CENTRAL BANK DIGITAL CURRENCY IN KUWAIT: ISSUANCE DETERMINANTS AND BANKS' PROFITABILITY

أحد مشاريع
مبادرة رؤية بنك الكويت المركزي والبنوك الكويتية لتطوير الشباب الكويتي

The 2023 Second Place Research Paper Winner
"Kuwaiti Economic Student Prize"

البحث الفائز بالمركز الثاني "بجائزة الطالب الاقتصادي الكويتي" لعام 2023

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العملة الرقمية للبنك المركزي في الكويت: محددات الإصدار و ربحية المصارف

أهداف البحث:

تسلط هذه الدراسة الضوء على العملة الرقمية للبنك المركزي بإعتبارها أحد أحدث و أهم المواضيع التي يتم دراستها بالأوساط الاقتصادية والمالية في العالم، وتهدف الدراسة إلى تحليل أهم العوامل المؤثرة في اصدار العملة الرقمية للبنك المركزي في دولة الكويت و قياس الآثار المحتملة لتدشين العملة الرقمية على ربحية المصارف الكويتية. و ذلك من أجل مواكبة تطورات التكنولوجيا المالية حول العالم مع ضمان الاستقرار المالي المحلي.

المنهجية العلمية:

تستعرض هذه الدراسة عدداً واسعاً من الأدبيات والدراسات الأكاديمية والتطبيقية في مجال العملة الرقمية للبنوك المركزية والتي تم نشرها عبر المجلات العلمية المحكمة والجهات المالية الدولية. قامت الدراسة في بناء نموذجين كميين لتحقيق الغرض من هذه الدراسة عبر نماذج اقتصادية قياسية مختلفة تم اجراءها بإستخدام برنامج Stata للتحليل الإحصائي.

النموذج الأول يختص في تحليل المحددات والعوامل المؤثرة في إصدار العملة الرقمية للبنك المركزي في الكويت من خلال نموذج الانحدار الاحتمالي الترتيبي بإستخدام بيانات السلاسل الزمنية الفصلية من 2014 إلى 2021، وتشمل هذه البيانات عوامل مثل: البنية التحتية الرقمية، قدرات الابتكار، الأطر القانونية، الإهتمام العام، التطور الاقتصادي، ظروف بيئة الاقتصاد الكلي والتحويلات المالية الدولية.

النموذج الثاني يقيس الآثار المحتملة لتدشين العملة الرقمية للبنك المركزي على ربحية المصارف في الكويت من خلال نموذج الانحدار الذاتي بإستخدام بيانات السلاسل الزمنية السنوية من 2000 إلى 2021، وتشمل هذه البيانات المؤشرات المالية للقطاع المصرفي مثل العائد على الأصول ونسبة ودائع العملاء إلى إجمالي الأصول ونسبة القروض إلى إجمالي الأصول، بالإضافة إلى عاملي النمو الاقتصادي والإنفاق الحكومي في دولة الكويت.

أهم النتائج:

تـشير نتائـج الدراسـة إلى أن إصـدار العملـة الرقميـة للبنـك المركـزي في الكويـت مرتبـط بشـكل وثيـق وإيجـابي بعوامـل البنيـة التحتيـة الرقميـة وقـدرات الابتـكار والأطـر القانونيـة والإهـتمام العـام والتطـور الاقتصـادي، بيـنما تعـتبر مسـتويات تقـدم الاقتصـاد المـحلي والأسـواق الماليـة هـي العامـل الأبـرز لإصـدار العملـة الرقميـة. وفـيما يخـص الأثـر المحتمـل للعملـة الرقميـة للبنـك المركـزي على ربحيـة المصـارف المحليـة، اظهـرت النتائـج أن ودائـع العـملاء تمثـل عـاملاً مـهماً لربحيـة المصـارف وأشـارت سـيناريوهات عوامـل الصدمـة إلى أن هجـرة الودائـع مـن المصـارف إلى العملـة الرقميـة قـد تؤثـر على ربحيـة المصـارف بنسـب متفاوتـة، إلا أن هـذه الآثـار المحتملـة يمكـن احتوائهـا عبر حزمـة اجـراءات متنوعـة، مثـل وضـع حـدود لتملـك الأفـراد للعملـة الرقميـة وتنظيـم عمليـة تحويـل الودائـع، وذلـك بالتزامـن مـع اطلاق العملـة الرقميـة للبنـك المركـزي.

الآثار والتوصيات:

عبر اسـتنباط هـذه النتائـج، فإن الدراسـة تدعـو الجهات المعنيـة في اطلاق العملـة الرقمية للبنـك المركـزي إلى وضـع القواعـد التنظيميـة الخاصـة لعمليـة اطلاق العملـة الرقميـة وتداولهـا لتحقيـق أهدافهـا الإيجابيـة على مختلـف الأصعـدة في الدولـة بالتـوازي مـع الحفـاظ على الإسـتقرار المالي. كذلـك فـإن هـذه الدراسـة تدعـو الجهـات المعنيـة في بحـث الجوانـب التقنيـة والتكنولوجيـة لإصـدار وتـداول العملـة الرقميـة لتحقيـق الاسـتخدام الآمـن لهـا، وكذلـك إلى دراسـة الجوانـب القانونيـة والشرعية المتصلـة بالتمويـل الإسلامي فـيما يخـص مفهـوم وإسـتخدامات العملـة الرقميـة للبنـك المركـزي.

ABSTRACT

In this study, we construct two estimation models using various datasets to analyse Central Bank Digital Currency (CBDC) in Kuwait, focusing on CBDC issuance determinants and its potential impact on the profitability of commercial banks. This analytical study aims to provide empirical investigation of CBDC in Kuwait, a topic that has recently gained global attention in the fields of economics and finance. Employing the ordered probit estimator in Model One, our findings reveal that digital infrastructure, innovation capabilities, institutional factors, public interest and economic development are key in determining the issuance of CBDC in Kuwait. Additionally, the development of the domestic economy and advancements in financial markets are identified as the most influential factors in this regard. The results from the VAR regression in Model Two indicate that customer deposits are a significant element for banks' profitability in Kuwait, where any shock to banks' deposits from CBDC replacement would affect their profits. In contrast, there are numerous mitigative measures to maintain financial stability in parallel with adopting CBDC.

Keywords: CBDC, Issuance Determinants, Banks' Profitability, Economic Development, Returns on Assets, Customer Deposits, Ordered Probit, Vector Autoregressive.

CHAPTER ONE: INTRODUCTION

Central Bank Digital Currency (CBDC) is an innovative development in the area of monetary policy and financial technology, reflecting a major transformation in how money is perceived and utilized in an increasingly digitalized world. Defined by the International Monetary Fund as a legal tender issued in digital form by central banks, CBDC represents both a new form of currency and a potential tool for improving the efficiency of the financial system (International Monetary Fund, 2021).

The concept of CBDCs has been driven by the rapid evolution and adoption of digital technologies in financial systems worldwide. CBDC is essentially a digital currency, but it stands apart from cryptocurrencies as it is state-backed and represents a sovereign currency (Chorzempa, 2021; Kiff et al., 2020). This state backing is crucial as it provides the financial stability and reliability that many decentralized digital currencies lack. The role of CBDC is multifaceted, where it can facilitate the existing financial structure, enhance the operational efficiencies of monetary transactions and extend financial inclusivity by bridging gaps in access to banking services.

The shift towards digital finance has been notably accelerated by the COVID-19 pandemic, which highlighted the limitations of conventional cash systems and the potential benefits of digital payments. Social distancing measures increased the demand for contactless payment options, pushing both consumers and financial institutions towards digital transactions that could be executed safely and swiftly, reducing the risk of virus transmission (Allen et al., 2022; Auer et al., 2020). Moreover, the pandemic exposed the need for quicker and more reliable methods of distributing financial aid, where CBDC could play a crucial role by enabling direct transfers from central banks to individuals (Brainard, 2021).

The adoption of CBDCs can significantly modify the prospects of monetary policy and financial stability. Central banks, recognizing the disruptive potential of cryptocurrencies and other digital payment innovations, are increasingly considering CBDCs as a strategy to maintain control over the monetary system (Group of Central Banks, 2021). For instance, the ability to issue CBDCs that are programmable and potentially interest-bearing offers central banks innovative tools for implementing monetary policy, potentially enhancing how they manage liquidity and achieve their economic targets (Barrdear and Kumhof, 2022).

Furthermore, CBDC holds the potential to make financial markets more inclusive and resilient. It can provide unbanked populations with access to secure and official banking services, thereby integrating a larger segment of the population into the formal economy. This integration can boost fiscal resilience, improve tax collection, and provide real-time data on economic activity, which are critical for developing countries and emerging markets (Shirai, 2019; Zams et al., 2020).

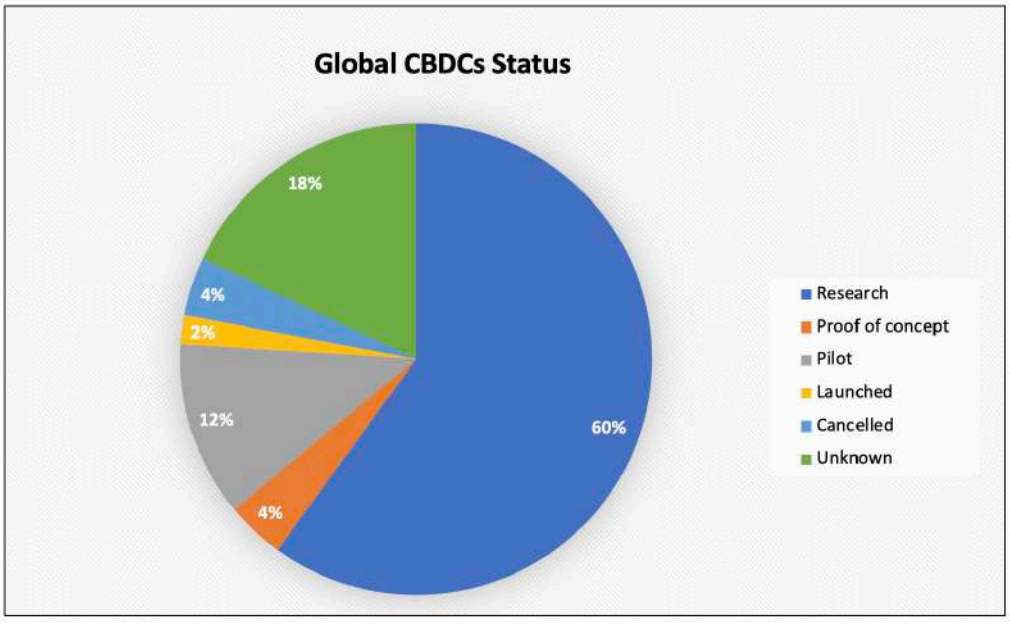


Figure 1: CBDCs Status across Countries (CBDC Tracker, 2024)

However, introducing CBDC exhibits some concerns and challenges. The potential impact on financial stability, the risk of disintermediation of the banking sector and security concerns are significant (Adalid et al., 2022; Agur et al., 2022). These factors require careful consideration and robust regulatory frameworks to ensure that the introduction of CBDC maintains the stability of existing financial systems and institutions.

