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Fintech, Foreign Bank Entry and Financial Sustainability in Developing Countries: Role of Financial Freedom

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List of Acronyms

ADB	Asian Development Bank
ADBI	Asian Development Bank Institute
ATM	Automated Teller Machine
BIS	Bank for International Settlements
CAREC	Central Asia Regional Economic Cooperation
CPI	Consumer Price Index
DFD	Digital Financial Development
DP	Digital Payments
FAS	Financial Access Survey (IMF)
FB	Foreign Bank
FBE	Foreign Bank Entry
FA	Foreign Assets (as % of total bank assets)
FDI	Foreign Direct Investment
FF	Financial Freedom
FI	Financial Inclusion
FinTech	Financial Technology
FS	Financial Sustainability
GDP	Gross Domestic Product
GFDD	Global Financial Development Database
ICT	Information and Communication Technology
IMF	International Monetary Fund
IQ	Institutional Quality
OLS	Ordinary Least Squares
POLS	Pooled Ordinary Least Squares
REER	Real Effective Exchange Rate
RO	Research Objective
SPSS	Statistical Package for Social Sciences
UNDP	United Nations Development Programme
WDI	World Development Indicators (World Bank)
WB	World Bank
Z-Score	Bank Stability Score (Distance to Default)

Abstract

Financial technology (FinTech) innovations and the rise of foreign banks have led to changes in the nature of financial services in many emerging markets and transition economies. While the increased use of digital finance may lead to improved efficiency, accessibility and inclusion, the introduction of foreign banks may provide competition and modernized banking practices; the ultimate impact of these two trends on long term financial sustainability remains unclear, especially in regions like those in the Central Asia Regional Economic Cooperation (CAREC) group, where there exists a wide range of institutional environments. Additionally, weak regulatory frameworks, susceptibility to external economic shocks and uneven levels of financial freedoms will add additional complexity to the integration of digital finance into traditional financial services.

The study examined the impacts of FinTech development and foreign bank entry on financial sustainability in 11 CAREC member states between 2008-2020, with a focus on the moderating effect of financial freedoms. In this study, FinTech adoption was defined as the number of digital payment transactions and/or ATM penetration in each country. Foreign bank presence in each country was represented by the percentage of foreign bank assets to total bank assets. Finally, banking stability and credit depth were measured by the bank's Z-score and credit-to-deposit ratios. Secondary panel data were collected from several international databases and used to perform descriptive analysis, correlation analysis, regression analysis and moderation analysis to evaluate the relationship between FinTech and banking sustainability, foreign bank entry and banking sustainability and how financial freedom acts as a moderator in the relationship between FinTech, foreign bank entry and banking sustainability.

Results indicate that digital payments have a significant and positive relationship to both banking stability and credit depth, however excessive foreign bank presence has a negative relationship to both of these variables. ATM penetration had mixed results and contributed positively to credit growth but did not contribute to banking stability. Lastly, the study found that financial freedom had a moderate influence on the relationship between FinTech and banking sustainability, enhancing the positive relationship of FinTech to banking sustainability, and also moderating the relationship between foreign bank entry and banking sustainability. This study contributes to the literature by integrating three previously separate fields: digital finance, foreign banking and institutional quality into one empirical model, providing policymakers in developing economies with relevant insights on how to manage competing priorities in promoting financial openness, innovation and long-term financial sustainability.

Keywords: FinTech Adoption, Foreign Bank Entry, Financial Sustainability, Financial Freedoms, Digital Payment Systems, Banking Stability, CAREC Member Countries

Chapter 1 Introduction

1.1 Background of the Study

The financial systems of emerging and transition economies are undergoing major change at an historic rate as digitalization, globalization, and institutional reforms restructure these finance systems. Amidst these changes several countries (Pakistan, Kazakhstan, Uzbekistan, Georgia and Mongolia) in the Central Asia Regional Economic Cooperation (CAREC) region are confronted with a double challenge of broadening access to financial services and maintaining financial stability. While these nations have made significant efforts to modernize, they still face a number of structural problems including financial exclusion and shallow credit markets as well as the concentration among banking structures, and varying levels of enforcement for regulations (Kim et al., 2021; World Bank, 2023; Asian Development Bank, 2024). This is exacerbated in the Kyrgyz Republic, Tajikistan and Afghanistan where tough geographical conditions and low coverage of bank branches prevent the public from having access to formal financial services.

