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Customer Adoption of Virtual Bank In Hong Kong Using UTAUT Model Integrating Perceived Risk, Trust and Price Value

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SBS-WP-2025-28

26 08 2025

ISSN (Print): xxxx-xxxx
ISSN: (Online): xxxx-xxxx

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ABSTRACT

Purpose - This research studied the driving factors for the customer adoption of virtual banks in Hong Kong using the UTAUT model, integrating perceived risk, trust, and price value. In addition, the mediation effect of trust on perceived risk on customer adoption was examined.

Design/method/approach - In this research, the sequential explanatory mixed methods design was employed to integrate the strengths of both quantitative and qualitative methods. A quantitative survey was conducted with 644 citizens in Hong Kong via an online platform, and a physical survey was used to collect the data. The survey data were then analyzed to test the hypotheses. PLS-SEM statistical procedures were used to come up with the inferential statistics. These quantitative research findings were triangulated with a case study interviewing 15 experienced banking professionals and 13 end users. A semi-structural open-ended questionnaire was published on the online survey platform Qualtrics and then distributed to the participants by an anonymous link.

Findings - The quantitative survey results showed that performance expectancy, perceived risk, trust, and price value significantly drove the behavioral intention to use virtual banks. The complementary mediation effect was suggested between perceived risk and trust. An important finding was that effort expectancy was not a significant factor in behavioral intention to use virtual banks. Six themes were grounded from the interview data that validate and triangulate the survey results related to the hypothesis.

Practical implications - The research discovers which levers have the most influence on user adoption for the virtual banks' management. Customer acquisition and promotion efforts can be designed in more precise and targeted ways. The same insights can be used in omnichannel strategies and defensive tactics for incumbent banks,. For regulators, the results related to perceived risks and trust can be used to guide public communications, consumer policies, and other regulatory initiatives.

Original/Value - This research may be the first of its kind to use the sequential explanatory mixed methods design with quantitative research first and then qualitative research to study this topic. It is also the first study that integrated the UTAUT model with perceived risk, trust, and price value to study virtual banks in Hong Kong.

Key words: Virtual Bank, Digital Bank, Digital-only Bank, UTAUT, Perceived Risk, Trust, Price Value

1. INTRODUCTION

The digital transformation of the financial industry, in the form of financial technology, or fintech, has significantly redefined financial services in the 21st century. Banks have continuously improved their forms and processes since the launch of the first automatic teller machine in 1967 in the UK, until the latest mobile banking with biometric authentication (King, 2012). The recent emergence of advanced technologies, including artificial intelligence and blockchain, as well as the COVID-19 pandemic of the last three years, has dramatically accelerated the application and adoption of fintech. The customer behavior regarding the adoption of fintech is thus of increasing interest to the industry stakeholders.

Many adoption models of technology have been proposed and researched (Davis, 1985; Featherman & Pavlou, 2003a; Min et al., 2008; Rogers, 2003; Venkatesh et al., 2003, 2012; Venkatesh & Bala, 2008; Venkatesh & Davis, 2000). However, no universally applicable theoretical framework has been identified. One of the significant areas of interest for technology adoption studies is e-services (Featherman & Pavlou, 2003). In the banking and financial services industry, the e-services to consumers are e-banking or digital banking. In one of the key focus areas of banking, specifically digital banks, the influencing factors have a diverse range and vary across time and countries.

In the late 1990s, during the internet and dot.com boom, many traditional industries and companies rushed into e-commerce and internet services. Financial institutions and banks also joined this e-commerce evolution. Banks began to offer internet banking to consumers for better customer service with more real-time, 7x24, and easily accessible services via the internet channel (Cronin, 1998; Egland et al., 1998). By introducing and applying internet technology, banks enabled consumers via internet banking to self-service and self-operate, including enquiries about accounts, checking of statements, and performing transactions.

User adoption of internet banking services became a research area of interest since then (Chang, 2003; M.-C. Lee, 2009; Tan & Teo, 2000; Y. Wang et al., 2003).

In the US, the introduction of internet banking first appeared in the mid-90s, given the technological advancements and business benefits. In Hong Kong, however, banks have been slow in adopting and providing internet banking to their customers. So, internet banking has not taken off very quickly there. Nevertheless, research studies on user adoption of internet banking in Hong Kong grew in numbers (Chan & Lu, 2004; Cheng et al., 2006; Wan et al., 2005; Yiu et al., 2007). In Asia, internet banking was first launched only recently. Then alongside came a wealth of studies on the adoption of internet banking in Asia (Chang, 2003; Ivanova & Kim, 2022; Lee, 2009; Naeem, 2020; Nayanajith et al., 2019; Nayanajith & Damunupola, 2019; Oly Ndubisi & Sinti, 2006; Rahi et al., 2019; Wang et al., 2003).

In the 2010s, benefited by the proliferation of smartphones, the wide implementation of 3G mobile networks, the rapid evolution of mobile commerce, and the advanced developments of mobile technologies such as biometric authentication, banks started to extend their online banking services from internet banking to mobile banking (Barnes & Corbitt, 2003; Krugel, 2007). Mobile banking became an increasingly important channel of banking services. In emerging markets, mobile banking will probably emerge as the primary channel to facilitate "financial inclusion" (Asfaw, 2015; Siddik et al., 2014; Singh et al., 2014). On the other hand, mobile banking provided a better customer experience than internet banking because smartphones, together with mobile data networks, enabled banking services to be accessed anytime, anywhere via mobile applications (Fenu & Pau, 2015).

In China, the internet user population is nearly one billion, with 99.7% accessing the internet via mobile devices (China Internet Network Information Center, 2021). Coupled with the emerging dominance of mobile banking, there were many research studies on user adoption of mobile banking from the perspectives of China and Taiwan since the early years

(Akhtar, Irfan, Sarwar, et al., 2019; Deng et al., 2010; Ho et al., 2020; Luarn & Lin, 2005; Siyal et al., 2019; Zhou et al., 2010; Zhou, 2012). In fact, in other countries, studies on user adoption of digital banking in recent years are also predominantly about mobile banking (KA & Subramanian, 2022; Kumar et al., 2023; López-Rodríguez & Cardozo-Munar, 2023; Sandhu et al., 2022; Saxena et al., 2022). In Hong Kong, however, the development and adoption of mobile banking lagged behind that of China. So, there were very few, if any, research studies on mobile banking in Hong Kong.

Virtual banks, or digital-only banks, are strategically important globally, not just in Hong Kong, in areas of financial inclusion, cost efficiency, and fintech innovations. In developing countries, virtual banks help to bridge the banking services gap of unbanked populations, estimated to be 1.4 billion adults (Demirgüç-Kunt et al., 2022, p. 31). They offer mobile-first or mobile-only solutions to bypass the financial infrastructure barriers. And yet, digital-only banks have completely different and disruptive business models from internet and mobile banking by traditional banks (Orăștean, 2018; Sibanda et al., 2020). They are usually new financial institutions that start from scratch without legacy systems, processes, and forms (King, 2018). For example, Nubank in Brazil and Paytm Payments Bank in India provide access to savings and lending services in rural areas and hence increase financial inclusion (Frost et al., 2019). In developed countries, fintech companies, such as fintech credit, drive operational efficiency and reduce costs compared to traditional banks with a brick-and-mortar model (Frost et al., 2019). They also embrace fintech innovations, including AI fraud detection and blockchain settlement, that help to revamp global payment systems (Gomber et al., 2018). Thus, virtual banks are not only local disruptors but also pivotal actors in achieving global financial accessibility goals.

In Hong Kong, the bank regulator, the Hong Kong Monetary Authority (HKMA), announced the introduction of virtual banks in 2017 as one of their initiatives in "A New Era

of Smart Banking" (Hong Kong Monetary Authority, 2017). In 2019, HKMA granted applicants eight virtual bank licenses, all of whom commenced business in 2020 (Goncalves, 2019; Hong Kong Monetary Authority, 2019). It was the same year the COVID-19 pandemic started, and the digital adoption accelerated. By the end of 2023, the total number of depositors reached 2.2 million for the eight virtual banks, the total deposits were HK$37.5 billion, and the total loans and advances were HK$19.5 billion (Hong Kong Monetary Authority, 2024a). However, none of the eight virtual banks achieved a full-year net profit. One of the possible reasons for the lack of net profit may be that the virtual banks' customers maintain shallow relationships only, for example, the average deposit is only HK$17,000 per customer. It may be affected by the lack of trust with the newcomers compared to the incumbent banks. It showed the strategic importance of increasing customer take-up to sustainable profits.

The HKMA then issued on 14 October 2024 the consultation conclusion on the proposed renaming of "Virtual Bank" (Hong Kong Monetary Authority, 2024b). The consultation received responses from a total of 5 institutional respondents and 21 individual respondents. In the conclusion report, it is stated that most respondents back the proposal to rename the term "Virtual Bank" and a larger part of the respondents went for the terminology "Digital Bank". Besides renaming virtual banks, the HKMA concluded in the report that it would also revise the "Guideline on Authorization of Virtual Banks" accordingly.

When first promoting the virtual banks, the HKMA on 30 May 2018 issued the "Revised Guideline on Authorization of Virtual Banks" (Hong Kong Monetary Authority, 2018), which was further revised on 25 October 2024 as "Guideline on Authorization of Digital Banks" to reflect the change of name and some principles of business (Hong Kong Monetary Authority, 2024c). In the version of the guideline, besides the change of taxonomy from "virtual bank" to "digital bank", one of the major revisions was that digital banks were

allowed to have physical branches in Hong Kong. This change in the business model implied that the delivery channels of banking services of digital banks changed from exclusively on digital channels to primarily on digital channels.