In Kuwait, the monetary authority is actively exploring the introduction of a national CBDC, named the Digital Dinar. Since 2019, the CBDC infrastructure in Kuwait has been under development to ensure that it can be swiftly launched if decided upon, focusing on providing a reliable and low-cost means of exchange that enhances monetary policy efficiency and liquidity management (The Central Bank of Kuwait, 2019; Smith, 2023). Introducing a CBDC in Kuwait would enable control over the money supply and improve the accuracy of liquidity forecasting, which is crucial for the effective application of monetary policies. This initiative reflects Kuwait's commitment to maintaining its financial stability and enhancing the efficiency of its financial system through innovative technologies.

This study attempts to make three contributions to the existing literature and to national efforts towards exploring CBDC in Kuwait. The first contribution is identifying the determinants of CBDC issuance in Kuwait and the extent of its adoption drivers, as Kuwait is an emerging market and one of the key financial technology leaders in the region. The second contribution involves investigating the potential implications of introducing CBDC on commercial banks' profitability in Kuwait and discussing the required mitigative measures to maintain domestic financial stability.

Providing empirical evidence and insights for policymakers about the context of CBDC in Kuwait constitutes the third contribution of this study. This study aims to bridge gaps in the existing literature, where analysing CBDC in Kuwait has not yet been empirically examined. Therefore, this study used various datasets, spanning from 2000 to 2021, and utilized multiple econometric approaches to generate robust outcomes regarding the drivers of CBDC issuance and its impact on banks' profitability in Kuwait.

Our results from the ordered probit model show significant relationships between the probability of issuing CBDC in Kuwait and the following factors: digital infrastructure, innovation capabilities, institutional factors, public interest and economic development. Furthermore, the results from the VAR model indicate that customer deposits play an important role in banks' profitability in Kuwait, where any shock to banks' deposits that might be caused by CBDC could potentially affect their profitability. However, there are several mitigative tools that could be implemented to prevent adverse implications on commercial banks.

The rest of this paper is constructed as follows. The theoretical framework is discussed in the next section. The empirical models' data and specifications are presented in the third section. The estimation results are discussed in the fourth section. The fifth section discusses the results. The sixth section concludes the study. The seventh section discusses the limitations and future suggestions of the study.

CHAPTER TWO: THEORETICAL FRAMEWORK

Background

The emergence of CBDCs can be attributed to a confluence of technological advancements and shifting financial paradigms. Traditional financial systems, characterized by inefficiencies and high transaction costs, have increasingly been challenged by the rise of digital and decentralized financial platforms. The introduction of CBDCs represents a direct response from central banks to address these challenges while ensuring the stability and integrity of financial systems. Central banks are motivated by the need to improve payment efficiencies, reduce operational costs and enhance the accessibility of financial services. According to Ward and Rochemont (2019), the evolution of money from physical to digital form is driven by the overarching goal of maintaining the efficacy of monetary policies in the digital era.

The decline in cash usage, accelerated by the COVID-19 pandemic, has further underlined the need for digital currencies that can act as legal tender while ensuring universal accessibility. The fear associated with physical cash transactions during the pandemic led to an increased interest in digital payment solutions (ECB, 2020). This shift has not only facilitated more streamlined transactions but also highlighted the critical role that CBDCs could play in fostering a more inclusive financial ecosystem, particularly in regions with limited banking infrastructure.

The practical implementation of CBDCs has been varied, with several central banks around the world conducting pilot projects and analytical studies to explore their viability. The Bank of England, for instance, has defined a CBDC as a new form of digital money that could potentially be used by households and businesses to make payments and store value, thus complementing cash and bank deposits rather than replacing them. This digital form of currency is designed to be accessible, providing functionalities that surpass those of traditional cash (Ward and Rochemont, 2019).

Countries like the Bahamas and China have been the earliest contributors in this area. The Bahamas launched the Sand Dollar, a digital currency aimed at enhancing financial inclusion across its many islands, a critical step given the logistical challenges of banking (Alonso et al., 2021). On the other hand, China has progressed significantly with its digital Yuan, aiming to digitize a part of its money supply to improve payment efficiency and promote monetary policy implementation (Auer et al., 2020).

The mechanisms underlying CBDCs involve complex technological and operational frameworks designed to secure transactions and ensure the scalability of the digital currency. At the core of most CBDC designs is the use of Distributed Ledger Technology (DLT), although not all CBDC projects utilize blockchain, the technology that hosts cryptocurrencies. The choice of technology depends on the objectives set out by the central bank, in order to balance between efficiency, security and control.

CBDCs have two types for different features and purposes. First, the retail CBDC, which has several features such as intended for public use, often focus on ensuring ease of use, wide accessibility and robust security measures to protect against fraud and cyber threats. The second type is the wholesale CBDC, where this type is designed for restricted use by financial institutions and focuses on improving the efficiency and security of interbank payments and settlements. The study by the Central Banks of Canada, England and Singapore highlights the potential of wholesale CBDCs to reduce counterparty credit risk, a significant concern in high-value financial transactions (Central Banks, 2018).

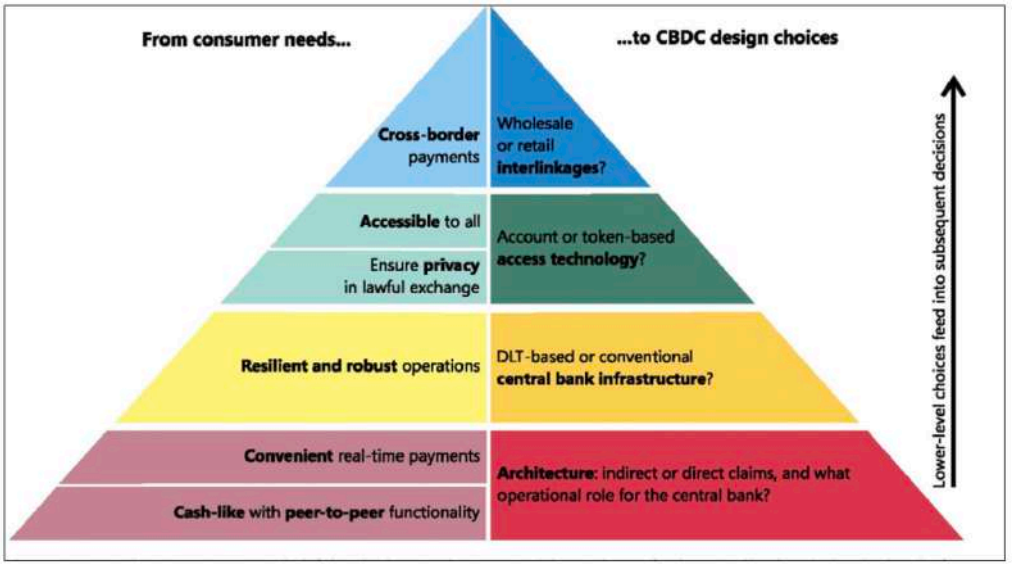


Figure 2: The CBDC Pyramid (Auer et al., 2020)

CBDCs and Cryptocurrencies

Cryptocurrencies gain remarkable attention due to their basis in blockchain technology as a decentralized ledger that enables transactions without a central authority (Ward and Rochemont, 2019). However, their adoption faces significant obstacles related to performance, interoperability, scalability and security. Central banks remain doubtful about the maturity of blockchain technology to replace or significantly alter current financial systems, reflecting a cautious stance towards these digital assets (Ward and Rochemont, 2019).

Otherwise, CBDC represents a digital form of fiat money issued and regulated by a country's central bank. Unlike cryptocurrencies, CBDCs are designed to carry all traditional functions of money as they serve as a medium of exchange, a unit of account and a store of value. This stability is largely because CBDCs, as legal tender, are backed by the central bank, providing them with inherent value stability unlike the highly volatile cryptocurrency market (Alonso et al., 2021).

One of the critical distinctions between CBDCs and cryptocurrencies lies in their operational frameworks. Cryptocurrencies operate on a decentralized network and are not controlled by any central authority, leading to their classification as non-sovereign assets. This decentralization can result in higher volatility and limited acceptance as a form of payment. CBDCs, however, are centralized and issued by central banks, allowing for more significant control and direct integration into the existing financial system (Alfar et al., 2023).

Furthermore, the environmental impact of these digital currencies also varies significantly. Cryptocurrencies are well-known for their substantial energy consumption due to the mining process, which has adverse environmental impacts. In contrast, CBDCs are designed to operate on more energy-efficient technology frameworks, which do not involve energy-intensive mining processes, thereby presenting a more sustainable option in the digital economy (Hasan et al., 2023; Ozili, 2023).

The reliability and risk associated with cryptocurrencies also contrast markedly with CBDCs. The supply and demand dynamics of cryptocurrencies lead to inflated prices and high volatility, making them unreliable as a store of value or medium for regular transactions. Conversely, CBDCs provide a risk-free alternative as they are fiat liabilities of the central bank and can be tightly regulated to ensure stability and reliability in financial transactions (Ozili, 2022).