There has been an explosion in digital financial service technologies that have the potential to close the gaps in financial access. Disruptive technologies such as mobile payments, digital banking platforms, blockchain applications and online credit services are being increasingly employed to access the underserved populations including rural areas (GSMA, 2022; Al Nawayseh, 2023). Recent global evidence suggests that digital identity systems, algorithms based credit decision models and inter-operable payment infrastructure have enhanced financial inclusion, data analytics for service productivity in emerging economies (UNDP, 2024; Sahay et al., 2023). FinTech is expanding and has many advantages, however it brings with it too much debate on its potential impact of FinTech Growth on financial stability. While it brings greater efficiency, transparency, and competition through Digitalization, it also creates opportunities for Cybersecurity Risk, operational disruption or change, Regulatory Arbitrage, and increased competition (pressure) for traditional banks, particularly where Supervision is weak (Vučinić; 2020; Daud et al.; 2022; Morgan and Pontines; 2023; Bank for International Settlements, 2024).

CAREC's increasing integration into the global financial system is due to enhanced foreign bank involvement and increasing cross-border flows of financial instruments. Foreign banks offer domestic institutions opportunities to enhance their local operations, diversify their offerings and

leverage international best practices and cutting-edge technology to bolster their risk strategies (Sant'Anna & Figueiredo, 2024; Claesens, 2022). As several studies demonstrate, foreign banks frequently serve as conduits for the adoption of new technology and modern management techniques in their respective host markets to promote competition and improve customer experience (IMF, 2024). On the other hand, an increase in a domestic financial institution's foreign exposure will often magnify the institution's vulnerability to external events (e.g., external shocks, foreign currency risk, and sudden swings in global financial markets) when domestic regulatory frameworks are characterized by inefficiency or lack of coherence (Schnabel, 2023; Chueca Vergara and Ferruz Agudo, 2021).

These advancements highlight financial freedom as an institutional component that influences how financial systems react to digitalization and the involvement of foreign banks. The degree of financial market openness, the caliber of regulation, the level of government intervention, and the degree of market liberalization are all indicators of financial freedom. According to recent research, financial freedom affects how quickly and efficiently digital technologies are adopted as well as how domestic financial stability is impacted by international financial integration. The aforementioned topics have been covered by Yang and Jung (2024), Hasan et al. (2023), and Heritage Foundation (2025). Increased financial independence can encourage investment, competition, and innovation. However, it is crucial to remember that excessive liberalization combined with lax oversight can erode regulatory ability, promote risk-taking, and increase systemic vulnerabilities. These topics have been covered by Brock and Chen (2024) and the Asian Development Bank Institute (2025). As a result, financial freedom plays a significant moderating role in determining how strongly FinTech adoption, foreign asset exposure, banking sector stability, and credit dynamics are related throughout the CAREC region.

1.2 Problem Statement

Transition economies and developing economies experience economic instability in terms of sustainable development of their economies mainly due to lack of regulatory authority and institutional barriers that hinder sustainable development. While CAREC countries develop and expand digital finance as well as increase foreign banking participation, it is still uncertain what time frame for financial stability and/or financial access will evolve from this. On one hand, the application of FinTech creates potential for an expanded reach, reduced transaction cost and

expanded outreach; however on the other hand, the application of FinTech also has the potential to create systemic vulnerabilities such as cyber-security threats, operational vulnerability and regulatory gaps if adequate supervisory frameworks do not exist (Koranteng & You, 2024).

Similarly, the entry of foreign banks provides increased efficiency and competition, however, it may also adversely impact an unstable domestic banking system by increasing susceptibility to global financial shocks and increasing competition amongst emerging markets (Chueca Vergara & Ferruz Agudo, 2021). There is limited empirical research that has considered how digital financial growth combines with the entry of foreign banks and the moderating role of financial freedom (as our measure of regulatory openness, market liberalization, and the quality of institutional oversight) when examining financial sustainability within the CAREC region. Research to date has primarily explored how these variables interact on a stand-alone basis or how best to measure them separately rather than how these variables together impact financial sustainability in the CAREC region (Meiling et al., 2021). This study seeks to fill this gap by investigating how financial freedom conditions the relationship between banking system characteristics, digital financial development, and foreign asset exposure, thereby advancing understanding of the institutional environment required to support financial sustainability in CAREC economies.