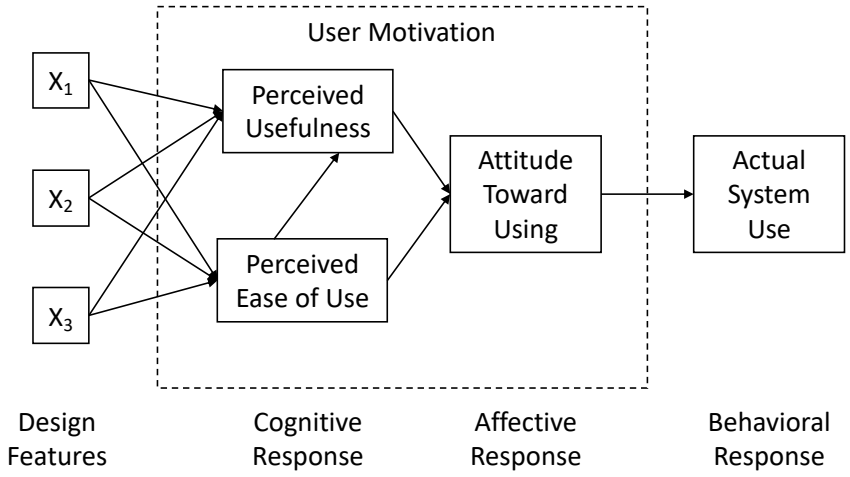
Since digital-only banks are a relatively new topic in the banking industry, there has been less prior research and studies on them compared to internet banking, mobile banking, and e-banking. There are some studies on digital-only banks in Europe, including the UK and Poland (Ndlovu et al., 2024; Schmidt-Jessa & Stradomski, 2023), in South Africa (Cele, 2023; Nel & Boshoff, 2021), in India (Bhatnagr & Rajesh, 2023; Taneja et al., 2024), in Indonesia (Putra et al., 2022; Yusfiarto et al., 2024), and in Korea (Jung & Cho, 2018; Kim & Bae, 2020; K.-Y. Lee & Park, 2022). Nevertheless, there are none in Hong Kong. This presents a research opportunity in Hong Kong for newly licensed virtual or digital banks because the subject is new to the market, and no related research has been conducted yet. This research project aims to address this research gap.

2. LITERATURE REVIEW

2.1. Technology Acceptance Model (TAM)

The research of the Technology Acceptance Model (TAM) originally referred to end-user systems used directly by members of organizations to support their work and assessed whether the users used the systems. It was developed based on a psychology model of human behaviors (Fishbein, 1967) and surveyed 100 organizational users to test the hypothesis. TAM was hypothesized that the users' actual usage of the system was caused by their attitude toward using the system. Attitude toward using was a function of two factors: perceived usefulness (PU) and perceived ease of use (PEOU). In another research by Davis (Davis, 1989), a regression test showed that PEOU was an antecedent of PU, instead of only a parallel antecedent of attitude toward using. Design features were factors that determined PU and PEOU.

Figure 1: Technology Acceptance Model (Source: Davis, 1985, p.24)



2.2. Extended Technology Acceptance Model (TAM2)

In another research of Venkatesh and Davis, additional antecedents of PU and attitude toward using, or usage intentions, were added to an extension of the Technology Acceptance Model, which is referred to as TAM2 (Venkatesh & Davis, 2000). Two antecedents, social influence and cognitive instrumental processes, were identified for PU and usage intentions. Social influence processes included subjective norm, voluntariness, and image. Cognitive instrumental processes included job relevance, output quality, result demonstrability, and PEOU. Both processes were suggested to have a significant influence on user acceptance. This extension of the model helped subsequent researchers to understand more about user adoption.

With additional factors, this extension addressed the issue of only positive utility factors in the original TAM. The two factors are supplemented in the social and cognitive areas. However, the TAM2 still lacked the negative factors that impacted user adoption of technology. These might include some common user concerns about changes or adopting new technologies, such as potential financial loss or costs, physical risks or harms, data security or privacy, customer support and help, opportunity costs or gains switched from existing technologies, sustainability or continuity of the new technologies. All these factors

were examples that could even lead to the failure of new technologies because they hindered users' acceptance.

2.3. Technology Acceptance Model 3 (TAM3)

The Technology Acceptance Model 3 (TAM3) is the most comprehensive evolution of the TAM family. It integrates the social-influence extensions of TAM2 with the computer-self-efficacy stream of research (Venkatesh & Bala, 2008). In TAM3, it is still perceived usefulness and perceived ease of use that drive behavioral intention. However, the two core constructs are further broken down into a more comprehensive set of antecedents. Subjective norms, image, job relevance, output quality, and result demonstrability drive perceived usefulness. Perceived ease of use is driven by computer self-efficacy, perceptions of external control, computer anxiety, computer playfulness, perceived enjoyment, and objective usability (Venkatesh & Bala, 2008; Venkatesh & Davis, 2000). By modelling both anchors, such as pre-formed beliefs, and adjustments, such as experience-based updates, TAM3 explains how user perceptions evolve. It offers more dynamic views on technology adoption than earlier TAM versions.

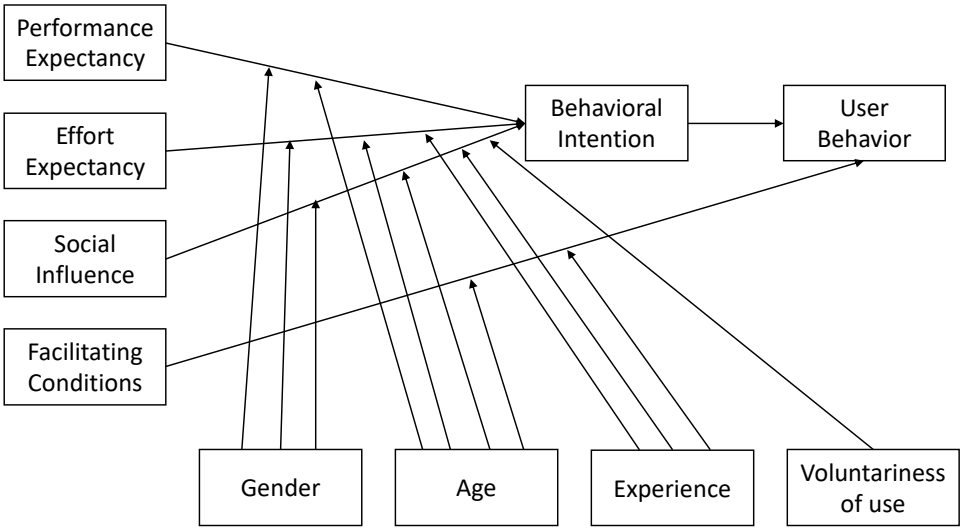
2.4. Unified Theory of Use of Acceptance of Technology (UTAUT)

The Unified Theory of Use of Acceptance of Technology was extended from TAM with a combination of four factors: performance expectancy, effort expectancy, social influence, and facilitation conditions (Venkatesh et al., 2003). UTAUT was constructed on the review of eight precedent theories and models: the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), the Technology Acceptance Model (TAM) (Davis, 1985), the Motivational Model (MM) (Davis et al., 1992), the Theory of Planned Behavior (TPB) (Ajzen, 1991), the Model of PC Utilization (MPCU) (Thompson et al., 1991), the Innovation Diffusion Theory (IDT) (Rogers, 2003), the Social Cognitive Theory (SCT) (Bandura, 1986) and a combined model of the Technology Acceptance Model and the Theory of Planned Behavior (C-TAM-

TPB) (Taylor & Todd, 1995). UTAUT was formulated and tested on the original data of the eight previous models, and the performance was found to be superior to that of the eight individual models.

Performance Expectancy was defined as "how much an individual believes that using the system will help him or her to attain gains in job performance." One of the constructs of Performance Expectancy was thus Perceived Usefulness of TAM. Effort Expectancy was defined as "how easy it is associated with the use of the system." Apparently, Perceived Ease of Use of TAM constitutes the constructs of Effort Expectancy. Social Influence was defined as "how important an individual perceives that others believe he should use the new system." Subjective Norm in TAM and many other theories represents Social Influence. Facilitation Conditions were defined as "how much an individual believes that an organizational and technical infrastructure exists to support use of the system." One of the constructs of Facilitation Conditions was Perceived Behavior Control of combined TAM and TPB, and many other theories. On top of the above four factors, UTAUT also had four moderating factors, including Gender, Age, Experience, and Voluntariness of Use, as shown in the figure below. These moderating factors explained the difference across different demographic segments and strengthened the explanatory power of UTAUT.

Figure 2: Unified Theory of Use of Acceptance of Technology (Source: Venkatesh et al., 2003, p.447)



2.5. Extended UTAUT (UTAUT2)

The Extended Unified Theory of Acceptance and Use of Technology (UTAUT2) extends the original UTAUT by integrating it with three new determinants: hedonic motivation, price value, and habit. It enriches the model for consumer-facing technologies while retaining age, gender, and experience as moderators for each path (Venkatesh et al., 2012). In UTAUT2, not only do performance expectancy, effort expectancy, social influence, and facilitating conditions (as in UTAUT) influence behavioral intention. Also, include psychological factors such as the intrinsic enjoyment users derive from the technology, their cost–benefit assessment, and the automaticity of repeated use. Empirical validations across mobile payments and smart-home devices show that these added constructs significantly improve explanatory power. The variance explained in behavioral intention by UTAUT2 often raises a substantial percentage compared with UTAUT. It underscores the extended model's value for predicting consumer adoption in digitally saturated markets.

2.6. Comparison of TAM and UTAUT

A thorough review of the literature shows that the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) are the two main models used to study user adoption of digital banking. In earlier research, TAM was the primary framework, especially in studies of internet banking services (Hanafizadeh et al.,

2014; Naeem et al., 2022; Tam & Oliveira, 2017). Over the past decade, particularly in research on mobile banking adoption, UTAUT and its components have become the dominant theoretical models (Baptista & Oliveira, 2016; Jadil et al., 2021). Additionally, among these two models, UTAUT is generally viewed as a more comprehensive framework for analyzing user acceptance of digital banking. However, some systematic reviews indicate that the reliance on TAM and UTAUT results in homogenization and a lack of innovation and new insights in e-banking adoption studies (Souiden et al., 2020). This overreliance might hinder progress and the development of new knowledge and theories in this field. Consequently, the dominance of TAM and UTAUT in research often leads to repetitive content and limited variation across many papers.