Advantages

The potential shift towards a less cash-dependent society, facilitated by CBDCs, addresses numerous economic and security concerns associated with physical cash. Ward and Rochemont (2019) argue that the drive towards cashless transactions in Western countries is motivated by the convenience and reduced transaction costs associated with digital payments, which are increasingly preferred over cash. The nuanced approach to reducing cash circulation, particularly high denomination notes, aligns with broader goals to reduce financial crimes such as money laundering and corruption.

Meanwhile, CBDCs aim to enhance financial stability and inclusivity. Maryaningsih et al. (2022) highlight that while CBDCs will not replace fiat currencies, they will serve as a stable digital alternative particularly useful in economies facing high inflation rates. The design of CBDCs potentially enables access to financial services for populations currently underserved by traditional banking systems, such as the elderly and those in remote areas (Tercero-Lucas, 2023).

One of the transformative impacts of CBDCs is their potential to formalize economic activities and reduce crime. Oh and Zhang (2022) point out that CBDCs increase transparency in financial transactions, enabling better monitoring and thus contributing to more effective tax collection and reduction in financial crimes such as money laundering. This monitoring capability is facilitated by the digital nature of CBDCs, which unlike cash, can be traced and regulated more efficiently.

The operational advantages of CBDCs over traditional banking systems are profound. Ward and Rochemont (2019) discuss how CBDCs could improve the efficiency of wholesale and interbank payments through faster settlement times and extended operational hours. These operational efficiencies are crucial for enhancing the responsiveness and agility of financial markets.

CBDCs can redefine the approach monetary policies are implemented and transmitted across the economy. Tercero-Lucas (2023) argues that CBDCs, by providing central banks a direct mechanism to manage economic variables, strengthen the transparency and effectiveness of monetary policy. The ability to directly influence economic activity through a digital currency could lead to more precise and impactful economic interventions.

The introduction of CBDCs could fundamentally change the economy, presenting both opportunities and challenges. Son et al. (2023) describe the issuance of a CBDC as a double-edged sword for economies, providing additional payment and investment options and thereby expanding market fluidity. However, this same accessibility and efficiency could increase competition within the financial sector, potentially eroding the profit margins of traditional financial intermediaries. This dynamic emphasizes the need for a balanced approach in CBDC implementation, one that fosters innovation while considering the potential disruption to existing financial services.

Considerations

The potential impact of CBDCs on monetary policy transmission and macroeconomic stability is an essential consideration. Das et al. (2023) claim that the importance of central banks closely monitoring the macroeconomic environment post-CBDC issuance. The adaptability of monetary policy in response to the economic shifts induced by CBDCs is crucial. Whether tightening or expanding financial conditions, the central bank needs to be prepared to use its policy instruments effectively to maintain economic stability and achieve financial objectives.

The role of CBDCs in transforming the informal economy is complex and varies across countries. Oh and Zhang (2022) show that the adoption and impact of CBDCs may differ significantly depending on the size of a country's informal economy. The traceability offered by CBDCs could greatly develop government capabilities in reducing tax evasion and other illegal activities. Additionally, CBDCs could promote financial inclusion and increase the overall fluidity of the economy. However, the effectiveness of CBDCs in replacing cash will largely depend on whether they offer comparative benefits, which is crucial in regions where cash is deeply embedded in daily transactions.

The legal considerations surrounding the launch of CBDCs are profoundly critical. Bossu et al. (2020) argue that the issuance of CBDC should be based on a robust and explicit legal foundation within central bank laws to avoid potential legal and political challenges. It is essential that CBDCs do not constitute a new monetary unit but rather a digital form of the existing monetary unit, ensuring their acceptance and integration within the current legal and financial systems. The careful consideration of the legal foundations of CBDCs is paramount in ensuring their successful integration and operation.

Another important consideration is the design of CBDCs, especially in terms of their impact on inflation control. Chen and Siklos (2022) suggest that a thoughtful design of CBDCs, possibly including the elimination of large denominations, could maintain control over inflation. The design

must align with broader monetary policy objectives to ensure that CBDCs do not disrupt existing financial and economic stability.

Issuance Determinants

As nations evaluate the potential integration of CBDCs, understanding the diverse factors influencing their adoption and issuance is crucial. These determinants are categorized into economic, technological, demographic, financial and institutional factors. Each factor plays a vital role in shaping the feasibility, design and functionality of CBDCs across different regions.

Economic factors are a primary consideration in the adoption of CBDCs. Developed economies with advanced financial markets often explore wholesale CBDCs to facilitate cross-border transactions and to improve the dynamism of international trade and financial services (Maryaningsih et al., 2022). Alternatively, economies characterized by significant financial exclusion consider retail CBDCs as vehicles to extend financial services to unbanked populations, promoting economic inclusivity and stability (Alfar et al., 2023).

Furthermore, the presence and scale of the informal economy significantly influence CBDC initiatives. Economies with large informal sectors might adopt CBDCs to transition these activities into the formal sector, thus expanding the tax base, increasing government revenues and reducing money laundering and other illegal activities (Auer et al., 2020).

Technological infrastructure is crucial to the successful adoption of CBDCs. The implementation and sustainability of CBDC initiatives rely heavily on a country's digital infrastructure. Auer et al. (2020) demonstrate that countries with advanced technology sectors and substantial investments in innovation are more likely to develop and sustain robust CBDC systems. This includes managing cybersecurity challenges, ensuring efficient transaction processing and scaling the digital currency system to meet national needs.

Demographic influences play a significant role in the reception and integration of CBDCs. Urbanization and the demographic profile, particularly the age distribution of the population, affect CBDC adoption. Younger, urban populations, which are typically more tech-savvy, facilitate smoother adoption and integration of CBDCs into daily economic activities. Alonso et al. (2020) suggest that societal openness to innovation and technology also significantly impacts the successful deployment and utilization of CBDCs.

The conditions of existing financial systems and the level of financial literacy among the population are important financial determinants. Well-developed financial systems that are transitioning towards digital solutions may integrate CBDCs more seamlessly. Financial literacy is pivotal in determining how quickly and effectively individuals and businesses can adopt CBDCs. Countries investing in financial education and digital literacy are likely to experience smoother transitions and higher adoption rates (Alfar et al., 2023).

The institutional framework, including the legal and regulatory environments, supports the issuance and operation of CBDCs. An explicit and robust legal framework is essential to tackle potential legal challenges and structure pathways for resolving disputes and uncertainties regarding CBDC transactions. Bossu et al. (2020) indicate that regulatory adaptations are necessary to manage unique digital currency challenges such as privacy, data security and cross-border transaction controls.

Table 1: CBDC Projects Around the Word (Sources: BIS, Central Banks reports)

Central Bank	CBDC Name	Investment Amount	Development Stage	Beginning of Interest
Bank of Canada	Digital CAD	CAD 20 million	Research	2016
Bank of England	Digital Pound	£200 million	Research	2020
Bank of Japan	Digital Yen	JPY 50 million	Research	2020
Bank of Korea	Digital Won	₩50 billion	Pilot	2020
Central Bank of Bahamas	Sand Dollar	$48 million	Launched	2018
Central Bank of Brazil	Digital Real	BRL 10 million	Research	2020
Central Bank of Russia	Digital Ruble	RUB 10 billion	Pilot	2020
European Central Bank	Digital Euro	€500 million	Research	2019

Federal Reserve	Digital Dollar	Unpublished	Research	2017
People's Bank of China	Digital Yuan	$1.5 billion	Pilot	2014
Reserve Bank of Australia	Digital AUD	AUD 20 million	Research	2020
Reserve Bank of India	Digital Rupee	₹350 million	Research	2020

Auer et al. (2020) point out that these determinants do not operate in isolation but interact in complex ways to influence CBDC adoption. For instance, the combination of economic and technological factors can determine how financial market development and digital infrastructure together facilitate or hinder the adoption of CBDCs. Likewise, institutional and demographic factors intersect, as younger, more urbanized populations may demand more robust regulatory frameworks to support the safe use of digital currencies (Auer et al., 2020).

Perspectives on CBDCs vary around the globe, with different countries recognizing distinct benefits and facing unique challenges. Advanced economies with strong financial systems might focus on enhancing existing digital payment systems and expanding international transaction capabilities while developing countries might prioritize financial inclusion and the formalization of economic activities (Maryaningsih et al., 2022; Alfar et al., 2023).

The Implications on Banks' Profitability

The potential impacts of CBDCs on the commercial banking sector are debatable among economists and scholars. On the concerns side, several studies in the literature indicate that CBDCs could lead into a potential reduction in traditional bank financing sources. Maryaningsih et al. (2022) note that the public's ability to shift deposits to CBDCs could lead to lower loan disbursement capabilities for banks. This shift could drain essential funds from the banking sector, impacting their primary function of credit provision (Agur et al., 2021; Kim and Kwon, 2019; Keister and Sanches,

2019). As deposits move from commercial banks to central banks, the available pool of loanable funds could diminish, constraining banks' ability to support economic activities through lending.

The introduction of CBDCs might force commercial banks to increase the costs associated with transferring funds out of bank accounts to retain their deposit base. Tercero-Lucas (2023) describes a scenario where banks could respond to CBDC competition by raising fees for certain transactions, which could ultimately make banking services less attractive to consumers. Furthermore, Kim and Kwon (2019) highlight that an increase in CBDC deposits could lower the reserve-deposit ratio at commercial banks, increasing the risk of bank panics due to insufficient cash reserves to meet withdrawal demands.

Consequently, the profitability of banks could be adversely affected by the issuance of interest-bearing CBDCs. As Son et al. (2023) explain, if CBDCs offer competitive interest rates, individuals might prefer to hold their savings directly with the central bank, bypassing traditional bank deposits. This could lead to a notable reduction in the deposit base that banks rely on for generating income through loan interests. In addition, an economy-wide shift from bank deposits to CBDCs could trigger financial disintermediation, raising long-term refinancing costs for banks and destabilizing their operational frameworks (Villaverde et al., 2021; Castren et al., 2022).

With the higher perceived security of CBDCs, customers may rapidly transfer funds from commercial banks to central banks during times of financial uncertainty, potentially destabilizing the banking system. This scenario is discussed by Kim and Kwon (2023) and Bech and Garratt (2017), who suggest that the ease and reduced cost of digital transactions could facilitate faster and larger-scale withdrawals, where this phenomenon will increase liquidity risks for banks.