1.3 Research Objectives

Following are the proposed objectives of this study:

1. This study will examine the effect of FinTech adoption measured through digital payments and ATM penetration on financial sustainability, proxied by Bank Z-score, in CAREC countries.
2. This study will assess the impact of foreign bank entry measured by foreign assets as a share of total bank assets on financial sustainability (Bank Z-score) in CAREC countries.
3. This study will analyse the effect of FinTech adoption (digital payments and ATM penetration) and foreign bank entry (foreign assets ratio) on financial intermediation stability, measured through bank credit to bank, in CAREC countries.

4. This study will investigate the moderating role of financial freedom in the relationships between FinTech adoption, foreign bank entry, and financial sustainability and intermediation stability in CAREC countries.

1.4 Research Questions

In order to accomplish this objective, several research questions were developed:

1. How does the adoption of FinTech affect financial sustainability in CAREC countries that are developing?
2. How do foreign bank entries affect financial sustainability in developing countries in the CAREC region?
3. Is there a moderating effect of financial freedom on the relationship between FinTech adoption and financial sustainability?
4. Is there a moderating effect of financial freedom on the relationship between foreign bank entry and financial sustainability?

1.5 Significance of the Study

This research has relevance both theoretically and practically. Academically, it adds to the already growing, though disjointed, body of knowledge that exists about "fintech" (financial technology), "foreign banks" and "financial sustainability" in developing countries. Previous research projects studied one or two of these components (e.g., digital financial services; foreign bank entry), but very few looked at all three of them together in relationship to each other in different institutional settings. As pointed out by Ullah & Begum (2025), financial inclusion does not ensure sustainability without institutional supports to steer technology-based developments toward the same outcomes.

This research adds value across all parts of the CAREC region that are currently transitioning from centrally planned economies to more market oriented economic systems. As these CAREC nations continue their journey toward financial regulation in accordance with EU directives (as they must) the research will provide governments with examples, best practices and lessons learned regarding how to create a better environment.

The results of this research will provide insights on how to best use digital innovations in conjunction with increased financial openness to achieve long-term stability within each nation's financial system. The results will also contribute to the overall achievement of many of the

United Nations Sustainable Development Goals for many of the CAREC nations. According to Arner et al. (2020) the optimal use of fintech for sustainable finance requires coherence between institutions; simply innovating and creating new products/services does not guarantee success.

1.6 Summary of the chapter

In this chapter, the context, rationale and scope for this study on how the CAREC countries' financial environment is changing because of digitalization, the involvement of foreign banks and changes in regulations was introduced along with an overview of how these three things have changed the way that financial systems operate within each of these countries. Structural issues exist within many of the countries in CAREC including; Financial exclusion, weak institutional capacities, and exposure to external shocks. Rapid FinTech adoption and greater access to cross-border financing create opportunities for CAREC economies; however, due to the vastly different levels of regulatory oversight and financial freedom in the different countries, they also raise important questions about their potential implications for Financial Sustainability within those countries. The problem statement showed that within the CAREC countries there is little empirical research that has been done to look at the relationships between FinTech, foreign bank entry and institutional quality all together.

Chapter 2: Literature Review

2.1 Introduction

Developing countries have been largely influenced by FinTech's increasing prominence, along with an influx of international banks, in terms of how these countries define and ensure financial sustainability within their regions. The shifting dynamics of the financial system as a result of these factors have produced numerous modifications to traditional banking systems and generated both new opportunities and new forms of challenges to achieving systemic financial resilience.

2.2 FinTech Adoption

Financial Technology (FinTech), has changed the face of the global Financial Services Industry, by delivering alternative methods to deliver banking services through the use of mobile payments, digital wallets, Peer-To-Peer (P2P) lending, Big Data Credit Scoring and Blockchain based Transaction Systems, etc. These developments have been particularly beneficial to individuals living in developing countries, which do not have local Bank Branches to serve their needs. At the same time, many FinTech Experts agree that, as FinTech expands into areas without existing Regulatory Frameworks, it increases the possibility of creating Systemic Vulnerabilities within the Financial System. Both, Daud et al. (2022) and Vucinic (2020) indicate that, if FinTech does not keep pace with new technological advancements, it may lead to increased risks, and further instability, in an already vulnerable Banking System.