2.7. Perceived Risk

On top of these base models, many researchers apply additional constructs to improve the overall explainability and interpretability of research models for user adoption of digital banking. One of the most commonly used extended factors is perceived risk (Bhatnagr & Rajesh, 2023; Giovanis et al., 2019; Li et al., 2021; Souiden et al., 2020). In the context of e-services, Perceived Risk was defined as "the potential for loss in the pursuit of a desired outcome of using an e-service." (Featherman & Pavlou, 2003). In related research, Perceived Risk was classified with six dimensions: security/privacy, financial, social, time/convenience, performance, and psychological risks (Cunningham, 1967; Featherman & Pavlou, 2003; Lee, 2009; Lu et al., 2005). The six risk dimensions are generally aggregated into the variable Perceived Risk, which is built as a negative factor. Researchers argued that while positive factors like perceived usefulness or effort expectancy are significant to customers' adoption, perceived risk is more important to the customers' continuation to use. In the case of online services, researchers concluded that customers were more concerned about cybersecurity and data privacy risks (Khedmatgozar & Shahnazi, 2018; Li et al., 2021). It was also mentioned

that the customers' lack of digital literacy and the rise of online fraud affect their perceived risk (Bhatnagr & Rajesh, 2023).

2.8. Trust

Another construct usually used with TAM and UTAUT is trust. Trust has been used as an essential construct since early research on customers' adoption of mobile banking (Lin, 2011; Masrek & Khairuddin, 2012; Zhou, 2012). And it is still being used in more recent research on customers' adoption of mobile banking as well as digital-only banks (Akhtar, Irfan, Kanwal, et al., 2019; Aldammagh et al., 2021; Tosun, 2020; Zhang et al., 2018). Studies of research on mobile banking adoption also pointed out that trust, including initial trust, is influential in the behavioral intention to use mobile banking (KA & Subramanian, 2022). With trust, customers tend to overweigh the benefits to the risks. Therefore, trust decreases customers' perceived risk and uncertainty about the services and increases the intention to use. In particular, trust is essential in the banking relationship, and customers need to trust banks before using their services (Tosun, 2020). Unlike traditional and established banks, digital-only banks are new business models and new companies to customers, and trust is suggested to be an essential factor for customer adoption. For internet-only banks in China, the study suggested that the behavioral intention of customer adoption is significantly driven by trust (Zhang et al., 2018). It is also suggested that customer trust in the big tech enterprises that founded and control these internet-only banks is transferred to the trust in the latter.

2.9. Price Value

Price value is seen as an additional construct to the TAM and UTAUT models in research papers but is less frequently used compared to perceived risk and trust. Price value is defined as, in the context of cognitive decision making, an individual performs a systematic assessment of the perceived benefits vis-à-vis the costs in monetary terms when adopting a

new technology (Brown & Venkatesh, 2005; Dodds et al., 1991). Price or costs are added in the UTAUT frameworks because consumers always consider price or costs that directly impact them when adopting and purchasing new technologies (Venkatesh et al., 2012). Studies have reported findings that the costs or fee structures significantly affect the customer adoption of mobile banking (Owusu Kwateng et al., 2018; Venkatesh et al., 2012). However, this result does not hold across countries because in some countries mobile banking comes with low cost or is free, while in others it is chargeable (Merhi et al., 2019). And besides cultural differences, some studies showed that within the same country, specific genders and ages have higher concerns about price value for the adoption of mobile banking (Merhi et al., 2020). So, it gives managers more insights into promoting mobile banking services with target marketing.

2.10. Research Gaps

Although both TAM and UTAUT are the predominant frameworks in the research of customer adoption of digital banking and digital-only banks, the former was more heavily used in older works and less in recent works. In some earlier papers, TAM had been criticized as being "overworked" by researchers, and it was recommended to work in new directions (Bagozzi, 2007; Goodhue, 2007). As the kind of technologies and their business applications grow more and more diversified, a more universal framework, such as UTAUT, would be more appropriate. In fact, research in recent years that employed UTAUT outnumbered those that used TAM. Therefore, it is proposed to extend the UTAUT theoretical framework with additional constructs, including perceived risks, trust, and price value, to study the customer adoption of virtual banks in Hong Kong. It is because most research on customer adoption of mobile banking applying the UTAUT framework is extended only with perceived risk and/or trust (Hanif & Lallie, 2021; Ivanova & Kim, 2022; Kumar et al., 2023; Malik, 2020; Mer &

Virdi, 2021). So there exists a research opportunity to integrate the UTAUT model with all the perceived risk, trust, and price value.

On the other hand, the research gap is that there are fewer studies on customer adoption of digital-only banks, which are far fewer in quantity compared to e-banking, internet banking, and mobile banking. There has not been any research on customer adoption of virtual banks in Hong Kong. One of the reasons is that virtual banks in Hong Kong are relatively new, even in the digital-only banks arena, with only four years of operations since their commencement of business in 2020. Another reason is that there were very few studies on customer adoption of e-banking in Hong Kong, and the latest one was dated 2010 (Chan & Lu, 2004; Cheng et al., 2006; Cheng & Yeung, 2010). The lack of interest of researchers may be because more research is being done on the monetary policy of Hong Kong (Fry, 2019; Greenwood, 2022; Phan et al., 2019).

3. RESEARCH METHODOLOGY

3.1. Research Design

In this research, the sequential explanatory mixed methods design was employed to integrate the strengths of both quantitative and qualitative methods. The project began with a quantitative method phase to test UTAUT-derived hypotheses, followed by a qualitative method phase to expand and explore the initial results, findings, and anomalies (Creswell & Creswell, 2017; Punch, 2016, p. 81; Saunders et al., 2019, p. 182).

In the quantitative phase of this research, a cross-sectional survey was conducted to form the quantitative foundation of this study. The research instrument used in this project is a self-administered structured questionnaire (Bougie & Sekaran, 2019, p. 105; Collis & Hussey, 2021, p. 205). The survey operationalizes core constructs from UTAUT, alongside the integrated variables of perceived risk (Bhatnagr & Rajesh, 2023), trust (Kumar et al., 2023), and price value (Owusu Kwateng et al., 2018). Items are measured using 7-point Likert scales

to enhance discriminant validity and reduce central tendency bias (Dillman, 2011). To ensure the reliability and validity of the questions, the questionnaires from the reviewed literature will be referred to.

In the quantitative phase, individual interviews were conducted to collect feedback. A semi-structured questionnaire with open-ended questions was used as the interview instrument of the case study. The semi-structured questionnaires were sent to the invited respondents using an anonymous link to Qualtrics, an online survey platform. No personally identifiable information was collected on the questionnaire to ensure all responses were anonymous and confidential. This research's qualitative case study adopted a purposeful sampling approach to ensure the inclusion of information-rich cases (Palinkas et al., 2015; Patton, 2014). The selection criteria of the first group prioritized professionals in virtual banks and traditional retail banking roles, which are crucial to this case study. As the second group, samples of end users were invited to participate in the case study interviews. The primary purpose is to explore more diverse voices in qualitative research. By incorporating the perspectives from end users, the results provide richer and more balanced viewpoints and can effectively mitigate the research limitation of sample bias.

3.2. Sampling Method

The research population of this research is refined to those eligible and capable of using a virtual bank in Hong Kong, within the whole population of Hong Kong. Therefore, it is proposed to define it as all the adults aged between 15 and 64 in Hong Kong. In the statistical reports by Census and Statistics Department of The Government of HKSAR, aged 65 and over is defined as “elderly dependency” and therefore may not be applicable to the study of the adoption of virtual banks in Hong Kong. So the mid-year population by age group of 15 – 64 is proposed to define the research population of this research, and it counts to 5,257,500 in 2023 (Census and Statistics Department, HKSAR, 2024, p. 5).

This research uses Structural Equation Modeling (SEM) to validate the hypotheses (Sarstedt & Mooi, 2014). Of the two SEM methods, PLS-SEM is used because it has the advantage of using a small sample size to determine parameter estimates and thus verify the research model (Jhantasana, 2023; Kock & Hadaya, 2018). It is more robust because it prioritizes prediction over model fit (J. F. Hair et al., 2017). In PLS-SEM, a prominent "10-times rule" states that the minimum sample size should be 10 times the maximum number of structural paths directed at a construct (J. F. Hair et al., 2017). Since there are a maximum of 5 arrows leading to the latent variable in the PLS-SEM model, the minimum sample size will be 50. Another is referred to as the "minimum R-squared method" (Hair et al., 2017; Kock & Hadaya, 2018), which was established on the power table of least squares regression and three factors, namely, the maximum number of structural paths directed at a construct, the significance level, and the statistical power (Cohen, 1992). According to the table of "minimum R-squared method", with a maximum of 5 arrows leading to the latent variable in the PLS-SEM model, a significant level of 0.05, effect size R^2 of 0.25, and statistical power of 0.8, the minimum sample size should be 70.

Although the minimum sample sizes estimated are 50 and 70, respectively, for higher significance and as the literature recommends, the minimum sample size for this research was set at 100 to 200.

3.3. Data Collection

In the quantitative research, a probability sample approach is approximated by combining randomization, multiple channel recruitment, and a non-probability stratified convenience approach (Vehovar et al., 2016). This sampling design aims to balance practicability with statistical inference by leveraging randomization at important steps to mitigate the risks of selection bias. Multiple channel recruitment with randomization is used to spread the sample as broadly as possible and approximate the population distribution. The

data are collected in three randomized channels, including finance and industry associations, social media platforms, and public spaces.

Multiple-channel recruitment with randomization was implemented. Both online questionnaires were conducted via the online survey platform “Qualtrics” and in-person surveys. The entire data collection effort was completed in the first quarter of 2025. In total, eight survey assistants and the author participated in the data collection process. They conducted street intercept surveys at different districts in Hong Kong (including from Hong Kong Island, Kowloon, and New Territories regions) at randomized times, including a combination of different days of the week, that is, weekdays and weekends, and different times of the day, including morning, afternoon, and evening (Vehovar et al., 2016).

Before starting the fieldwork, the author briefed all survey assistants. The agenda included the survey background, instructions, and, most importantly, the ethical requirements for conducting the survey, which encompassed voluntary participation, anonymity, confidentiality, and the collection of no personally identifiable information.

