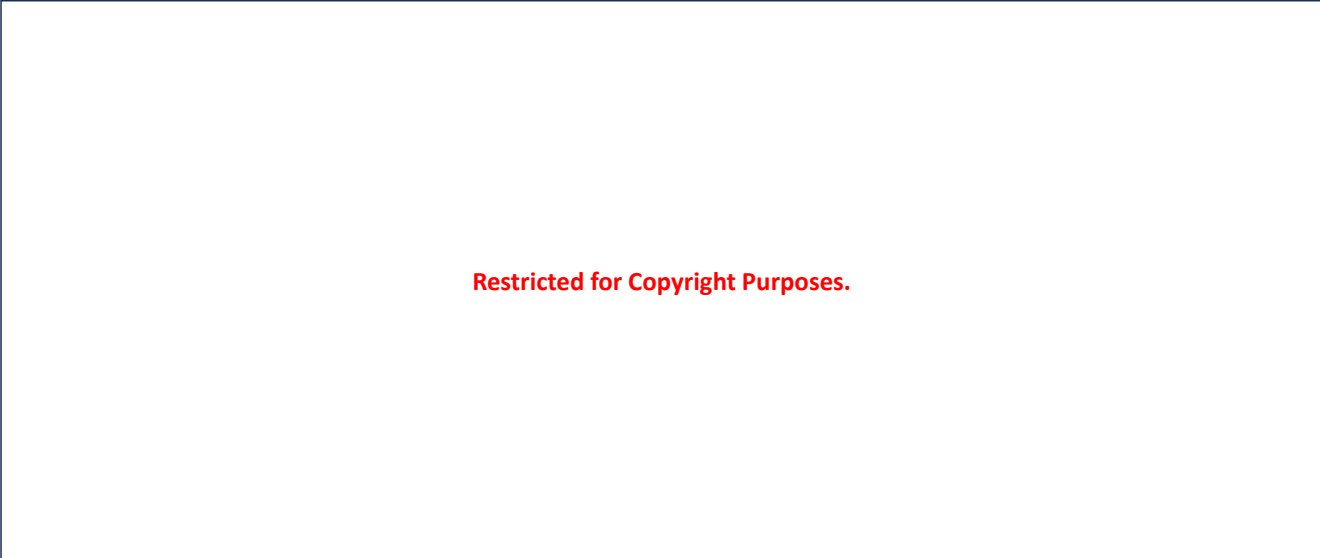
Note 1 – An app user profile (merchant or customer) can only be logged into one device at a time. If a user is currently logged on but then tries to log into a 'new' device, they will only have access through the 'new' device. The other device will be automatically logged off as the new device logs in.
RESTRICTED

Transaction Journey

Customer View

1. Accept payment by selecting **'Pay' button** on Wallet page
2. Scan merchant-generated QR code and review **e-HKD amount**
3. Confirm payment by selecting **'Pay' button**
4. **'Transaction History'** option in the top, right corner of the Successful Payment Complete page
5. Users can view all transactions including any **e-HKD Reward**

Restricted for Copyright Purposes.

Note 1 – The QR codes generated and scanned in this pilot are not static. There is a new, unique QR code generated for each individual transaction and the same QR code cannot be used for multiple transactions.
All HSBC Open Wallet images and text are the copyright of HSBC. Copyright: HSBC Group 2023. ALL RIGHTS RESERVED.

Transaction Journey

Merchant View

1. Initiate payment request by selecting **'Receive' button on Wallet Page**
2. **Enter and confirm** the payment **amount** to **generate QR code**[1]
3. Present **QR code** to **Customer** to **scan and receive payment**
4. **'Transaction History'** option available on QR code generation page
5. Users can **view all transactions** including any rewards

Restricted for Copyright Purposes.

Note 1 – The QR codes generated and scanned in this pilot are not static. There is a new, unique QR code generated for each individual transaction and the same QR code cannot be used for multiple transactions.
All HSBC Open Wallet images and text are the copyright of HSBC. Copyright: HSBC Group 2023. ALL RIGHTS RESERVED.

"Remember me" mechanism (Customer and Merchant)

"Remember me" mechanism set-up

1. **Select "Remember me"** after entering registered username
2. Enter registered **password** to log-on
3. Continue the usual log-on process with **verification** by registered email <u>or</u> phone number OTP (refer to App Log-on Journey for details)

"Remember me" mechanism – subsequent log-on

1. Enter registered **password directly** to log-on
2. Continue the usual log-on process with **verification** by registered email <u>or</u> phone number OTP (refer to App Log-on Journey for details)

Restricted for Copyright Purposes.

RESTRICTED

Reset / change password (Customer and Merchant)

Reset password in logon section

1. Select **"Forgot your password?"** to initiate password reset
2. Enter registered **email address**
3. Verify with **OTP** code sent to entered email address
4. Enter **mobile phone number**
5. Verify with **OTP** code sent to entered phone number
6. Create and confirm **new password**

Restricted for Copyright Purposes.

RESTRICTED

"FAQ" and "Help Center" Available on the 'Me' Page for Both All App Users

"FAQ"

1. Select "FAQ" on the "**Me**" screen
2. Press the desired topic to see the associated questions

"Help Center" to Directly Contact HSBC with Any Feedback or Issues

1. Select "Help center" on the "**Me**" screen
2. **Enter your message** and click **Submit**. HSBC will acknowledge messages right away and get back to you

Restricted for Copyright Purposes.

RESTRICTED

"Help Center" can also be Accessed for a Specific Transaction

"Help Center" to Directly Contact HSBC about a Specific Transaction

1. Go to **Transaction History** screen and **select t**he transaction that a query is to be raised about.
2. Select "Questions about this transaction" in the Transaction Details screen.
3. Select "Feedback to this case" from the "How can I help you?" menu
4. **Enter your message** and click **Submit**. HSBC will acknowledge messages right away and get back to you as soon as possible.

Restricted for Copyright Purposes.

RESTRICTED

Key Notes

HSBC Open Wallet App is a Secure and User-Friendly Tool

The HSBC Open Wallet App is a **secure and user-friendly** interface to make Hypothetical e-HKD CBDC payment transactions as part of this experiment.

- The only personal data HSBC requires to use the App is the HKUST email address and Hong Kong phone number that you provided when signing up for this research study, which HSBC will **secure, maintain and expunge in accordance** with local regulations and internal HSBC policies.
- Additionally, HSBC will **fully test** the App and underlying IT/blockchain architecture **prior to launch** for resilience, cybersecurity and data protection.

Your Participation is Voluntary

If you choose to participate, you will receive **100 Hypothetical e-HKD tokens**, which you can use at participating merchants during the pilot period.

- During the pilot, you may also be rewarded with **additional Hypothetical e-HKD tokens** through the Hypothetical e-HKD Rewards promotion.
- Finally, upon completion of the pre and post surveys, you will receive a **50 HKD e-voucher** to a local vendor as a token of appreciation.

You may also withdraw from this pilot and delete your App user profile at any time.

- Once withdrawn, you will not be able to re-join the pilot and will forfeit any remaining Hypothetical e-HKD tokens in your Wallets.
- HSBC will secure, manage and expunge any data at the HSBC level in accordance with local regulations and HSBC internal policies.

RESTRICTED