There are acknowledged potential negative aspects of FinTech, which can be mitigated, when they are supported by Strong Institutional Arrangements. A recent Study by Safiullah and Paramati (2024) identified evidence of an economy with a Robust Regulatory Framework, being able to utilize the capabilities of FinTech Companies to support the Traditional Banking System, by reducing transaction costs, increasing the Allocation of Credit, and enhancing Banks ability to assess Risk. Related Studies have shown that when the Potential of FinTech is maximized through Digital Payments, Mobile Banking and Online Transaction Channels, it is feasible to have a Positive Impact upon Financial Inclusion (GSMA, 2022; Al-Nawayseh, 2023). Digital Payment Systems have been a key factor in the expansion of FinTech, in enabling Secure Low-

Cost Transactions, allowing Consumers to eliminate the need to Use Physical Cash, and Eliminating the Need for Consumers to Physically Visit a Bank. The Expansion of Digital Payments, has been associated with Increased Economic Participation, Increased Remittance Activity, and Improved Efficiency of Government-to-People Transfers (Babuna et al., 2022).

Another indicator of Access to Finance, is the availability of ATMs, which interact with the use of FinTech. An ATM, represents a type of Traditional Physical Infrastructure. To enable a country to transition towards the utilization of Digital Finance, it is essential to Increase the Number of Available ATMs. Research indicates that ATMs, will Enhance the Opportunities for Individuals to Utilize Digital Financial Services, by Providing the Opportunity for Individuals to Convert Cash into E-Money and Vice Versa, as this will be a Critical Component of the Digital Financial Ecosystem, especially in Environments that are at an Intermediate Stage of Developing Digital Finance (Hasan et al., 2023). Furthermore, Research Suggests that Improvements to Payment Systems through Digital Technologies, will Ultimately Reduce Pressure on ATMs, as Individuals Will Optimize for Making Payments and Using E-Money Digitally Rather Than Visiting a Banking Outlet (Khan & Hijazi, 2021).

Institutional Readiness, Regulatory Quality and the Interaction between Digital and Physical Financial Infrastructures All Influence the Adoption Process of FinTech in both Developed and Transition Economies (including Many CAREC Countries). The Literature Indicates that Digital Payments and ATMs, are Complementary in Providing Financial Access. Their Effectiveness Will Depend Upon the Degree of Support Provided to Digital Innovations Through Appropriate Oversight and Adequate Consumer Protection, as well as the Presence of Stable Banking Systems.

2.3 Foreign Bank Entry

Foreign Banks have been key players in the transformation of the financial infrastructure of developing and emerging market economies by providing new capital, technology and risk management techniques. Foreign Bank Entry has often led to better financial intermediation and increased competition where local banking sectors have traditionally been highly concentrated or government controlled (Gopalan, 2015; Chueca Vergara & Ferruz Agudo, 2021). Nevertheless, the academic literature notes that the benefits of foreign bank entry are not automatically realized,

especially in cases where institutional weakness, low regulatory quality and/or a lack of supervisory capacity exist. For example, in such cases foreign bank presence can lead to heightened vulnerability to exogenous shocks and can be used to spread crisis through cross-border interlinking (Schnabel, 2019; IMF, 2015).

More recent empirical research provides a clearer picture of the relationship between foreign bank entry and the governance/ regulatory environment. Studies like those conducted by Kusi et al. (2021), found that foreign bank entry has a generally positive effect on banking stability in African economies. However, the strength of this positive effect is much greater when there is good corporate governance and an effective regulatory regime in place. Similar to Kusi's study, Bouzidi (2024) demonstrated that foreign banks may improve efficiency but at the same time increase the risk of instability to smaller or lower capitalized domestic banks when prudential regulation is lacking. These findings support the general consensus that net benefits derived from foreign bank participation will largely depend upon the relative strength of institutional quality, contract enforcement and supervisory standards.

From a measurement perspective, foreign assets divided by total bank assets are a common proxy for measuring the degree of internationalization and foreign exposure of a country's banking system. The IMF and BIS cross border banking literature employ the ratio of foreign claims or foreign assets to total bank assets as indicators to measure the degree of integration of a country's banking system into global financial markets (IMF, 2015). Additionally, Chen (2019) measured foreign bank entry using the ratio of foreign bank assets to total banking assets and documented significant variation in foreign presence levels in host countries with important implications for competition and risk taking. As foreign bank assets among total bank assets represent not only the number of foreign owned banks operating within a given economy but also the number of cross-border claims held by domestic banks, examining this indicator along with other indicators related to financial freedom and banking stability is critical to fully understand the impact of foreign bank entry and cross-border integration on financial sustainability within the CAREC region.