In the qualitative research case study, the finalized questionnaire was published on the online survey platform Qualtrics and then distributed to the participants by an anonymous link. In the version of the questionnaire for banking professionals, only the years of banking experience, working experience with virtual banks, traditional banks, or both, and the areas of banking experience were asked for and collected. In the version for end users, only gender, age range, education level, and which virtual banks were used were asked and collected. No personal identifiable information (PII) was collected, and the whole interview process remained anonymous and confidential.

3.4. Data Analysis

For the quantitative results, statistics software SmartPLS version 4 was used to analyze the data in two steps. The first step was to assess the measurement model to ensure its

reliability and validity. Cronbach's alpha and composite reliability were calculated to confirm internal consistency. The average variance extracted (AVE) was calculated to validate the convergent validity (Fornell & Larcker, 1981). The Fornell-Larcker criterion, where AVE is greater than squared inter-construct correlations, and the heterotrait-monotrait ratio were calculated to verify discriminant validity (Henseler et al., 2015).

The second step was to evaluate the structural model by calculating the hypothesized relationships. These include the standardized path coefficients (β) and their statistical significance. R^2 value of the model was calculated to quantify the explanatory power as weak (0.25), moderate (0.5), or strong (0.75) based on benchmarks (Cohen, 1992). Effect sizes (f^2) were also calculated to classify predictors' substantive impacts as small (0.02), medium (0.15), or large (0.35).

For the qualitative results, thematic analysis was used for data analysis. The advantages of this method are its flexibility with methodological rigor in identifying and analyzing themes in the textual data (Braun & Clarke, 2019). Qualitative research software Taguette was used for the execution of thematic analysis. The standard "Bruan and Clarke" six-step process was followed and executed, including familiarization, initial coding, theme development, theme review, theme definition, and reporting (Christou, 2022; Maguire & Delahunt, 2017; Peel, 2020).

3.5. Research Model and Hypotheses

The research employs an extended Unified Theory of Acceptance and Use of Technology (UTAUT) framework, integrating the core predictors of Performance Expectancy (PE) and Effort Expectancy (EE) with three additional contextually critical constructs: Perceived Risk (PR), Trust (TR), and Price Value (PV). As detailed below, this selective model adaptation as to which factors to include and exclude is justified theoretically and contextually.

3.5.1. Core UTAUT Foundations: Performance Expectancy (PE) and Effort Expectancy (EE)

Both Performance Expectancy (PE) and Effort Expectancy (EE) represent fundamental cognitive mechanisms in technology adoption (Venkatesh et al., 2003). PE captures the perceived utility of a technology in enhancing task performance, while EE reflects the anticipated ease of interaction. These constructs are universally crucial in most FinTech adoption contexts, including mobile banking and mobile payment, in which functional efficiency and user experience are users' top priorities (Alalwan et al., 2017; Zhou, 2012). Basically, nearly all online banking adoption studies that apply the UTAUT model or its variants hypothesize PE and EE as the core factors. Those include papers on e-banking in India (Mer & Virdi, 2021), e-banking in Zimbia (Daka & Phiri, 2019), digital banking in Vietnam (Nguyen et al., 2020), mobile banking in Pakistan (Raza et al., 2019), mobile banking in Mongolia (Ivanova & Kim, 2022) and mobile banking comparison of China and Pakistan (Akhtar, Irfan, Kanwal, et al., 2019). For research on digital-only banks, these same hypotheses still hold, including that on neobank in India (Bhatnagr & Rajesh, 2023; Taneja et al., 2024), internet-only bank in Taiwan (Lee & Kang, 2021), and internet-only bank in Korea (Kim & Bae, 2020).

Given the robust explanatory power of PE and EE across financial technology, such as mobile payment, on top of mobile banking and virtual banks, their inclusion provides a theoretically anchored baseline for understanding behaviour intentions of user adoption (Alkhowaiter, 2020; Taneja et al., 2024; Tang et al., 2021; Wang & Yi, 2012). Their retention aligns with UTAUT's core proposition that perceived benefits and usability are primary drivers of behavioural intention (BI).

3.5.2. Exclusion of Facilitating Conditions (FC)

Facilitating Conditions (FC) is defined as the degree to which an individual believes that organizational and technical infrastructure exists to support the use of the system (Venkatesh et al., 2003). It is excluded for strong contextual reasons. In the user adoption of virtual banks in Hong Kong, FC is rendered insignificant because of the ubiquity of modern technologies. Access to virtual bank services in Hong Kong only requires a smartphone and internet connectivity. These resources are now ubiquitous among the Hong Kong population (Census and Statistics Department, HKSAR, 2024, p. 193). Moreover, the data collection methodology of this study included an online questionnaire platform, which ensured the respondents possessed these prerequisites before participating in the survey.

Many studies on user adoption of digital banking and digital-only banking also support the insignificant effect of FC. Some of the examples are that on digital banking in Indonesia (Rahardhan & Legowo, 2024) and in Vietnam (Nguyen et al., 2020), digital-only banks in the UK (Ndlovu et al., 2024) and in India (Taneja et al., 2024). Consequently, FC variability is minimized, diminishing its discriminant power in predicting BI. Prior research notes that FC's significance attenuates when infrastructure barriers are negligible (Baptista & Oliveira, 2015). Including it would thus contribute slight explanatory variance while unnecessarily complicating the model and lengthening the questionnaire.

3.5.3. Exclusion of Social Influence (SI)

Social Influence (SI), the extent to which users perceive that important others believe they should use a system, was omitted based on the distinctive nature of financial decision-making. SI represents "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003, p. 451). It was excluded based on the personal and private nature of financial decision-making. Personal finance and investment activities are inherently private and involve high personal stakes (e.g.,

asset security, long-term planning). Unlike enterprise technology adoption or social media platforms, where peer influence plays a significant role, financial management and investment decisions are typically characterized by individual autonomy and privacy concerns. In an early and most cited study of mobile banking adoption in Mozambique, Africa, results did not confirm the impact of social influence on behavioral intention, even though Mozambique is a collectivist and high power distance society (Baptista & Oliveira, 2015). In another study of mobile banking adoption in a European country, Portugal, with a sample size of 194 individuals, results also showed that social influence has no significant effect on behavioral intention (Oliveira et al., 2014). The interpretation of such results was that mobile banking is private and confidential. Confidentiality and security outweigh the desire to show off and impress others. Even for mobile payment adoption, an earlier study in China supported that social influence was not significant on behavioral intention (Wang & Yi, 2012).

Empirical studies support that SI often demonstrates non-significant effects on mobile banking adoption relative to cognitive factors like trust and perceived risk (Alalwan et al., 2017; Oliveira et al., 2014). In user adoption of virtual banks, where decisions revolve around personal financial management, intrinsic factors outweigh normative pressures. More recent studies support the non-significance of SI towards BI of adoption of online banking services, such as digital banking in Nepal (Nepal & Nepal, 2023), Vietnam (Nguyen et al., 2020), and Indonesia (Rahardhan & Legowo, 2024), e-banking in Zimbia (Daka & Phiri, 2019), and mobile banking in Pakistan (Raza et al., 2019).

3.5.4. Contextual Imperatives: Integrating PR, TR, and PV

The inclusion of Perceived Risk (PR), Trust (TR), and Price Value (PV) is paramount for capturing fintech users' adoption behavioural intention. The contextual details are mentioned below.

3.5.5. Perceived Risk (PR)

Perceived risk (PR) is defined as “an uncertainty regarding possible negative consequences of using a product or service”. Financial transactions inherently contain uncertainty about potential losses (e.g., internal and external fraud, data breaches, investment volatility). Studies support that PR is thus a critical barrier in e-services, which include online financial services (Featherman & Hajli, 2016; Featherman & Pavlou, 2003). Virtual banks in Hong Kong intensify these concerns due to the absence of physical branches and extensive use of technologies in banking service distribution. It means they have more risk factors, such as AML risk and technology risk, than incumbent banks. This makes PR a must-have factor on online banking and even more for virtual banks in Hong Kong (Luo et al., 2010).

Numerous studies support the significant effect of PR on user adoption of online banking. They range from research on internet banking in Taiwan (Lee, 2009) to those on mobile banking in Jordan (Alalwan et al., 2016), online banking in India (Kaur & Arora, 2020), mobile banking in Vietnam (Van et al., 2020), digital banking in Indonesia (Rahardhan & Legowo, 2024). Studies on digital-only banks also confirm the significance of PR, such as that on internet-only banks in Korea (Jung & Cho, 2018), digital banks in Indonesia (Putra et al., 2022), digital-only banks in South Africa (Cele, 2023), neo banks in India (Bhatnagr & Rajesh, 2023; Taneja et al., 2024), Integration of PR in the model directly addresses virtual banks’ trust deficit challenge.

3.5.6. Trust (TR)

Trust (TR) is the fundamental requirement for confidence in online service providers and their technological platforms (McKnight et al., 2002). TR, therefore, represents another critical additional factor to the user adoption of virtual banks in Hong Kong. The intangible nature of virtual banks' digital banking services, compounded with the absence of physical presence, puts trust a high priority because users must rely on virtual banks to safeguard their

financial assets and personal information (Patil et al., 2020). Therefore, TR has been consistently supported as a key factor of user adoption of digital banking across multiple studies and cultural contexts. Some of the examples included studies on mobile banking in China (Akhtar, Irfan, Kanwal, et al., 2019), digital banking in Vietnam (Nguyen et al., 2020), e-banking in India (Mer & Virdi, 2021), and digital banking in Pakistan (Tariq et al., 2024). In the context of digital-only banks, much research also supported TR as significant to user adoption, including those on internet-only banks in Korea (Jung & Cho, 2018), digital-only banks in Malaysia (Saif et al., 2022), neo banks in India (Taneja et al., 2024), and digital-only banks in the UK (Ndlovu et al., 2024).