Given these challenges, banking institutions and regulators should consider strategic and regulatory responses to mitigate the potential negative impacts of CBDCs. This might include developing new business models that can coexist with CBDCs, enhancing the value proposition of banking services or advocating for regulatory frameworks that ensure a level playing field between CBDCs and traditional banking products (Sandner et al., 2020; Skingsley, 2016).

Alternatively, numerous empirical studies indicate that the negative implications on commercial banks' profitability are marginal and manageable. Tercero-Lucas (2023) elaborates on how an interest-bearing CBDC would directly affect the banking sector by influencing the rates for

sight deposits and loans. The author suggests that if CBDCs offer higher interest rates, traditional banks will be forced to increase their rates to remain competitive, potentially increasing their operational costs.

Moreover, Kim and Kwon (2019) claim that the introduction of CBDCs might lead to enhanced financial stability by providing central banks with additional tools to control monetary policy and liquidity more effectively. The authors also suggest that allowing the central bank to lend CBDC deposits back to commercial banks could prevent liquidity shortages, thereby stabilizing the financial system.

Andolfatto (2021) demonstrates that establishing a suitable rate for CBDCs might not influence the profitability of commercial banks and issuance of CBDCs does not substantially impact the rates of loans. Chiu et al. (2023) investigate how CBDC releases affect the profitability of banks within a competitive banking environment. Their research indicates that the deployment of CBDCs enhances the competitive stance of banks, leads to higher deposit rates, and broadens the scope of financial brokerage services offered by commercial banks.

The seminal analysis by Adalid et al. (2022) examines the potential implications of a digital euro on bank intermediation. Their findings indicate that the impacts could vary significantly across different financial institutions and scenarios. In high-demand scenarios for CBDCs, there could be a detrimental impact on banks' intermediation capacity due to a significant outflow of deposits unless mitigated by regulatory measures such as caps on CBDC holdings or incentivizing banks through other liquidity providing measures (Adalid et al., 2022).

The strategic design of CBDCs is crucial in mitigating potential adverse effects on commercial banks. Imposing limits on the amount of CBDC an individual or entity can hold, and regulating the convertibility from bank deposits to CBDCs, are seen as effective strategies to control the migration of deposits from commercial banks to the central bank, thus maintaining the liquidity requirements of the traditional banking system (Group of Central Banks, 2021).

On a broader economic level, the introduction of CBDCs could reshape monetary policy transmission and potentially enhance financial inclusion. However, these benefits come with challenges such as increased competition for deposit funding, which might necessitate adjustments in financial regulation and bank business models (Das et al., 2023). Additionally, the actual take-up of CBDCs and their attractiveness compared to existing monetary options will significantly influence their impact on the financial system.

Long-term considerations include the potential for CBDCs to reduce the costs associated with handling cash and the possibility of fostering new financial technologies and business models that could coexist with traditional banking functions, as proposed by Sandner et al. (2020).

Bellia and Calès (2023) delve into the implications of implementing a digital euro, as initiated by the Eurosystem's two-year investigation that began in mid-2020. Their research evaluates how different levels of CBDC adoption could affect key profitability metrics such as return on assets (ROA) and return on equity (ROE) across Eurozone banks. The findings indicate that while a moderate uptake of CBDCs would minimally affect bank ROE, a scenario with a cap of 3,000 EUR on CBDC holdings would slightly decrease the ROE by 4% for large banks.

In contrast, Bellia and Calès (2023) indicate that a more extensive adoption scenario revealed a significant reduction in ROE, dropping to 2.7% for large banks and 2.4% for smaller ones, underling the potential risks to bank profitability, especially for those heavily reliant on deposit funding. To address these concerns, the study suggests imposing limits on CBDC holdings as a mitigative measure.

The interest-bearing CBDC, when managed as a monopoly, could expand a bank's deposit base and lending capacity through heightened competition, as suggested by Andolfatto (2021). Similarly, Chiu et al. (2022) state that the impact of CBDCs on bank disintermediation might be limited, depending on how the CBDC is remunerated. If the CBDC offers a higher rate than traditional deposits, it could lead to reduced loan and deposit volumes. A previous study by Brunnermeier and Niepelt (2019) highlights potential policy measures that could counteract the negative effects of CBDCs on traditional banking. These include ensuring that the central bank remains committed to acting as a lender of last resort, which could mitigate the risks associated with large-scale transitions from bank deposits to CBDC holdings.

Regional and Local Context

Project Aber, initiated by Saudi Arabia and the UAE in 2019, uses DLT-based solutions for cross-border and domestic settlements, showcasing the transformative potential of financial technology in achieving sustainable development goals (SDGs). This project found by Hasan (2023) significantly enhances firm-level commitment to SDGs across all GCC countries, encouraging stakeholder collaboration for sustainable development. Gulf countries are relying on technological advancements as key drivers

for increased sustainability efforts in the region, while global fintech developments, including CBDC, are positively influencing SDGs and fostering sustainable financial practices (Al-Saidi, 2022; Hoang et al., 2022; Ozili, 2023).

CBDC's adoption from Islamic finance and Shariah principles perspectives have been discussed by Lukonga (2023). The author notes that the introduction of CBDCs in Islamic countries presents several complex design challenges. Given the Shariah prohibition against interest, CBDCs that offer returns would either need to be non-remunerative or structured to include profit-sharing mechanisms instead of conventional interest payments. Further, the author suggests the integration of CBDCs into tokenized financial markets must be carefully managed to align with Islamic banking norms, particularly the prohibition against using CBDCs for speculative transactions such as foreign exchange derivatives.

In the local context of banks' profitability, AlHarthi (2022) found that deposit volume positively impacts the profitability of Kuwaiti banks. This aligns with insights from Alshammari (2021), Haddad and Alali (2021) and Azam and Siddiqui (2012), which suggest that an efficient strategy to enhance bank profitability is to increase deposit volumes, possibly through attractive deposit interest rates to entice higher customer deposits. These findings point out the critical role of deposits in enhancing bank profitability, suggesting that introducing CBDC might threaten banks' profitability if CBDC shifts deposits into the central bank, as discussed in the previous literature.

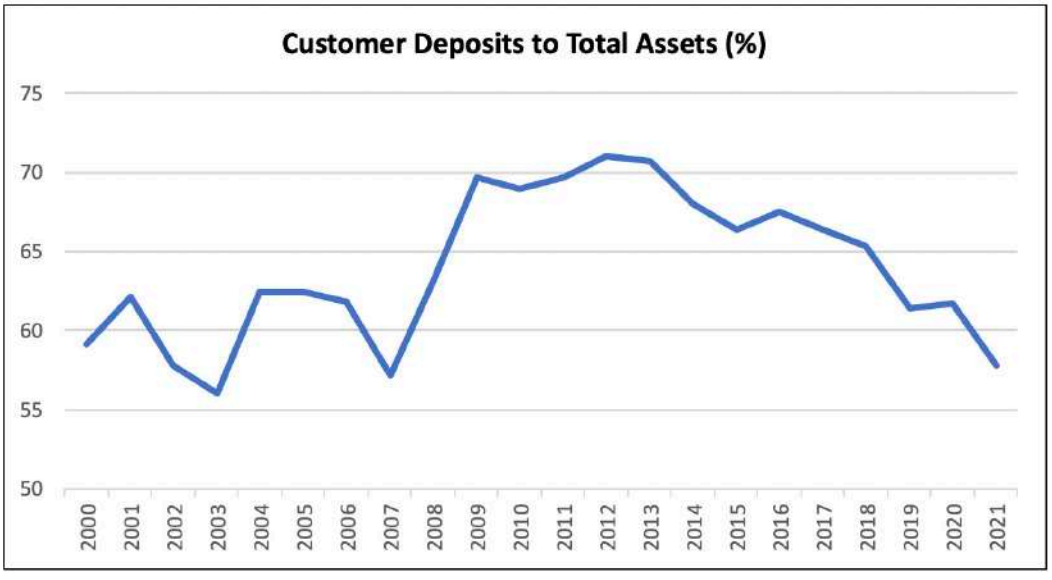


Figure 3: Ratio of Customer Deposits to Total Assets of Commercial Banks in Kuwait (CBK, 2024)

CHAPTER THREE: EMPIRICAL STRATEGY

The main aims of this study are to analyse the influential factors determining CBDC issuance in Kuwait and to measure the impact of adopting CBDC on the profitability of local commercial banks. Therefore, this study employs two estimation models: one for CBDC issuance determinants and another for the impact of CBDC on banks' profits in Kuwait.

The first model (Model One) investigates the determinants of issuing CBDC in Kuwait. This model tests the theoretical frameworks by Auer et al. (2020), Maryaningsih et al. (2022) and Alfar et al. (2023) regarding the determinants of CBDC issuance within the Kuwait context. The hypothesis in this model indicates that the issuance of CBDC in Kuwait is determined by several factors: digital infrastructure, innovation capabilities, institutional factors, public interest, economic development, macroeconomic conditions and cross-border transactions.

The second model (Model Two) is based on the theoretical frameworks of Adalid et al. (2022) and Bellia and Calès (2023). It evaluates the effects of CBDC on banks' profitability in Kuwait. This model constructs multiple shock scenarios where deposits in commercial banks could be replaced by CBDC, examining the potential impact of each scenario on banks' profits. The hypothesis in Model Two suggests that CBDC has explicit adverse effects on banks due to high CBDC take-up and the consequent reduction in deposits in commercial banks.

Data

Model One – CBDC Issuance Determinants

Each estimation model utilizes datasets with varying time series frequencies due to data availability specific to the context of CBDC in Kuwait. The dataset for Model One, which focuses on CBDC issuance determinants, consists of quarterly data from 2014Q1 to 2021Q4. The CBDC variable indicates the status of CBDC interest in Kuwait, it is set to zero during periods without official interest in the CBDC project and changes to one when interest begins. This data was obtained from the Central Bank Digital Currency (CBDC) Tracker.

The digital infrastructure drivers in Model One are represented by the ratio of individuals using the internet to the total population in Kuwait, sourced from the International Telecommunication Union (ITU) Database. Innovation capabilities are measured by the logarithm of high-technology exports (USD) from Kuwait and were obtained from the UN Comtrade Database. The percentile rank of Government effectiveness was used to measure the institutional factors, where the data for this variable was obtained from the Worldwide Governance Indicators by the World Bank.