2.4 Financial Sustainability

Long term financial sustainability for the financial institution means the ability to be able to sustainably function through time, successfully managing risks, and absorbing shock without risking the long term viability of the institution itself, nor destabilizing the overall financial system. Long term financial sustainability can be viewed from five distinct viewpoints: capital adequacy, asset quality, liquidity strength, stable earnings, and effective institutional governance. The Bank Z-Score is a common metric to evaluate the stability of banks because it measures the likelihood of bankruptcy using profit, leverage, and return volatility. A higher Z-Score means a bank has more ability to survive economic downturns. In recent years, researchers have found that the Z-Score is a good indicator of bank stability in both developed and developing economies, and is influenced by the quality of regulation and macro-economic conditions (Demirgüç-Kunt et al., 2021; Lee & Lu, 2023).

An additional factor of financial sustainability is the level of liquidity and credit intermediation in the banking system. Many analysts utilize the bank credit to deposits ratio to measure the level of funding stability and liquidity risk within the banking system. A greater ratio represents a greater amount of lending than deposits, and can increase financial development, however, this also creates a higher risk of a liquidity shortage if the economy were to enter a stressful period (Berger & Bouwman, 2022). More recently, researchers have noted that a large increase in lending, particularly if there are no sufficient regulations supporting lending, can create a systemic risk problem in emerging markets (Chen & Wu, 2024). In contrast, a balanced credit-to-deposit ratio provides for long-term financial sustainability and creates a situation in which lending can be increased without jeopardizing the financial stability of the funding.

Access to banking services is important; however, a number of researchers have noted that, while access is necessary, it is insufficient to create financial sustainability. In their study, Ullah and Begum (2025) concluded that financial sustainability, which encompasses both financial institution stability and growth, has multiple requirements that extend beyond access to banking services. Specifically, they identified three critical components to achieving financial sustainability: sound risk management, an appropriate level of capital reserves, effective institutional governance, and operational resilience. The findings of Ullah and Begum (2025) support the broad international evidence that indicates financial sustainability cannot be achieved

through simply increasing access to banking services among a large population, but also requires the existence of a robust structure for managing risks, providing liquidity and maintaining resilience in the event of unforeseen events or shocks (Ghosh, 2022; Kaufmann & Weber, 2023).

For policymakers within the CAREC region, financial sustainability is one of the primary concerns of government officials due to existing structural vulnerabilities, high levels of vulnerability to external shocks and significant variability in the degree of regulation across countries. As a result, examining indicators such as the Bank Z-Score and the bank credit-to-deposits ratio provide policymakers with information to understand the extent to which banks in the CAREC region have the capacity to achieve financial sustainability.

2.5 Nexus between fintech adoption, financial sustainability and foreign bank entry

FinTech adoption has been an important driver of change in the financial sector with both digital payments and ATM penetration serving as important measures of the digital and physical components of financial access. The use of digital payment metrics, such as the volume or value of electronic transactions, measure the extent to which consumers and businesses shift away from cash-based to electronic financial services. Research demonstrates that greater usage of digital payments has contributed to increased efficiency, reduced transaction costs and increased financial inclusion, thus providing indirect support to financial sustainability through expanding the deposit base and increasing funding options (Babuna et al., 2022; Daud et al., 2022). Nevertheless, the rapid pace of digitalization of finance will also create new financial sustainability challenges through its potential to generate operational vulnerabilities, cyber threats and competitive disruption of financial service providers that could compress bank profit margins and encourage greater risk taking behavior in areas with less than optimal regulatory and supervisory oversight relative to the pace of technology (Koranteng & You, 2024; Vučinić, 2020). ATM's per 100,000 adults serve as another FinTech related proxy in this research as it measures the physical reach of the formal financial system. ATM's are an important component of the legacy infrastructure but also act as a bridge between legacy and digitalized payments systems. They provide both cash-in and cash-out functions which enable customers to use their accounts through either digital or semi-digital means (i.e., mobile wallets and online banking) and have been shown in emerging market studies to increase the level of financial inclusion while providing a mechanism for transitioning to greater levels of digitalization in payment systems

where there is limited access to branches (Khan & Hijazi, 2021; Hasan et al., 2023). However, if a bank does not develop corresponding digital channels and instead relies heavily on its physical network it will be limited in terms of cost savings, operational efficiency and ultimately in its ability to maintain financial sustainability.