Because of the nature and definitions, PR always goes together with TR. Risk is a factor that erodes trust and, therefore, indirectly affects the user adoption of digital banking services. Various studies supported the positive moderation relationship between perceived risk and trust in BI to use online banking. Some examples are research in internet banking in Iran (Damghanian et al., 2016), mobile banking in Vietnam (Van et al., 2020), online banking in India (Kaur & Arora, 2020), and mobile banking in Malaysia (Sandhu et al., 2022). Even in the specific segment of digital-only banks, examples are plentiful, such as those on internet-only banks in Korea (Jung & Cho, 2018), digital banks in Indonesia (Putra et al., 2022), and neo banks in India (Taneja et al., 2024).

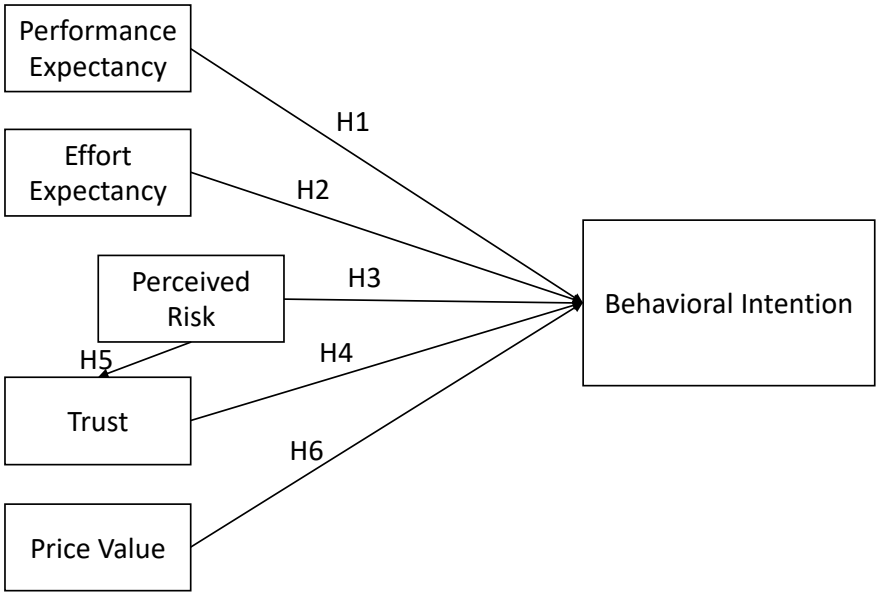
3.5.7. Price Value (PV)

In extended UTAUT or UTAUT2, the construct Price Value (PV) is defined as the trade-off between perceived benefits and monetary costs (Venkatesh et al., 2012). It is deemed essential for virtual bank users' adoption because users evaluate fees, interest rates, and transaction costs against service benefits. Unlike other consumer technologies, where price sensitivity may be secondary, decisions on digital banking services selection often involve direct comparison of fees, transaction costs, and value propositions against traditional

financial services. Studies from different regions and cultures support that PV is significant in driving user adoption of digital banking. Examples are research on mobile banking adoption in Pakistan (Raza et al., 2019), Iran (Farzin et al., 2021), Jordan (Alalwan et al., 2017), and England (Merhi et al., 2019). Studies on digital-only banks also support the same, such as that on internet-only banks in Korea (Lee & Park, 2022), neo bank in India (Bhatnagr & Rajesh, 2023), digital-only banks in Malaysia (Saif et al., 2022) and South Africa (Cele, 2023).

The research model and hypotheses of this study are as follows:

Figure 3: Research Theoretical Model (Source: Author)



$H1_0$: Performance Expectancy does not affect behavioral intention to use virtual banks

$H1_a$: Performance Expectancy affects behavioral intention to use virtual

$H2_0$: Effort Expectancy does not affect behavioral intention to use virtual banks

$H2_a$: Effort Expectancy affects behavioral intention to use virtual banks

$H3_0$: Perceived Risk does not affect behavioral intention to use virtual banks

$H3_a$: Perceived Risk affects behavioral intention to use virtual banks

$H4_0$: Trust does not affect behavioral intention to use virtual banks

$H4_a$: Trust affects behavioral intention to use virtual banks

$H5_0$: Perceived Risk does not affect Trust

$H5_a$: Perceived Risk affects Trust

$H6_0$: Price Value does not affect behavioral intention to use virtual banks

$H6_a$: Price Value affects behavioral intention to use virtual banks

4. RESEARCH FINDINGS AND DISCUSSION

4.1. Quantitative Survey Results

At the end of the data collection period, 782 questionnaires were distributed, and 644 responses were received, representing a response rate of 82.35%. For online channels, 562 questionnaires were distributed, and 453 responses were received, representing a response rate of 80.60%. For the physical survey, 220 paper questionnaires were distributed, and 191 completed ones were collected, representing a response rate of 86.81%.

4.2. Descriptive Statistics

Out of the 644 survey respondents, 54.19% identified as “male” and 40.22% as “female,” while 5.59%, or 36 respondents, chose not to provide their gender data. On age groups, “21-30”, “31-40”, and “41-50” share a similar proportion of the total respondents, while the age group of “51-60” has 2% more respondents than the previous three age groups. Data revealed that the distribution of respondents was divided quite equally between three groups: secondary school and higher diploma holders, bachelor's degree holders, and master's degree or above holders. The survey data on virtual banks’ usage shows a 60/40 split of non-users and users. Among the users of virtual banks, most of them use one (24.84%) or two (9.47%) virtual banks out of the eight. Users of four virtual banks or more constitute only the very thin tail of the total responding sample.

Table 1: Demographic data of survey respondents (Source: Author)

	Count	**%**
Gender		
Female	259	40.22%

Male	349	54.19%
Preferred not to say	36	5.59%
Age		
20 or below	21	3.26%
21-30	118	18.32%
31-40	126	19.57%
41-50	139	21.58%
51-60	156	24.22%
61 or above	84	13.04%
Education		
Secondary School	82	12.73%
Associate, Higher diploma, higher certificate	69	10.71%
Bachelor degree	245	38.04%
Master degree or above	248	38.51%
Number of virtual banks using		
Zero	381	59.16%
One	160	24.84%
Two	61	9.47%
Three	22	3.42%
Four	7	1.09%
Five	5	0.78%
Six	3	0.47%
Seven	1	0.16%
Eight	4	0.62%
Grand Total	**644**	

4.3. Inferential Statistics

4.3.1. Evaluation of the Measurement Models

4.3.1.1. Internal Consistency Reliability. Cronbach's alpha is a conventional standard for the evaluation of internal consistency reliability (Hair et al., 2021, p. 118). It is an assessment of the reliability depending on the intercorrelations between variables. Another measurement in PLS-SEM procedures for internal consistency reliability is composite reliability (Hair et al., 2021, p. 119). Composite reliability considers the individual outer loadings of the variables in its calculations. Both Cronbach's alpha and composite reliability have a value between 0 and 1. The higher the value, the higher the reliability. In classical literature, it is suggested that standard thresholds of both Cronbach's alpha and composite

reliability should be above 0.7 to be regarded as internally reliable (Hair et al., 2011). All the values of Cronbach's alpha and composite reliability of the six constructs of the research theoretical model are higher than the threshold of 0.7. It is suggested that all the model variables have sufficient internal reliability.

4.3.1.2. Convergent Validity. Average variance extracted (AVE) is one of the most commonly used measures to assess convergent validity on the construct level (Fornell & Larcker, 1981). The higher the value of AVE, the higher the variance of the indicators that explain the constructs. The generally agreed threshold of AVE for convergent validity is equal to or greater than 0.5 (Chin, 1998). The values of the calculated AVE of all six constructs of the research theoretical model are greater than the threshold of 0.5. Therefore, adequate convergent validity can be declared by the assessment of AVE.

Table 2: Constructs' Reliability and Validity (Source: Author)

Construct	Cronbach's alpha	Composite reliability (ρ_a)	Composite reliability (ρ_c)	Average variance extracted (AVE)
BI	0.821	0.846	0.893	0.737
EE	0.887	0.888	0.930	0.816
PE	0.904	0.908	0.940	0.839
PR	0.855	0.865	0.912	0.775
PV	0.844	0.859	0.905	0.761
TR	0.818	0.835	0.891	0.732

4.3.1.3. Discriminant Validity. Discriminant validity assesses the degree to which one construct is really discrete from the other constructs in the same research theoretical model (Hair et al., 2021, p. 120). The Fornell-Larcker criterion is one of the traditional methods to assess discriminant validity by researchers (Fornell & Larcker, 1981; Rahi, 2018). It calculates the square root of AVE and compares it with the correlation of other variables. The criterion is that the square root of the AVE of the construct should be larger than its highest correlation with any other constructs. From Table 3, all six constructs have their square root of AVE larger than their correlations with any other constructs, and they are discriminant.

Therefore, the results supported that the measurement model has sufficient discriminant validity.

Table 3: Discriminant Validity - Fornell-Larcker Criterion (Source: Author)

	BI	**EE**	**PE**	**PR**	**PV**	**TR**
BI	0.858					
EE	0.709	0.903				
PE	0.753	0.769	0.916			
PR	-0.426	-0.431	-0.291	0.881		
PV	0.754	0.739	0.747	-0.392	0.872	
TR	0.684	0.691	0.602	-0.642	0.682	0.855

Another assessment of discriminant validity is the cross-loading analysis (Rahi, 2018). According to this analysis, the factor's loadings on its own construct should be larger than the factor's cross-loading on any other constructs (Hair et al., 2021, p. 122). The cross-loadings listed in Table 4 show that all the factors have significantly larger loadings compared to the cross-loadings with other factors and are discriminant. So, the cross-loading analysis results supported the notion that the measurement model has sufficient discriminant validity.