Public interest in CBDC was captured by the average search intensity score for "CBDC" and related terms by individuals in Kuwait, where this data was obtained from Google Trends. Logged GDP per capita (constant 2015 USD) was used as a proxy for economic development and was obtained from the World Bank's national accounts data. The ratio of household final expenditures to GDP was applied to represent macroeconomic conditions and obtained from the World Bank's national accounts data. Cross-border transactions were represented by the ratio of Personal remittances to GDP and obtained from UNCTAD.

Model Two – CBDC Impact on Banks' Profitability

The dataset for Model Two, which investigates the effect of CBDC on commercial banks' profitability, comprises annual time series data from 2000 to 2021. Return on Assets (ROA) is used in this model as a proxy for aggregate banks' profits. ROA is a ratio that illustrates how profitable a banking sector is in relation to its total assets, where this data was obtained from the Global Financial Development Database of the World Bank. The variable of interest in this model is the ratio of customer deposits to total assets, which was extracted from the Central Bank of Kuwait (CBK). The ratio of loans to total assets is also included in the model, where this was obtained from the CBK.

The macroeconomic factor in this model is represented by the GDP growth rate, obtained from the World Bank's national accounts data. Since the government dominates the majority of economic activity in Kuwait, logged government expenditures (KWD) were added to the model, where this data was obtained from the Ministry of Finance (MOF).

Econometric Methods

Model One

To estimate the drivers of issuing CBDC, this study utilized an ordered probit approach for Model One, since the standard ordinary least squares would provide inconsistent estimates (Auer et al., 2020). The ordered

probit model, developed by McKelvey and Zavoina (1975), is a type of regression used for predicting an ordinal dependent variable based on an independent variable. This sort of regression is employed when the dependent variable has categorial order. Therefore, Model One is specified as follows:

$$Prob(CBDC_t = 0{,}1 \mid X_t) = F(\alpha + \beta X_t + \epsilon_t) \quad \textbf{(1)}$$

Where $Prob\ (CBDC_t = 0{,}1 \mid X_t)$ is the probability that the status of the official interest in the CBDC project in Kuwait equals 0 (no interest) or 1 (interest), F is the functional form of ordered probit, X_t is the potential driver of CBDC issuance, α is the intercept in the model, β is the coefficient associated with the predictors X_t and ϵ_t is the error term.

The Marginal effect of each predictor will be calculated after running the ordered probit regressions in order to quantify how the change of predictors would affect the probability of issuing CBDC in Kuwait. The marginal effect of each factor on CBDC issuance can be calculated as follows:

$$ME_{X_t} = \beta \cdot f(\alpha + \beta X_t) \quad \textbf{(2)}$$

Where $f(.)$ is the probability density function (pdf) of the standard normal distribution, which represents the gradient of the cumulative distribution function (F) used in the probit model. β is the coefficient associated with each regressor X_t. The calculation evaluates the change in probability at the given value of each regressor regarding the context of CBDC issuance.

Model Two

Estimating the effects of CBDC take-up scenarios on banks' profitability in Model Two will be calculated after analysing the influential factors on the profitability of commercial banks. The econometric model is written as follows:

$$ROA_t = \alpha + \beta_1 DEP_t + \beta_2 LTA_t + \beta_3 GDP_t + \beta_4 log(GOV_t) + \epsilon_t$$

(3)

Where the dependent variable is (*ROA*) and stands for Return on Assets. Regarding the independent variables, the variable of interest in this model is (*DEP*) which stands for the ratio of customer deposits to total assets, and (*LTA*) refers to the ratio of loans to total assets. The other factors are represented by the GDP growth rate (*GDP*) and logged government expenditures (*GOV*).

The Vector Autoregressive (VAR) model is used to estimate the drivers of commercial banks' profitability. The VAR model is a crucial approach that captures the capture the linear interdependencies among multiple time series. This approach allows for the prediction of a matrix of interrelated variables using their lagged (past) values, where each variable in the model is expressed as a linear combination of past values of all variables. The simple representation of the VAR model equation is written as follows:

$$Y_t = \delta + \theta_{1,1} Y_{t-1} + \theta_{2,1} X_{t-1} + \epsilon_t$$

(4)

In equation (4), Y_t is the dependent variable, δ represents the intercept term and $\theta_{1,1}$ is the coefficient of the first lag of *Y*, where it is the effect of the previous value of on its current value. $\theta_{2,1}$ is the coefficient of the first lag of the independent variable *X*, where this coefficient measures the effect of the previous value of *X* on the current value of *Y*. The error term is represented by ϵ_t and it is assumed to be uncorrelated white noise.

The choice of lag length in the VAR model can determined based on information criteria such as the Akaike Information Criterion (AIC) to ensure that the model includes all relevant historical information without overfitting. Several diagnostic tests will be implemented to measure the stability and fitness of the model, such as normality tests, Wald test and the Roots of the companion matrix. All econometric approaches will be conducted by Stata statistical software.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Model One – CBDC Issuance Determinants					
CBDC interest status (scale 0-1)	36	0.44	0.50	0	1
Internet use (%)	36	93.58	8.41	78.7	100
Logged High-technology exports (USD)	36	16.72	1.39	15.14	19.25
Government effectiveness (scale 1-100)	36	48.87	3.93	43.80	57.54
Public intensity (scale 1-10)	36	3.05	2.41	0	8.08
Logged GDP per capita (USD)	36	10.20	0.06	10.08	10.28
Household final expenditures (%)	36	41.53	4.89	28.98	46.13
Personal remittances (%)	36	12.60	2.04	9.55	16.38
Model Two – CBDC Impact on Banks' Profitability					
Return on assets (%) (***ROA***)	22	1.64	0.84	0.17	3.34
Deposits to total assets (%) (***DEP***)	22	63.88	4.69	56.02	71.06
Loans to total assets (%) (***LTA***)	22	20.99	2.96	13.66	23.89
GDP growth rate (%) (***GDP***)	22	2.88	6.07	-8.85	17.32
Logged Government expenditures (KWD) (***GOV***)	22	9.43	0.61	8.06	10.04

CHAPTER FOUR: RESULTS

Descriptive statistics for the variables in the examined models are shown in Table 2. It has been demonstrated that official interest in the CBDC project in Kuwait began in the third quarter of 2019 and has remained at the research stage. The highest average ROA of commercial banks in Kuwait was 3.34 per cent in 2006, where the highest ratio of customer deposits to total assets was recorded at 71 per cent in 2012.

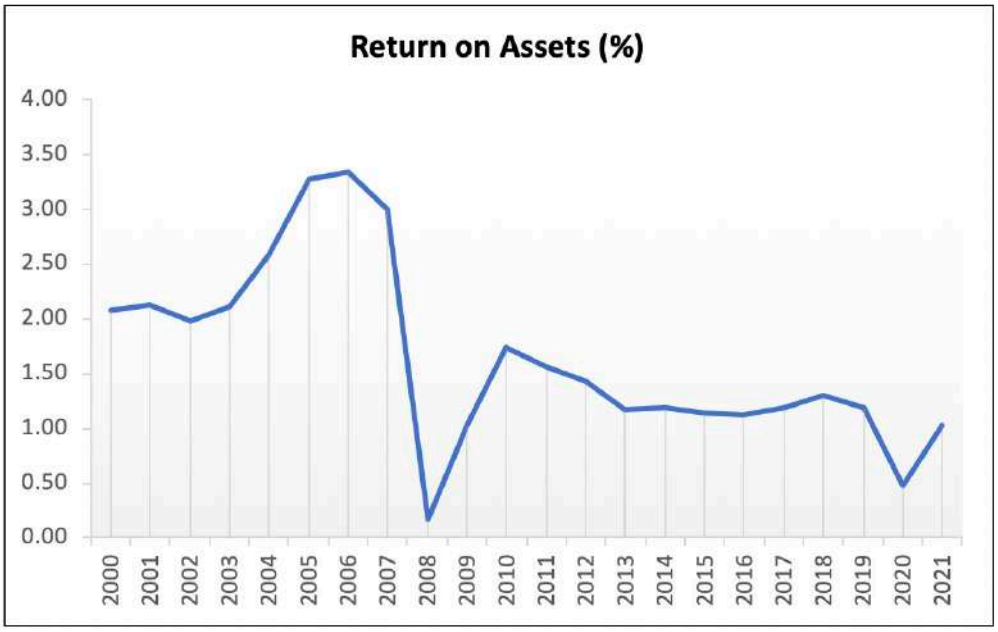


Figure 4: Return on Assets of Commercial Banks in Kuwait (The World Bank, 2024)

CBDC Issuance Determinants

Table 3 illustrates the results of univariate ordered probit regressions on the CBDC interest status. The results confirm a strong and positive association between the digital infrastructure and CBDC, in line with the previous findings by Alfar et al. (2023) and Auer et al. (2020) that advanced technology sectors facilitate the adoption of CBDC in financial sectors. Innovation capabilities are a critical driver for issuing CBDC in Kuwait, where our results indicate that the extent of domestic innovation has positively and significantly influenced interest in CBDC.

This result is consistent with findings by Alfar et al. (2023) and Alonso et al. (2020), which suggest that innovation and technology significantly affect the successful issuance and utilization of CBDCs.

The regulatory environment plays a crucial role in determining the issuance of CBDC. Our results reveal that government effectiveness is encouraging CBDC in Kuwait, supporting the prior arguments that institutional frameworks shape the feasibility and functionality of CBDC (Alfar et al., 2023; Bossu et al., 2020; Auer et al., 2020). Likewise, public interest towards CBDC, captured by Google trends, is conducive and significant for adopting CBDC, aligning with the previous results by Auer et al. (2020).