Foreign bank entry constitutes yet another structural factor interacting with both financial sustainability and FinTech adoption. Foreign bank presence is measured using foreign assets among total bank assets in this research as it represents the degree of international exposure and cross border integration of the domestic banking system. As documented in literature on foreign banks, foreign banks have been shown to improve efficiency, introduce superior technologies and improve risk management practices, leading to enhanced financial performance and potentially higher Z-scores in host countries (Sant' Anna & Figueiredo, 2024; Chueca Vergara & Ferruz Agudo, 2021). Additionally, foreign banks often act as early adopters of digital technologies and modern payment systems and therefore can accelerate FinTech diffusion in host markets through demonstration effects and competitive pressure on domestic banks.

While there is evidence that foreign bank entry can contribute to financial sustainability, the literature does not document a uniformly positive relationship between foreign bank entry and financial sustainability. There is evidence that large foreign asset shares can increase vulnerability to external shocks particularly in cases where domestic regulation, resolution frameworks and supervisory capacity are inadequate (IMF, 2015; Schnabel, 2019). Under these conditions, foreign banks can propagate global financial stress into domestic markets while focusing on the most profitable segments of the market, leaving under served segments reliant on weaker local banks. Furthermore, foreign banks may also stimulate aggressive competition among domestic banks encouraging them to assume additional risk or extend credit at a rate faster than the supporting deposit base provides, thus negatively impacting the credit-to-deposits ratio and undermining financial sustainability (Chen & Wu, 2024).

There is growing interest in literature examining the interaction between FinTech adoption and foreign bank entry, however, empirical research in this area is very limited especially in regions such as CAREC. As foreign banks bring global payment platforms, data analytics and mobile banking applications to host markets, they can complement or compete with local FinTech initiatives (Claessens, 2022). Therefore, whether domestic institutions react to foreign banks by upgrading their own digital capabilities can result in either a more efficient and inclusive

financial system that enhances sustainability through product and outlet diversification, or concentrated digital innovation that fails to translate into system wide financial sustainability. As a result, we propose the following hypothesis based on the literature discussed above:

H1: Digital Payments has a statistically significant effect on Bank z score in developing countries.
H2: ATM per 100,000 adults has a statistically significant effect on Bank z score in developing countries.
H3: Foreign assets among total bank assets has a statistically significant influence on Bank z score.
H4: Digital Payments has a statistically significant effect on Bank credit to bank in developing countries.
H5: ATM per 100,000 adults has a statistically significant effect on Bank credit to bank in developing countries.
H6: Foreign assets among total bank assets has a statistically significant influence on Bank credit to bank.

2.6 Financial Freedom

The way that a nation has its regulatory laws regarding its financial system defines the extent of its "financial freedom." Financial freedom is an important enabling factor in the development of "sustainable finance," as it enables innovation to occur while maintaining overall stability. Yang and Jung (2024), particularly, emphasize the need for regulatory openness and institutional preparedness for FinTech led financial transformations in developing economies. FinTech brings about increased competition, increases outreach to consumers and businesses, and decreases operational risk thereby increasing sustainability (Safiullah & Paramati, 2024). However, in a restrictive or opaque environment, FinTech can create instability in the financial system. Therefore, financial and information communication technology (ICT) development should be used together to mitigate the risks of rapid technological innovation (Meiling et al., 2021). Chueca Vergara and Ferruz Agudo (2021) warn that when foreign banks operate in low-regulatory freedom environments they will most often prioritize profit repatriation or exit from a crisis thus creating instability.

Financial freedom acts as a mediator and shapes how institutional and market-based factors lead to financial results. The prior research shows that the effects of banking system stability, foreign bank entry and FinTech adoption are not consistent across all countries but rather depend upon the regulatory framework. Yang and Jung (2024) indicate that financial freedom expands the positive impact of financial development policy and allows credit markets and banking institutions to react more quickly to market signals than those operating under restrictive regulations. On the other hand, when there are restrictions on regulation, even well-structured financial reform does little to improve access or efficiency.

Research has provided extensive empirical evidence on how financial freedom affects relationships within the financial system. Hasan, Horváth and Ma (2023) found that financial freedom strengthened the relationship between bank competition and financial development by promoting innovation and removing structural barriers. The researchers suggested that in countries with less regulation banks are more likely to convert stability reforms into additional access to financial services. Similar to this study, Imran and Kiani (2022) reported that financial freedom positively moderated the effect of foreign bank entry on financial sector performance. In countries with open financial markets foreign banks contributed to innovation and efficiency at a higher rate than in countries with heavily regulated markets, which could reduce the effectiveness of foreign presence by crowding out domestic institutions or exposing markets to increased volatility.