Table 4: Discriminant Validity - Cross Loadings (Source: Author)

	BI	**EE**	**PE**	**PR**	**PV**	**TR**
BI1	**0.898**	0.633	0.707	-0.339	0.701	0.603
BI2	**0.901**	0.681	0.712	-0.353	0.727	0.624
BI3	**0.770**	0.492	0.494	-0.426	0.482	0.529
EE1	0.627	**0.898**	0.648	-0.419	0.639	0.626
EE2	0.662	**0.908**	0.713	-0.391	0.680	0.649
EE3	0.630	**0.903**	0.722	-0.358	0.682	0.597
PE1	0.744	0.728	**0.914**	-0.299	0.683	0.567
PE2	0.664	0.692	**0.912**	-0.263	0.688	0.562
PE3	0.655	0.691	**0.923**	-0.232	0.682	0.522
PR1	-0.323	-0.326	-0.210	**0.847**	-0.285	-0.520
PR2	-0.360	-0.367	-0.219	**0.889**	-0.318	-0.559
PR3	-0.432	-0.437	-0.328	**0.905**	-0.422	-0.610
PV1	0.712	0.660	0.702	-0.351	**0.894**	0.608
PV2	0.694	0.680	0.696	-0.338	**0.899**	0.629
PV3	0.551	0.589	0.539	-0.341	**0.822**	0.542
TR1	0.502	0.572	0.501	-0.401	0.581	**0.817**
TR2	0.668	0.670	0.589	-0.548	0.655	**0.893**
TR3	0.569	0.533	0.456	-0.664	0.519	**0.854**

Studies have shown that both the Fornell-Larcker criterion and cross-loading analysis cannot detect violations of discriminant validity in some cases (Henseler et al., 2015). Therefore, a latest statistical technique called heterotrait-monotrait ratio (HTMT) analysis is introduced as the third analysis to assess discriminant validity precisely. HTMT represents the mean of all correlations of all the factors across constructs of all constructs, so-called the heterotrait-heteromethod correlations, over the mean of correlations of all the factors within the same construct, so-called the monotrait-heteromethod correlations (Hair et al., 2021, p. 122). The closer the HTMT ratio is to 1, the less discriminant validity the model has. The threshold value of HTMT is suggested to be 0.90 if the constructs in the theoretical model are considered to be conceptually similar (Hair et al., 2021, p. 123; Henseler et al., 2015; Kline, 2023). A lower and stricter threshold value of 0.85 applies if the model's constructs are considered conceptually dissimilar. Since all the HTMT ratios in Table 5 are lower than the threshold values, the discriminant validity of the measures can be established.

Table 5: Discriminant Validity - Heterotrait-Monotrait Ratio (HTMT) (Source: Author)

	BI	**EE**	**PE**	**PR**	**PV**	**TR**
BI						
EE	0.822					
PE	0.859	0.857				
PR	0.515	0.491	0.324			
PV	0.884	0.851	0.847	0.458		
TR	0.824	0.811	0.699	0.748	0.820	

4.3.2. Evaluation of the Structural Model

4.3.2.1. Collinearity. Variance inflation factor (VIF) is the measure of collinearity, and it is defined as the reciprocal of the tolerance, which represents the portion of variance in the dependent variables not explained by the independent variables (Hair et al., 2021, p. 147). The threshold value of VIF is 5, where any VIF values of the independent variables below that represent no critical collinearity issues. A lower threshold value of 3 can ensure no collinearity issues (Becker et al., 2013; Mason & Perreault, 1991). Since all the VIF values in

Table 6 are lower than the threshold value of 5, it supports that the data do not have collinearity issues.

Table 6: Collinearity Statistics (VIF) – Inner Model Matrix (Source: Author)

	BI	EE	PE	PR	PV	TR
BI						
EE	3.274					
PE	3.037					
PR	1.757					1.000
PV	2.963					
TR	3.024					

4.3.2.2. Common Method Bias. The common method bias was assessed through the Variance Inflation Factor (VIF) values of the inner model. Besides being used for the assessment of collinearity of the inner model, VIF can also be used to assess the model's common method bias (Kock, 2015). The threshold value of 3.3 is used to determine if the model is contaminated by common method bias. In this research project, all the VIF values are lower than 3.3. The model can be considered free from common method bias.

4.3.2.3. Explanatory Power. The Coefficient of Determination R^2 is one of the most used indicators of explanatory power. It is calculated by squaring the correlations between the actual and predicted values of the endogenous variable. The R^2 value ranges from 0 to 1. The higher the R^2 value, the higher the explanatory power. A common set of threshold values defines 0.75 as a "substantial" R^2 value, 0.50 as a "moderate" R^2 value, and 0.25 as a "weak" R^2 value (Hair et al., 2011). The R^2 value of BI is 0.686, which is higher than 0.50 but lower than 0.75, the explanatory power of Behavioral Intention to Use Virtual Banks (BI) is classified as "moderate". The R^2 value of TR is 0.412, which is higher than 0.25 but lower than 0.50, the explanatory power of Trust (TR) is established and classified as "weak".

Table 7: Coefficient of Determination R^2 (Source: Author)

	R-square	Explanatory Power
BI	0.686	Medium
TR	0.412	Weak

Besides R^2, effect size f^2 is used to assess the strength of the structural model relationships (J. Hair et al., 2021, p. 195). It is defined as the delta in R^2 value resulting from the omission of a specific factor from the structural model. General guidelines on the threshold values of effect size f^2 for small, medium, and large effects are 0.02, 0.15, and 0.35, respectively, of the exogenous latent variable (Cohen, 2013). The effect size f^2 analysis is shown in Table 8. In all the independent variables of Behavioural Intention (BI), Performance Expectancy (PE) has the highest effect size of 0.135 on BI, which can be regarded as medium. All the other independent variables have an effect size of small. The effect size of Perceived Risk to Trust is large.

Table 8: Effect Size f^2 (Source: Author)

	f-square	**Effect Size**
EE -> BI	0.004	Small
PE -> BI	0.135	Medium
PR -> BI	0.006	Small
PR -> TR	0.700	Large
PV -> BI	0.087	Small
TR -> BI	0.039	Small

4.3.2.4. Significance and Relevance of the Structural Model Relationships. The path coefficients, standard deviation, *t*-values, and *p*-values calculated from the collected data and output by SmartPLS version 4 are listed in Table 9. Each hypothesis of the theoretical method is evaluated with the corresponding estimate of the path coefficients and the significance levels. According to the *p*-value, the hypotheses H1, H3, H4, H5, and H6 are supported to be statistically significant. It supports that Performance Expectancy (PE), Perceived Risk (PR), and Trust (TR) statistically significantly affect Behavioral Intention to Use Virtual Banks (BI). It also supports that Perceived Risk statistically significantly affects Trust (TR). The only hypothesis that is not supported is H2, meaning that Effort Expectancy (EE) does not statistically significantly affect Behavioral Intention to Use Virtual Banks (BI) ($p > 0.05$). This deviates from the first model hypothesized in the first article of Venkatesh et al., 2003.

Nevertheless, some recent studies also found that effort expectancy does not exhibit a positive relationship with intention to use mobile banking (Hanif & Lallie, 2021; Tariq et al., 2024).

Tables 10 and 11 list the confidence intervals and confidence intervals bias corrected. Confidence intervals of all factors, except Effort Expectancy (EE), do not contain zero. Therefore, they support that PE, PR, TR, and PV are significant factors of BI. Since the 95% confidence interval of EE ranges from -0.023 to 0.157, which includes zero, it supports that EE is an insignificant factor to BI. These results are consistent with those from *p*-values. Both tables also show that minimal bias adjustment of all factors.

The final results of the path coefficients and whether the relationships are statistically supported are shown in Figure 14.

Table 9: Path Coefficients, Standard Deviation, t-values, p-values (Source: Author)

	Original sample (O)	**Sample mean (M)**	**Standard deviation (STDEV)**	***t*-statistics (|O/STDEV|)**	***p*-values**
EE -> BI	0.065	0.064	0.046	1.427	0.154
PE -> BI	0.359	0.358	0.044	8.157	0.000
PR -> BI	-0.059	-0.059	0.028	2.090	0.037
PR -> TR	-0.642	-0.643	0.034	19.111	0.000
PV -> BI	0.285	0.286	0.045	6.346	0.000
TR -> BI	0.191	0.192	0.041	4.714	0.000

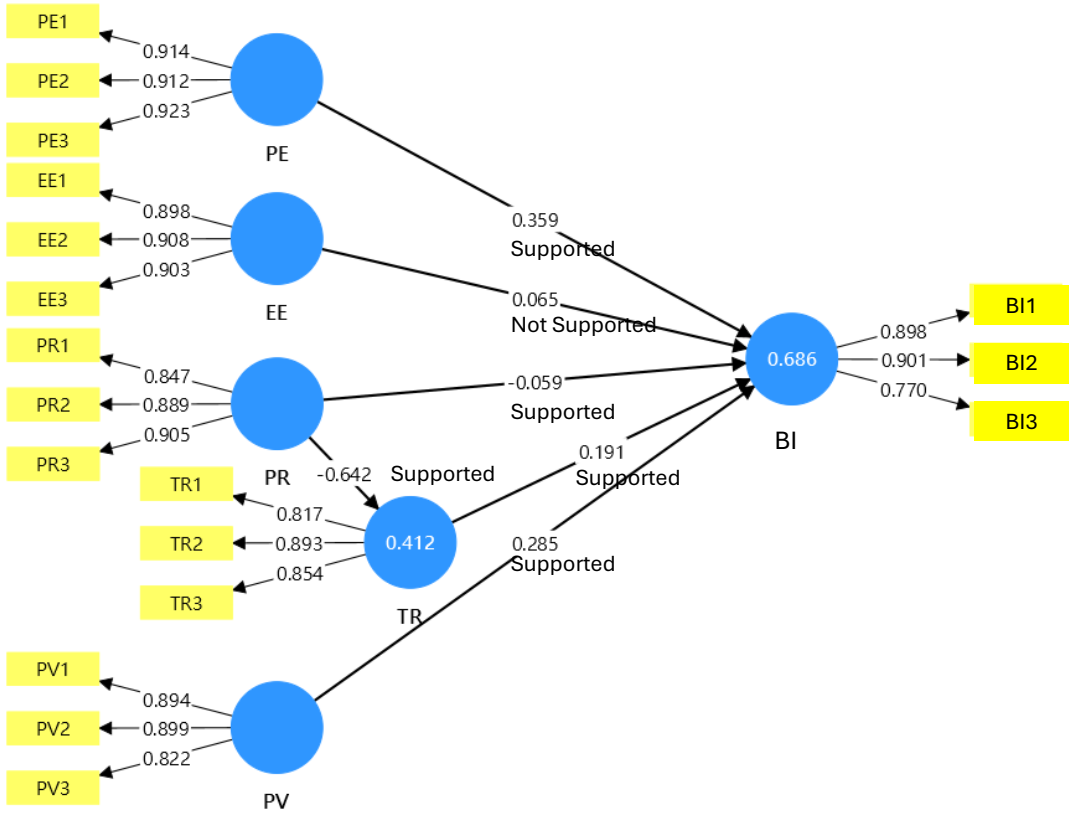
Table 10: Confidence intervals (Source: Author)