Table 3: Results of the Ordered Probit Model

Univariate ordered probit regressions on CBDC interest status in Kuwait							
Digital infrastructure							
Individuals using the internet	1.377**						
(% of population)	(0.018)						
Innovation capabilities							
Logged high-technology exports		0.466***					
(USD)		(0.004)					
Institutional factors							
Government effectiveness			0.217***				
(Percentile rank)			(0.000)				
Public interest							
Search intensity				0.339***			
(Score 1-10)				(0.004)			
Economic development							
Logged GDP per capita					15.22***		
(USD)					(0.001)		
Macroeconomic conditions							
Household final expenditures						0.217*	
(% of GDP)						(0.055)	
Cross-border transactions							
Personal remittances							0.201*
(% of GDP)							(0.062)
Pseudo R^2	0.54	0.17	0.21	0.22	0.25	0.17	0.07

Note: ***, ** and * refer to the levels of significance at 1%, 5% and 10% respectively. P-values are in the parentheses.

Consistently with Maryaningsih et al. (2022), our results indicate that the scope of economic development is strongly significant in the context of adopting CBDC. This finding suggests that levels of economic development and advancements in financial markets are increasing the intensity of exploring CBDC. Although statistically weakly significant, the outcome of macroeconomic conditions exhibits positive effects on CBDC issuance; this finding supports the results by Maryaningsih et al. (2022). Similarly, our results reveal that the extent of cross-border transactions raises the official interest in CBDC issuance in line with previous literature (Auer et al., 2020; Maryaningsih et al., 2022), although it is statistically weakly significant.

Overall, digital infrastructure, innovation capabilities, institutional factors, public interest and economic development each represent important elements that have a strong and positive association with the issuance of CBDC in Kuwait. However, macroeconomic conditions and cross-border transactions have weak linkages with CBDC adoption in Kuwait. In order to quantify the effect of each CBDC driver, Figure 5 displays the average marginal effect of CBDC issuance determinants. This figure demonstrates that economic development, measured by GDP per capita, has the greatest impact on CBDC issuance compared with the other determinants, at 4.5 per cent.

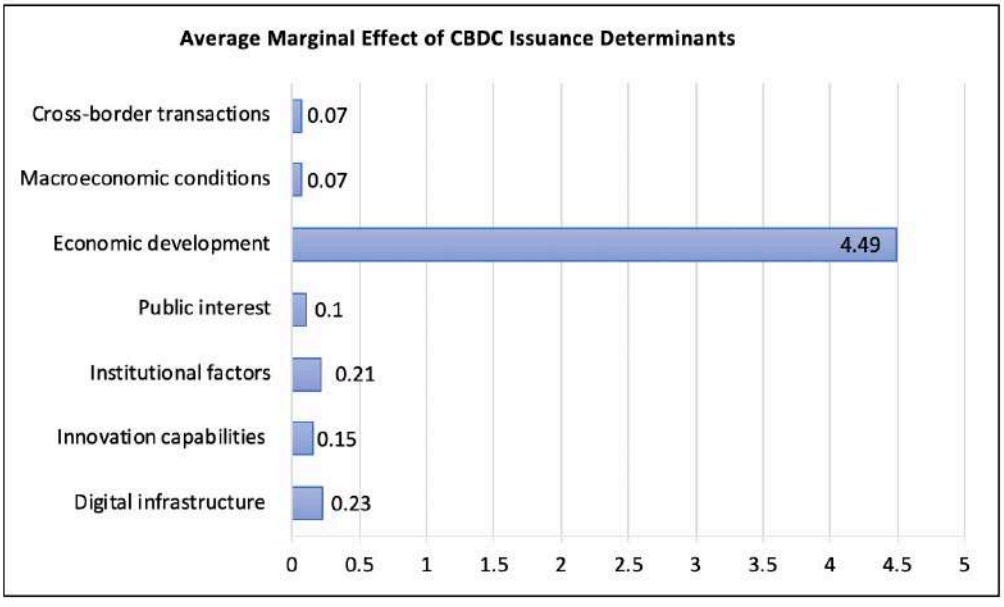


Figure 5: The Marginal Effect of CBDC Issuance Determinants (Source: Author's calculation)

This result implies that any 1 per cent increase in GDP per capita is associated with a 4.5 per cent increase in the official intensity of issuing CBDC. Additionally, this result suggests that CBDC issuance in Kuwait

is determined by the domestic economy's development and financial markets' advancements. However, the lowest effects on CBDC adoption were observed with macroeconomic conditions and cross-border transactions, each contributing only 0.07 per cent.

CBDC Impact on Banks' Profitability

Before running the VAR model regression to analyse the profitability of commercial banks, the lag-order selection was tested to choose the optimal lag length for the model. Table 4 reveals that two lags is the optimal selection for the number of lags in our model. Therefore, equation (3) will be transformed to the VAR model with two lags, and it is written as follows:

$$ROA_t = \alpha + \beta_{1,1}ROA_{t-1} + \beta_{1,2}ROA_{t-2} + \beta_{2,1}DEP_{t-1} + \beta_{2,2}DEP_{t-2} + \beta_{3,1}LTA_{t-1} + \beta_{3,2}LTA_{t-2} + \beta_{4,1}GDP_{t-1} + \beta_{4,2}GDP_{t-2} + \beta_{5,1}log(GOV_{t-1}) + \beta_{5,2}log(GOV_{t-2}) + \epsilon_t \quad \textbf{(5)}$$

The VAR model regression results of the drivers of commercial banks' profitability are shown in Table 5. The ratio of customer deposits to total assets (*DEP*) is the variable of interest in this model to investigate its effects on banks' profitability, which is measured by the ratio of returns to total assets (*ROA*), and thereafter estimate CBDC take-up scenarios. The results indicate that the first lag of customer deposits (*DEP*) is positively significant with respect to banks' profits, suggesting that any 1 per cent increase in customer deposits increases banks' profitability by 0.068 per cent.

Table 4: Results of Lag-order Selection

Lag-order selection criteria	Information Criterion
Lag	Akaike Information Criterion (AIC)
0	18.983
1	14.703
2	14.187*

Our findings are consistent with prior studies on the determinants of banks' profitability in Kuwait, where their results indicate that deposit volumes positively affect the profitability of Kuwaiti banks (AlHarthi,

2022; Alshammari, 2021; Azam and Siddiqui, 2012). Although the result of customer deposits assets (*DEP*) in its second lag exhibits an unexpected sign, it is statistically insignificant, implying that the result of the second lag is inconsequential. The value of R-squared indicates that our regression model explains 86 per cent of the variability in the return on assets (*ROA*), the proxy of banks' profitability.

CBDC take-up scenarios

Given that the baseline impact of customer deposits on banks' profitability is positive and significant at 0.068 per cent, introducing CBDC in Kuwait might have negative consequences on banks' profits due to concerns about deposits outflows from commercial banks to the central bank. Following the approach of Adalid et al. (2022) and Bellia and Calès (2023), we construct three shock scenarios where deposits in commercial banks could be replaced by CBDC. The lowest scenario assumes that deposits in commercial banks will be replaced by CBDC at 25 per cent, the moderate scenario assumes a replacement rate of 50 per cent and the highest scenario assumes a replacement rate of 75 per cent.

Table 5: Results of the VAR Regression Model

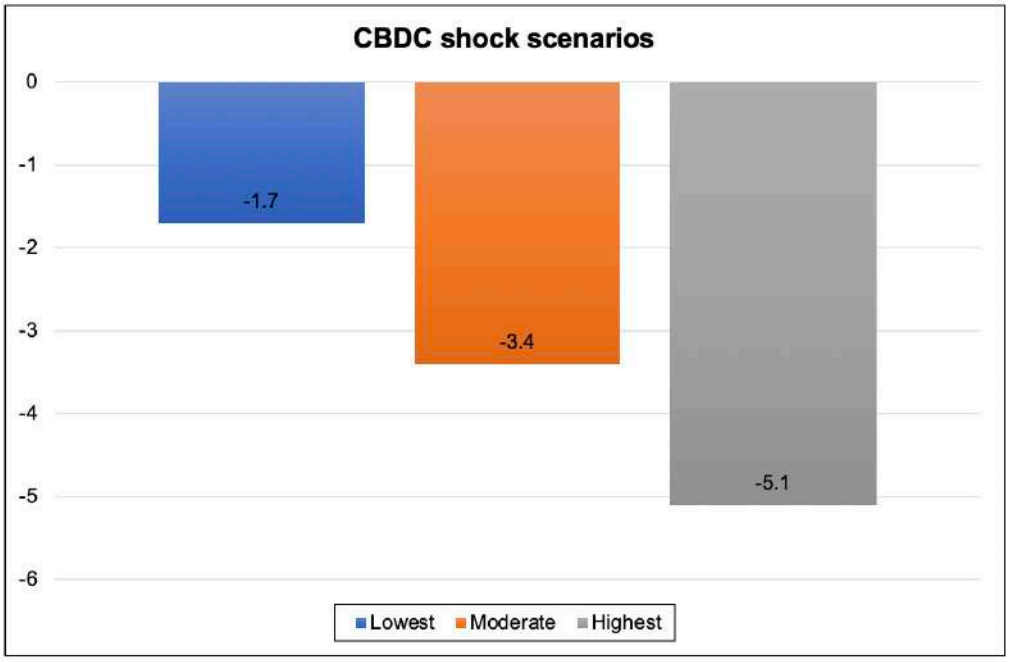
Variable	Coefficient	Std. Err.	z-value	P-value
ROA_{t-1}	0.083	0.305	0.27	0.784
ROA_{t-2}	-0.232	0.293	-0.79	0.43
DEP_{t-1}	0.068**	0.033	2.06	0.039
DEP_{t-2}	-0.017	0.040	-0.44	0.66
LTA_{t-1}	0.264**	0.119	2.22	0.027
LTA_{t-2}	-0.039	0.149	-0.26	0.792
GDP_{t-1}	0.017	0.022	0.77	0.44
GDP_{t-2}	-0.007	0.025	-0.29	0.775
$log(GOV_{t-1})$	-0.460	0.677	-0.68	0.497
$log(GOV_{t-2})$	-1.497***	0.523	-2.86	0.004
Intercept	12.185**	4.798	2.54	0.011
R^2	0.86			

Note: ***, ** and * refer to the levels of significance at 1%, 5% and 10% respectively.