More recent research has demonstrated that financial freedom also moderates the role of financial freedom in the digital financial transformation process. Meiling et al. (2021) showed that digital finance provides greater financial inclusion in countries with liberal financial systems, which provide the regulatory framework for competition and ease of entry for FinTech companies. Conversely, digital payment, mobile banking, etc. innovations are reduced in their benefits by compliance burdens, low competitive pressures, and a lack of consumer protection infrastructure in markets with restrictive regulatory regimes.

Additionally, financial freedom may also moderate the relationship between financial stability and risk taking. Chen and Wu (2024) suggest that high financial freedom in countries requires strong regulatory quality to limit excessive risk taking. As a result, in countries with high financial freedom, high bank Z-scores would be more effective in achieving long term financial sustainability because prudent behavior is reinforced through market discipline. However, in

restrictive regulatory environments, even improvements in bank stability may not translate into increased accessibility or improved efficiency due to bureaucratic constraints, state control or a lack of competitive pressure.

Existing literature suggests that the impact of digital finance and foreign bank participation on financial stability is contingent upon institutional quality and regulatory openness (Hasan et al., 2023; Yang & Jung, 2024). Higher financial freedom facilitates innovation, competition, and efficiency, enabling FinTech and foreign banks to positively contribute to financial sustainability. Conversely, in restrictive or weak regulatory environments, the same developments may increase systemic risk and instability.

Accordingly, financial freedom is conceptualised as a moderator that influences how effectively FinTech adoption and foreign bank entry translate into banking stability and sustainable credit expansion.

In total, the literature supports our contention that financial freedom serves as an important contextual variable that moderates how the characteristics of the banking sector and the various forms of financial innovation affect long-term financial sustainability. To explain the variation in digital financial innovation, ATM penetration, and cross border asset exposure among the member countries of the CAREC region, where the level of regulatory quality and openness vary significantly, understanding the moderating role of financial freedom is crucial.

Therefore, based on the literature we propose the following hypothesis:

H7: Financial Freedom moderates the relationship between Digital Payments and Bank z score.

H8: Financial Freedom moderates the relationship between ATM per 100,000 adults and Bank z score.

H9: Financial Freedom moderates the relationship between foreign assets among total bank assets and Bank z score.

H10: Financial Freedom moderates the relationship between Digital Payments and Bank credit to bank.

H11: Financial Freedom moderates the relationship between ATM per 100,000 adults and Bank credit to bank.

H12: Financial Freedom moderates the relationship between foreign assets among total bank assets and Bank credit to bank.

2.7 Research Gap

Although research on FinTech, financial integration, and banking sector reforms has expanded in recent years, several important empirical and contextual gaps remain. First, most existing studies focus on the direct impact of FinTech on financial inclusion, efficiency, or stability, yet they rarely incorporate the institutional environment in which digital finance operates (Koranteng & You, 2024; Daud et al., 2022). Given that institutional quality and regulatory openness vary significantly among different geographic areas, researchers should not generalize results from developed or more advanced emerging market economies to structurally diverse regions like CAREC. Thirdly, empirical studies of foreign bank entry have been inconsistent and depend heavily on the specific institutional setting in which they take place. Therefore, while there is some evidence that foreign banks can improve both the efficiency and the stability of local banking systems, other studies suggest that foreign banks can also lead to destabilization in weak regulatory environments (Sant'Anna & Figueiredo, 2024; Chueca Vergara & Ferruz Agudo, 2021). The implications for policy are clear, as the impact of foreign bank entry depends heavily on good governance, but many of the existing studies treat institutional factors as background variables and do not examine them in detail.

Fourth, while FinTech adoption and foreign financial integration are taking place at the same time in many emerging markets, there is little academic research that has studied how these two phenomena will affect each other and ultimately how they will affect financial sustainability in the long run. Much of the current research focuses on the individual phenomenon of either FinTech adoption or foreign financial integration and ignores the possibility that the relationship between the two could be influenced by the interaction of foreign banks and FinTech platforms. There is substantial evidence that digital innovation and foreign participation can interact in meaningful ways, including through technology transfer, competition and cross-border financial flows.

Fifth, the role of financial freedom as a moderator of the relationship between foreign banks, FinTech and financial sustainability remains an under-explored area of research. Financial freedom can increase competition, openness and regulatory efficiency but it is unclear whether financial freedom will moderate the relationship between bank stability, digital finance and foreign asset exposure (Hasan et al., 2023; Yang & Jung, 2024).