	Original sample (O)	**Sample mean (M)**	**2.5%**	**97.5%**
EE -> BI	0.065	0.064	-0.023	0.157
PE -> BI	0.359	0.358	0.271	0.445
PR -> BI	-0.059	-0.059	-0.114	-0.003
PR -> TR	-0.642	-0.643	-0.705	-0.571
PV -> BI	0.285	0.286	0.198	0.373
TR -> BI	0.191	0.192	0.111	0.270

Table 10: Confidence intervals bias corrected (Source: Author)

	Original sample (O)	Sample mean (M)	Bias	2.5%	97.5%
EE -> BI	0.065	0.064	-0.001	-0.021	0.159
PE -> BI	0.359	0.358	0.000	0.271	0.444
PR -> BI	-0.059	-0.059	0.000	-0.112	-0.001
PR -> TR	-0.642	-0.643	-0.001	-0.701	-0.566
PV -> BI	0.285	0.286	0.001	0.197	0.372
TR -> BI	0.191	0.192	0.000	0.111	0.270

Figure 4: Final Results of PLS-SEM Structural Model (Source: Author)



4.3.2.5. Mediation Effect. In the research theoretical model, there is a mediation relationship between Perceived Risk (PR), Trust (TR), and Behavioral Intention to Use Virtual Banks (BI). Figure 15 depicts this mediation relationship between the three constructs with the path coefficients calculated from the survey data.

In this sample, the indirect effect (PR -> TR -> BI) is statistically significant ($p < 0.01$). It has a negative impact (the path coefficient is -0.123, *the t-statistic* is 4.547, and the *p*-value is 0.000). The direct effect between PR and BI is statistically significant ($p < 0.01$) and has a

negative impact (the path coefficient is -0.642, *t*-statistic 19.111, and *p*-value 0.000). As both the indirect effect and the direct effect are statistically significant and in the same direction, which is negative, the type of mediation of trust on perceived risk and behavioral intention is complementary mediation (Zhao et al., 2010).

The results imply that the more trust the users have in the brand of the virtual banks, the more likely the users are to adopt virtual banks. Trust acts as a complementary or enabling factor for the effect of Perceived Risk on the Behavioral Intention to Use Virtual Banks. These results mean that the significant negative or erosion effect of Perceived Risk on Trust can affect users adversely in the adoption of virtual banks.

Figure 5: Mediation relationship between PR, TR, and BI (Source: Author)

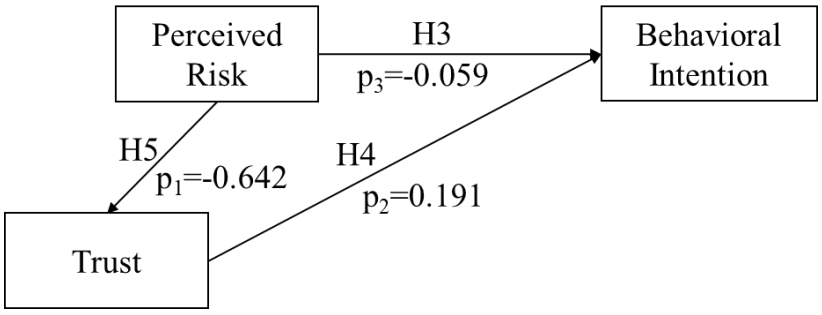


Table 11: Mediation analysis of PR between TR and BI (Source: Author)

Direct Effects			
Path	**Path coefficient**	***t*-value**	***p*-value**
PR -> BI	-0.059	2.090	0.037
PR -> TR	-0.642	19.111	0.000
TR -> BI	0.191	4.714	0.000
Indirect Effects			
Path	**Path coefficient**	***t*-value**	***p*-value**
PR -> TR -> BI	-0.123	4.547	0.000

In summary, the quantitative survey results are summarized in Table 12. Since the structural model of this research project includes a mediation relationship between PR, TR, and BI, the mediation effect was evaluated. The result of the evaluation concluded that it is a partial mediation relationship classified as “complementary mediation”.

Table 12: Summary of Significance and Relevance Assessment of Structural Model (Source: Author)

Hypothesis	**Significance**
$H1_a$: Performance Expectancy (PE) has an effect on Behavioral Intention to Use Virtual Banks (BI)	$H1_a$ is accepted
$H2_a$: Effort Expectancy (EE) has an effect on Behavioral Intention to Use Virtual Banks (BI).	$H2_a$ is rejected
$H3_a$: Perceived Risk (PR) has an effect on Behavioral Intention to Use Virtual Banks (BI)	$H3_a$ is accepted
$H4_a$: Trust (TR) has an effect on Behavioral Intention to Use Virtual Banks (BI)	$H4_a$ is accepted
$H5_a$: Perceived Risk (PR) has an effect on Trust (TR)	$H5_a$ is accepted
$H6_a$: Price Value (PV) has an effect on Behavioral Intention to Use Virtual Banks (BI)	$H6_a$ is accepted

4.4. Qualitative Case Study Results

The case study recruited banking professionals from six virtual banks and seven traditional retail banks, resulting in a total of 15 cases (one from each bank, except two from one virtual bank and two from one traditional bank) using a purposive sampling strategy. The case study also recruited end users using virtual banks and those not using virtual banks. This segment consisted of 13 participants, and it made the total sample size of the case study 28. This sample size aligns with widely accepted qualitative research protocols, where case studies usually involve a smaller number of participants to prioritize depth over breadth (Gerring, 2006; Stake, 1995; Yin, 2013).

Table 13: Current and Previous Roles and Responsibilities of Banking Professionals (Source: Author)

Roles and Responsibilities Area	**Count of Responses**
Branch Management	1
e-Banking / Digital Banking	11
Customer Acquisition / Experience	9
Product Development / Marketing	11
Wealth Management	9
Customer Services	4
Business Planning / Strategy	9
Operation Controls / Governance	3

Management	4

Table 14: Gender and Usage of Virtual Banks by End User Respondents (Source: Author)

Gender	**Number**	**Using Virtual Bank or Not?**	**Number**
Male	9	**Not using**	7
Female	4	**Using**	6

4.4.1. Thematic Analysis Results

The responses of the 28 participants were downloaded for data analysis. The responses to each question were first grouped for data familiarization. A free and open-source qualitative research software, Taguette, was used for tagging and coding the response data. Then the initial codes were reviewed to discover and interpret the themes that emerged. Thematic maps were developed from all the themes to illustrate the thematic analysis results.

4.4.1.1. Theme 1 – Performance Expectancy (PE) Affects Behavioral Intention to Use Virtual Banks (BI). This theme validates and triangulates the survey results related to Hypothesis H1, which states that performance expectancy significantly affects behavioral intention to use virtual banks. Respondents emphasized that transaction speed is critical to virtual bank users. They also viewed simplified and intuitive interfaces and seamless experiences as vital for virtual banks. Universally, they saw system reliability and stability as non-negotiable for virtual bank users. Incident examples, such as frequent app crashes or delays, erode trust due to the lack of physical fallbacks in the case of virtual banks. Participants overwhelmingly supported the idea that virtual banks excel in core functions and products, such as deposits, loans, and payments.

4.4.1.2. Theme 2 – Effort Expectancy (EE) Does Not Affect Behavioral Intention to Use Virtual Banks (BI). This theme validates and confirms the survey finding of the second hypothesis, which states that Effort Expectancy (EE) has no significant effect on Behavioral Intention to Use Virtual Banks (BI). Most respondents saw that the digital banking market is

very mature in Hong Kong. As a result, they noted that effort expectancy now becomes a baseline requirement. Respondents justified that while effort expectancy might not drive user adoption of virtual banks, poor usability drives attrition. A few respondents reasoned that younger generations, accustomed to digital platforms, may prioritize features over simplicity. However, some respondents implied that older users or less tech-savvy individuals still require intuitive designs. Those with a deep understanding of the local market and customers reasoned that the impact of effort expectancy is intertwined with other factors, including security, transaction speed, and incentives.

4.4.1.3. Theme 3 – Perceived Risk (PR) Affects Behavioral Intention to Use Virtual Banks (BI). This theme validates and triangulates the survey results related to Hypothesis H3, which posits that perceived risk has a significant impact on the behavioral intention to use virtual banks. Respondents generally acknowledged that the oversight of the Hong Kong Monetary Authority and the Deposit Protection Scheme (DPS) alleviate the perceived risks of customers in Hong Kong. Many respondents believed that older customers exhibited more risk aversion, often mixed up "virtual banks" with speculative "virtual assets" due to the term "virtual". Some respondents noted that perceived risk was not uniform across all situations. They noted that customers are more cautious regarding larger transactions, but risk perceptions are minimal for smaller, trial-based interactions. Another observation from respondents was that the risks related to virtual banks were not unique. They are similar to those of traditional banks, especially in digital banking. Another comment from respondents is that users tolerate higher perceived risks for higher utility features, such as express loan applications.

4.4.1.4. Theme 4 – Trust (TR) Affects Behavioral Intention to Use Virtual Banks (BI). This theme validates and triangulates the survey results related to Hypothesis H4, which states that trust has a significant impact on the behavioral intention to use virtual banks. All

respondents universally agreed that trust was the fundamental factor for user adoption, particularly in high-value and high-stakes banking contexts. Several respondents linked trust to the Hong Kong regulatory regime and indicated that the robust oversight by the Hong Kong Monetary Authority enhances public confidence in virtual banks. Most respondents related trust closely to the reputation of the parent company or brand behind the virtual bank. They highlighted that virtual banks backed by well-known, established financial institutions or tech firms are more likely to be adopted by customers. Many of them believed that trust is not born but is built on consistent and positive experiences across all customer touchpoints.