Figure 6 illustrates three assumptions of how CBDC take-up and its replacement of deposits in commercial banks might affect banks' profits in Kuwait. The lowest scenario suggests that if 25 per cent of deposits in commercial banks are transferred to the central bank, banks' profitability will decrease by 1.7 per cent. The moderate scenario indicates that if 50 per cent of deposits in commercial banks are transferred to the central bank, their profits would drop by 3.4 per cent. The highest shock scenario reveals that if 75 per cent of deposits are transferred to the central bank, their profits would drop by 5.1 per cent.

Consequently, our assumptions support the arguments of Adalid et al. (2022) and Bellia and Calès (2023) that adopting CBDC exhibits adverse implications for commercial banks in terms of the potential outflows of deposits. The authors state that the range of negative effects varies according to the extent of the shock scenario, which aligns with our results in Figure 6. However, these assumptions were constructed based on multiple scenarios of concerns, which could be mitigated before introducing a CBDC.

Figure 6: CBDC Shock Scenarios on Banks' Profitability in Kuwait (Source: Author's calculation)



Adalid et al. (2022) suggest implementing regulatory arrangements such as imposing caps on CBDC holdings or encouraging banks through liquidity provisions. In line with this suggestion, Bellia and Calès (2023) argue that imposing limits on CBDC holdings is considered a mitigative measure. Likewise, a study by the Group of Central Banks (2021) indicates that

regulating the convertibility from bank deposits to CBDC is an effective strategy for managing the migration of deposits from commercial banks to the central bank.

Moreover, a prior study by Sandner et al. (2020) demonstrates that, in the long term, CBDC will reduce commercial banks' costs associated with handling cash and encourage them to innovate new financial and business models. Thus, there is a bundle of measures that could mitigate the adverse effects of the future introduction of CBDC on the banks' profitability in Kuwait.

Diagnostic tests

Multiple diagnostic tests have been used to evaluate the normality and stability of the results of our VAR regression model. Table 6 illustrates the results of three normality tests: Jarque-Bera, Skewness and Kurtosis. The p-values from these results accept the null hypothesis that the model follows a normal distribution, suggesting that the model is appropriately normally distributed. Moreover, the Wald test is applied to assess the significance of coefficients in our VAR model for the first and second lags. The Wald test results in Table 7 reject the null hypothesis of insignificance and reveal that our VAR model coefficients are statistically significant.

Table 6: Results of Normality Tests for the VAR Model

Normality Tests	
Jarque-Bera	0.072
	(0.964)
Skewness	0.025
	(0.962)
Kurtosis	2.710
	(0.791)

Note: P-values are in the parentheses.

Table 7: Results of Wald Test for the VAR Model

Wald Test	
Lag	**Chi-Squared**
1	19.182***
	(0.002)
2	19.300***
	(0.002)

Note: ***, ** and * refer to the levels of significance at 1%, 5% and 10% respectively. P-values are in the parentheses.

Furthermore, the Roots of the companion matrix are used to determine the stability of our VAR model (see Figure 7). The plotted points (roots) are inside the unit circle, indicating the stability of our VAR model.

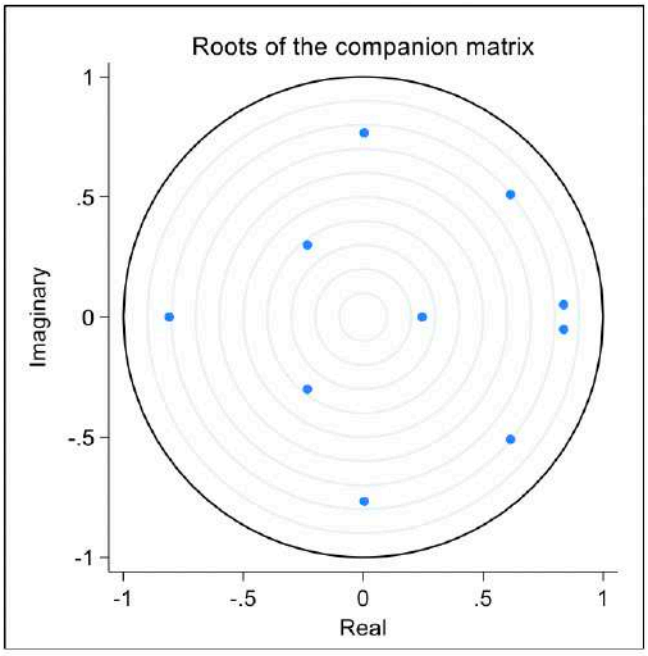


Figure 7: The Roots of the VAR Model

CHAPTER FIVE: DISCUSSION

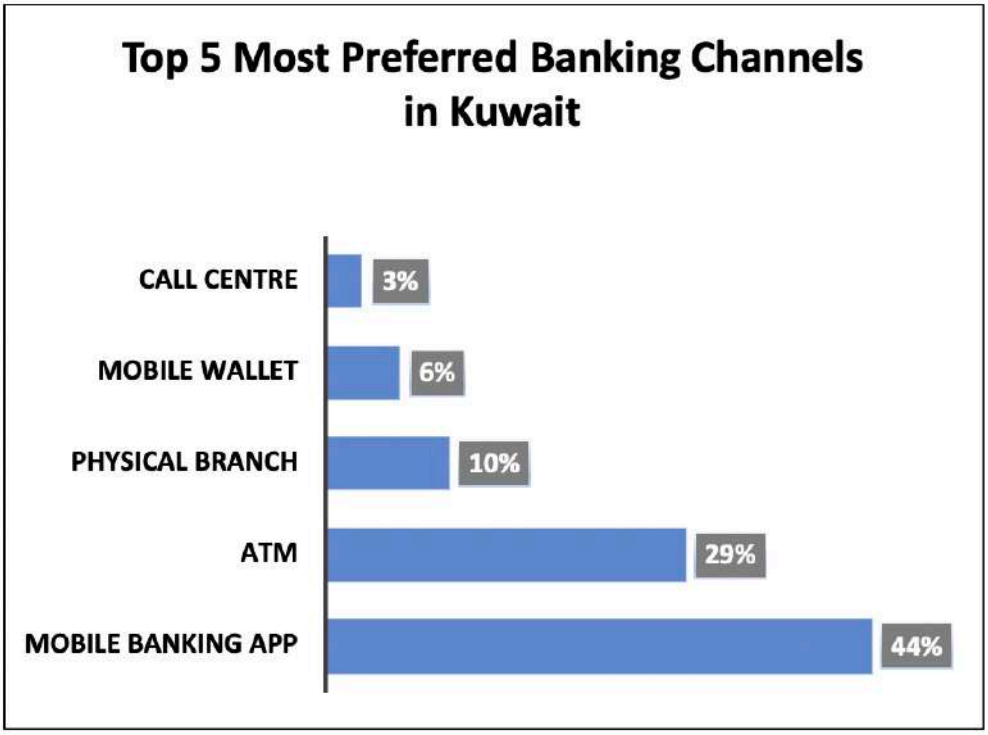
The findings from the CBDC issuance determinants model reveal that Kuwait has a well-established digital infrastructure to launch CBDC. The three key components of the monetary system in Kuwait - represented by the central bank, financial firms and clients - have sufficient digital and technological capabilities to adopt CBDC. Besides the prominent support from the central bank for FinTech products through the CBK Regulatory Sandbox (CBK, 2022), domestic commercial banks are investing heavily in delivering their services digitally and the clients are responding positively to this transformation (See Figure 8). This phenomenon indicates the official and public preparedness for the adopting of CBDC.

The regulatory and legal aspects are critical factors for the adoption of CBDC in Kuwait, as reported in our results. Kuwait has a robust set of legislations that address security concerns surrounding the use of CBDC. For instance, Law No. 20 of 2014 regulates electronic transactions and Law No. 63 of 2015 prevents cybercrimes and promotes data protection. These legislative measures encourage the adoption of CBDC in Kuwait and reflect the institutional interest in the latest technological developments, indicating that new legislation could be crafted for CBDC in the future if needed. Furthermore, our results suggest significant public interest in CBDC, implying that a wide segment of individuals in Kuwait has prior knowledge about CBDC, which will facilitate its launch and adoption.

Economic development has the greatest influence on the adoption of CBDC in Kuwait, according to our results in Table 3 and Figure 5. The extent of economic development, quantified by GDP per capita, denotes a broader measure of growth, living standards, human capital and sustainability. The results demonstrate that CBDC issuance is significantly driven by economic development levels, suggesting that economic expansions and growth encourage CBDC issuance in Kuwait. Conversely, this result also indicates that contractionary periods hinder CBDC adoption.

Meanwhile, the national strategic vision of the state to transform Kuwait into a regional financial and economic hub will stimulate the probability of CBDC issuance, as a result of the anticipated boost in economic sectors following this transformation. Therefore, our findings point out that the utilization of CBDC in Kuwait increases during periods of economic expansion, where domestic economic conditions are shaped by fiscal and monetary policies alongside exogenous shocks.

Figure 8: Preferred Banking Channels in Kuwait (Ipsos, 2023)



Interestingly, our findings on the potential impacts of CBDC adoption on commercial banks' profitability provide considerable insights. The results reveal that banks' profitability in Kuwait is positively and significantly influenced by customer deposits, where any increase (decrease) in customer deposits leads to a rise (decline) in commercial banks' profits. Thus, customer deposits are shown an important driver for financial performance for domestic commercial banks, where this result poses a potential threat if CBDC were to replace deposits, leading to an outflow of deposits from commercial banks to the central bank.

Three scenarios were constructed in this study to identify the potential risk to banks' profits, ranging from the lowest to highest shock scenarios (See Figure 6). The lowest CBDC take-up scenario shows that commercial banks' profitability might be negatively affected by 1.7% if 25% of deposits in commercial banks are transferred to CBDC. The moderate scenario indicates that banks' profitability could be reduced by 3.4% if half of customer deposits shift to the CBDC, while the highest scenario suggests that banks' profitability could decline by 5.1% if 75% of customer deposits are replaced by CBDC.

The estimation results from these three scenarios demonstrate that CBDC adoption carries potential adverse effects on the financial performance of commercial banks in Kuwait at different levels. However, the potential detrimental consequences of CBDC can be addressed and mitigated before its adoption through several methods. Imposing caps or limits on CBDC holdings and their interest rates is one crucial solution to reduce the risk to commercial banks' profitability. Alternatively, regulating the convertibility of deposits from banks to CBDC is an efficient measure to control the potential transfer of deposits from commercial banks to the central bank.

In comparison with other countries, Law No. 30 of 2008 in Kuwait guarantees deposits in all domestic banks by the central bank, reducing the risk of customer deposit outflows even in the event of potential commercial bank failure. Therefore, individuals in Kuwait have confidence in their deposits within the commercial banking sector, as they are secured by the monetary authority. Moreover, domestic banks have the ability to change this potential threat of CBDC to an opportunity by reducing their operational costs associated with handling cash and by creating novel financial services and attractive liquidity provisions.

CHAPTER SIX: CONCLUSION

The investigation of CBDC adoption and its implications has grown significantly over the years, owing to the crucial role that financial technology plays in the global economies. This study focuses on two aspects: 1) CBDC issuance determinants in Kuwait and 2) the impact of CBDCs on the profitability of commercial banks in Kuwait. While most studies in the field of CBDCs have focused either on drivers of CBDC adoption or CBDC effects on financial stability, this study attempts to bridge the gap in the literature by investigating CBDC issuance determinants and its consequences on banks' profitability in Kuwait, as an emerging market and one of the key players in the regional financial arena.

This study utilizes various datasets and econometric techniques to achieve its main purposes, by segregating the methodology into two models. Model One aims to identify the determinants of CBDC issuance in Kuwait, utilizing quarterly time series data from 2014Q1 to 2021Q4. The data of the CBDC Tracker has been used as a dependent variable in this model to capture the status of official interest in CBDC in Kuwait. The regressors in this model were digital infrastructure, innovation capabilities, institutional factors, public interest, economic development, macroeconomic conditions and cross-border transactions. These variables represent the main determinants of issuing CBDC in this model.

The ordered probit model estimator and average marginal effect were used in Model One to analyse how CBDC issuance in Kuwait is determined by these factors. The results of univariate ordered probit regressions show significant and positive associations between the probability of issuing CBDC in Kuwait and the following factors: digital infrastructure, innovation capabilities, institutional factors, public interest, and economic development. However, our results indicate that macroeconomic conditions and cross-border transactions have a weak relationship with CBDC issuance, although they exhibit positive effects.

This result implies that the issuance of CBDC in Kuwait is determined mainly by the extent of advanced technology, domestic innovation abilities, regulatory environment, public intensity and advancements in financial markets. Meanwhile, the results of the average marginal

effects demonstrate that economic development has the greatest effect, suggesting that the development of the domestic economy and advancements in financial markets are the most influential factors in the official intensity of issuing CBDC in Kuwait.

Alternatively, Model Two in this study evaluates the potential impacts of introducing CBDC in Kuwait on the profitability of commercial banks. The dataset for this model consists of annual time series data from 2000 to 2021 and includes several banking and macroeconomic indicators in Kuwait. Return on Assets (ROA) is the dependent variable in this model and was used as a measure of aggregate banks' profits. The independent variables are: the ratio of customer deposits to total assets, the ratio of loans to total assets, the GDP growth rate and government expenditures.

The ratio of customer deposits to total assets is the variable of interest in Model Two, where it is used to determine the effects of deposits on banks' profitability and thereafter estimate the implications of CBDC take-up and the outflows of deposits from commercial banks to the central banks on banks' profits. The VAR regression model is used to measure the extent of deposits' effects on banks' profitability in Kuwait. Our VAR model reveals that customer deposits play a crucial role in banks' profitability, where a one per cent increase in deposits leads to a 0.068 per cent increase in banks' profits.

Three CBDC shock scenarios were constructed to evaluate the effects of deposits migration from commercial banks to the central bank on the profitability of commercial banks after introducing CBDC in Kuwait. The lowest shock scenario indicates that deposits migration will reduce banks' profits by 1.7 per cent, the moderate scenario indicates that the decrease in banks' profits will occur at 3.4 per cent, while the highest scenario shows that the reduction in banks' profitability will be at 5.1 per cent.

Although the three shock scenarios suggest that introducing CBDC in Kuwait might have negative effects on commercial banks, there are numerous tools to mitigate the adverse consequences. Imposing caps on CBDC holdings, regulating deposits convertibility and providing liquidity are all catalysts that would maintain stability within the banking and financial sectors. Furthermore, introducing CBDC reduces the costs associated with cash handling and induces commercial banks to shift to advanced financial and operational models. The results of Model Two have been validated through multiple diagnostic tests, all of which confirm the robustness and stability of the VAR model results.

CHAPTER SEVEN: LIMITATIONS AND FURTHER RESEARCH OF THE STUDY

This study analyses CBDC issuance determinants in Kuwait and predicts the potential effects of introducing CBDC on the profitability of commercial banks. However, this study focuses on the aggregate level of the CBDC context in Kuwait due to the lack of data, particularly for Model One of CBDC issuance determinants, as the topic of CBDC has only recently emerged as a new field in economics and finance. The insufficient available data restricts conducting sectoral-level study about CBDC in Kuwait, especially to assess the capabilities of domestic digital infrastructure to host the CBDC project.

Moreover, CBDCs exhibit complexity in terms of monetary and regulatory laws, and it is important to consider these concerns before introducing CBDC, while the core objective of this study is to investigate CBDC from a macro-financial perspective. Likewise, Kuwait has been a prominent hub for Islamic financial institutions, yet this study does not provide an in-depth the Islamic financial position towards CBDC as it concentrates on the macro-financial aspects. Additionally, the study measures the implications of CBDC on banks' profitability at the aggerate level by using a quantitative methodology and estimating the average of the financial indicators.

The recognized limitations provide important insights and suggest directions for future research in the domestic context of CBDC. The legal and Sharia aspects of CBDC design and mechanism need to be considered and reviewed to ensure that introducing CBDC is consistent with regulatory frameworks in the state. Examining the ability of the digital infrastructure to run CBDC should be conducted from technical and cybersecurity perspectives to foster the safe usage of this new financial instrument. Similarly, conducting qualitative studies to analyse the viewpoints of policymakers in the financial and banking sectors is crucial to determining internal concerns.

Furthermore, using panel data of commercial banks is recommended to estimate the potential impacts of CBDC at the sectoral level and to identify the variations in potential effects by banks' sizes and their types, whether they are traditional or Islamic banks. In general, these suggestions provide a roadmap for additional comprehensive studies about CBDC topics in Kuwait to discuss the relevant considerations and concerns from various perspectives.

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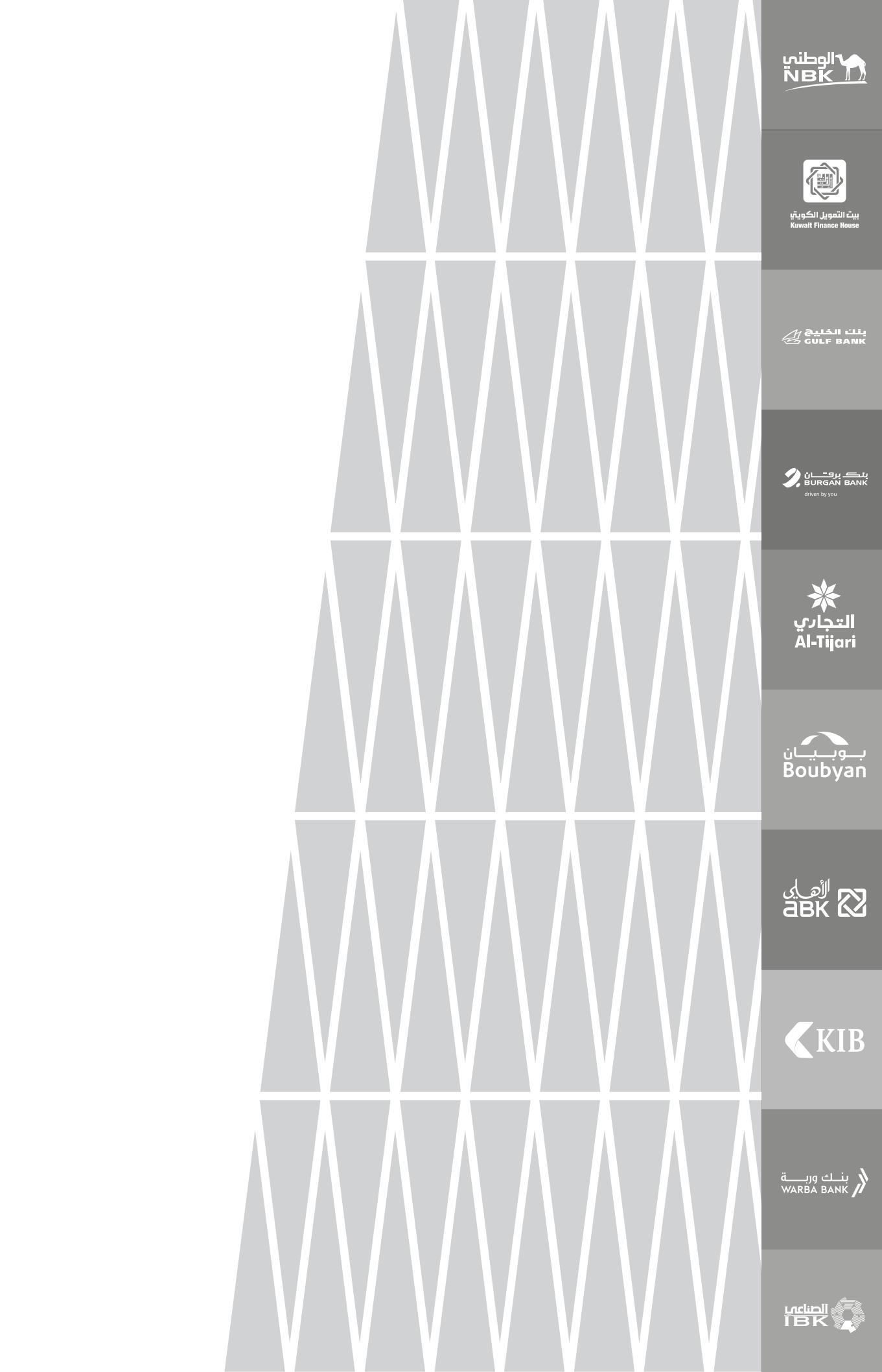
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