4.4.1.5. Theme 5 – Perceived Risk (PR) Negatively Affects Trust (TR). This theme confirms and validates the survey results related to Hypothesis H5, which states that perceived risk has a significant impact on trust. All participants overwhelmingly supported the idea that perceived risk strongly erodes trust in virtual banks. Respondents repeatedly mentioned cybersecurity and privacy concerns as significant drivers of perceived risk. Many respondents found that external influences, including market sentiment, media coverage, and peer recommendations, often shape perceived risk. Respondents reported that negative news, e.g., the closure of Silicon Valley Bank, or any incidents involving virtual banks, can amplify risk perceptions of the customers, regardless of the actual risk level. Several respondents pointed out that trust and perceived risk are subjective. It depends on individual factors such as security sensitivity, familiarity with technology, and risk tolerance. Respondents acknowledged that virtual banks, as newer technology applications, face greater skepticism and require time and effort to build trust among less tech-savvy customers.

4.4.1.6. Theme 6 – Price Value (PV) Affects Behavioral Intention to Use Virtual Banks (BI). This theme validates and triangulates the survey results related to Hypothesis H6, which states that price value significantly affects behavioral intention to use virtual banks. Respondents widely acknowledged competitive pricing as the major driver of

customer acquisition for virtual banks. Most respondents highlighted how virtual banks use aggressive pricing, including higher deposit rates, lower lending fees, and promotional incentives, to attract new customers. Certain respondents commented that many customers, particularly those with high price sensitivity or "interest seekers", were drawn to virtual banks due to their competitive pricing. They expected those customers to compare financial benefits across banks frequently and are mainly motivated by rewards, rebates, and other price opportunities. Most of them thought that competitive pricing is effective for customer acquisition in the short term but not for customer retention in the long term. They maintained that a more complete value proposition, comprised of customer experience, service reliability, and a broad range of financial services, is needed to sustain customer loyalty. Most respondents acknowledged that although pricing is a key acquisition tool for virtual banks, it is not always sufficient to entice the broader customer base. They noted that many customers value other factors, such as trust, convenience, and service range, more than marginal financial benefits.

4.5. Integration of Case Study Results and Quantitative Survey

In the qualitative research part, the case study interview results were analyzed by thematic analysis. Six themes were grounded in the interview data to triangulate the quantitative survey results. The themes obtained from the responses of both the experienced banking professionals and the end users supported the survey findings. Table 15 illustrates the comparison of the results of the quantitative survey and the case study.

Table 15: Comparison of the Results of Quantitative Survey and Case Study (Source: Author)

Hypothesis Results of Quantitative Survey		**Themes grounded in Case Study**	
$H1_0$	Performance expectancy does not have an effect on behavioral intention of user adoption of virtual banks. Results: The null hypothesis $H1_0$ was rejected with a *p*-value of 0.000,	**T1**	Performance expectancy has a positive effect on behavioral intention of user adoption of virtual banks. Results: Nearly all the participants agreed on this statement. Some

	smaller than the threshold value of 0.01. It is concluded that performance expectancy has a statistically significant positive effect on behavioral intention of user adoption of virtual banks.		respondents found that transaction speed is critical and a core expectation to virtual banks. Besides that performance stability is also the baseline requirement for virtual banks.
$H2_0$	Effort expectancy does not have an effect on behavioral intention of user adoption of virtual banks. Results: The null hypothesis $H2_0$ was accepted with a *p*-value of 0.154, greater than the threshold value of 0.05. It is concluded that effort expectancy does not have a statistically significant effect on behavioral intention of user adoption of virtual banks.	**T2**	Effort expectancy does not affect behavioral intention of user adoption of virtual banks. Results: Majority of the respondents agreed with this statement also the level of agreement was not as high as other themes. Many respondents acknowledged the digital banking market in Hong Kong is mature. Therefore effort expectancy becomes a hygiene factor and does not affect the adoption of customers.
$H3_0$	Perceived risk does not have an effect on behavioral intention of user adoption of virtual banks. Results: The null hypothesis $H3_0$ was rejected with a *p*-value of 0.037, smaller than the threshold value of 0.05. It is concluded that perceived risk has a statistically significant negative effect on behavioral intention of user adoption of virtual banks.	**T3**	Perceived risk has a negative effect on behavioral intention of user adoption of virtual banks. Results: All the participants ubiquitously agreed with this theme. Many respondents cited the regulations in Hong Kong, such as supervision of HKMA and Deposit Protection Scheme help to mitigate some perceived risks towards virtual banks. Other respondents noted that perceived risk is more specific to context, for example for small amount the customers usually perceived less risks.
$H4_0$	Trust does not have an effect on behavioral intention of user adoption of virtual banks. Results: The null hypothesis $H4_0$ was rejected with a *p*-value of 0.000, smaller than the threshold value of 0.01. It is concluded that trust has a statistically significant positive effect	**T4**	Trust has a positive effect on behavioral intention of user adoption of virtual banks. Results: All the case study participants agreed with this statement. Many of the respondents thought both regulation framework and parent group branding helped to establish the initial trust of

	on behavioral intention of user adoption of virtual banks.		customer on virtual banks. The consistent and positive customer experiences were important to build and sustain the customer trust thereafter.
$H5_0$	Perceived risk does not have an effect on trust. Results: The null hypothesis $H5_0$ was rejected with a *p*-value of 0.000, smaller than the threshold value of 0.01. It is concluded that perceived risk has a statistically significant negative effect on trust.	**T5**	Perceived risk has a negative effect on trust. It implies a mediating effect of trust on risk (Perceived Risk → Trust → Behavioral Intention). Results: All the participants agreed the effect that perceived risk erodes trust and thus an indirect effect on behavioral intention of user adoption. Many respondents noted that cybersecurity and privacy are the two major risk concern because virtual banks operate all on technology. Other respondents also remarked that perceived risks are greatly shape by market sentiment and media coverage.
$H6_0$	Price value does not have an effect on behavioral intention of user adoption of virtual banks. Results: The null hypothesis $H6_0$ was rejected with a *p*-value of 0.000, smaller than the threshold value of 0.01. It is concluded that price value has a statistically significant positive effect on behavioral intention of user adoption of virtual banks.	**T6**	Price value has a positive effect on behavioral intention of user adoption of virtual banks. Results: All the case study participants were in agreement with this statement. They widely acknowledged competitive pricing is an important tools for customer acquisition. At the same time, they also supported for customer retention and growth, virtual banks need to deliver more than price value and beyond.

5. CONCLUSION

Virtual banks, is a special type of commercial banks that deliver its products and services on digital channels only and is restricted from establishing physical branches (Hong Kong Monetary Authority, 2018; Or, 2018). This type of bank has existed in different

jurisdictions around the world under different names and subjects of academic research. They include neo banks in the UK and Europe (Ziouache & Bouteraa, 2023), neobanks in India (Shabu & Ramankutty, 2022), internet-only banks in Korea (Lee & Park, 2022; Yoon & Lim, 2020), internet-only banks in China (Li et al., 2021; Zhang et al., 2018), digital-only banks in South Africa (Cele, 2023; Nel & Boshoff, 2021), and digital-only banks in Malaysia (Saif et al., 2022). The study on the factors affecting user adoption of virtual banks can bring both significant practical and theoretical contributions.

Among the past studies using UTAUT and extended UTAUT to study mobile banking in developed and developing economies (Alkhowaiter, 2020; Souiden et al., 2020; Tam & Oliveira, 2017), this research integrated the UTAUT model with perceived risk, trust, and price value to study virtual banks in Hong Kong, an International Financial Centre, to give more insights. There have been few previous studies on internet banking, mobile banking, and virtual banks in Hong Kong, and most have used only a quantitative method. This research may be the first of its kind to use the sequential explanatory mixed methods design with quantitative research first and then qualitative research to study this topic.

Contrary to the classical theoretical UTAUT frameworks (Venkatesh et al., 2003, 2012) and most other previous research in different countries (Bhatnagr & Rajesh, 2023; Ivanova & Kim, 2022; Lee & Kang, 2021; Mer & Virdi, 2021; Nepal & Nepal, 2023; Nguyen et al., 2020), the empirical survey results supported that effort expectancy is not statistically significant to the user adoption of virtual banks in Hong Kong. It aligns with Hong Kong's high digital literacy (96% internet usage and 78.9% PC usage) (Census and Statistics Department, HKSAR, 2024, p. 193) and market maturity of FinTech. The ease of use is no longer a differentiator but a service baseline. As noted by case study participants, digital banking services of both virtual and traditional banks now compete on advanced features beyond usability, such as personalized services and AI applications. It demonstrated the

special market situation of Hong Kong, an International Financial Center with a population of high digital literacy and a fintech adoption rate.

Based on the primary and empirical data collected, the statistical analysis of PLS-SEM discovered the complementary mediation of trust on perceived risk to user adoption of virtual banks in Hong Kong. Although the mediation of trust on risk has been researched in a few studies of internet banking and mobile banking in Asia (Damghanian et al., 2016; Jung & Cho, 2018; Sandhu et al., 2022; Van et al., 2020), it is the first of its kind conducted on virtual banks in Hong Kong. The empirical results reveal that in Hong Kong, perceived risk has a direct effect as well as an indirect effect mediated by trust on user adoption of virtual banks. While regulation assurance and small-value transactions help alleviate the direct effort of perceived risk, trust may be impacted more by perceived risk in the case of any risk incident. It is very important for virtual banks to invest more to minimize security risks and operational risks to protect customer trust and thus the user adoption. It is also important for the banks to communicate regularly with their customers about their investments and efforts to mitigate such risks to maintain and build customer trust.

The research delivers valuable insights into the influencing factors of user adoption of virtual banks in Hong Kong by addressing a gap in the existing literature. It comprehensively understands the local customer adoption behavior by integrating the UTAUT framework with perceived risk, trust, and price value. The findings provide meaningful implications for virtual banks, traditional banks, and regulators. Even though the research has its limitations, it warrants future research opportunities and contributes to both the academic and practical domains.

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