Finally, there is very little empirical research that has focused on the economies of CAREC. Many of the existing studies focus on broader regional classifications (e.g., Asia) and therefore fail to capture the unique institutional, geographic and financial features of the CAREC member countries (Kim et al., 2021; Samad et al., 2023).

Therefore, this study aims to fill the gaps identified above by analyzing the joint effect of FinTech and foreign bank presence on financial sustainability in CAREC countries while controlling for financial freedom. The goal of this study is to provide a better understanding of the conditions that contribute to sustainable financial systems in the CAREC region by combining multiple aspects of financial development with institutional quality.

2.8 Conceptual Framework

This study's theoretical relationship between variables will be illustrated in the conceptual framework with FinTech adoption, foreign bank entry, financial sustainability and the moderating effect of financial freedom. This conceptual framework is based on institutional and financial development theories and it reflects how digital financial systems (digital payment usage and ATM penetration), and global financial integration (the percentage of foreign assets to total bank assets) affect banking sector stability and bank credit depth in the Carec Countries. The core dependent variable is financial sustainability which can be reflected using two measures; the Bank Z-score and the bank credit-to-deposit ratio. Recognizing the impact that the institutional environment of a country has on the empirical examination of the relationship between independent and mediating variables, the conceptual framework includes financial freedom as a mediating variable that affects the strength and direction of those relationships. The conceptual framework contains twelve hypotheses reflecting both main and interaction effects and provides a detailed structure for the empirical investigation into how technological advancements, cross border financial influences and open regulation combine to support financial sustainability in developing countries.

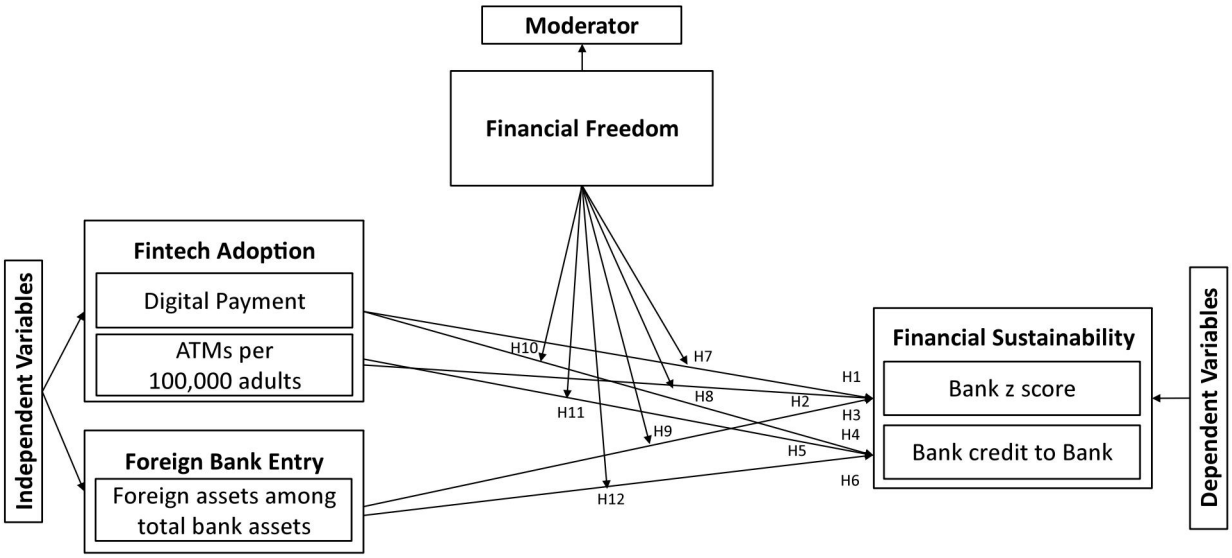

Figure 1: Conceptual Framework

2.9 Research Hypotheses

Based on the existing literature, the following hypotheses are proposed to the study:

H1: Digital Payments has a statistically significant effect on Bank z score in developing countries.

H2: ATM per 100,000 adults has a statistically significant effect on Bank z score in developing countries.

H3: Foreign assets among total bank assets has a statistically significant influence on Bank z score.

H4: Digital Payments has a statistically significant effect on Bank credit to bank in developing countries.

H5: ATM per 100,000 adults has a statistically significant effect on Bank credit to bank in developing countries.

H6: Foreign assets among total bank assets has a statistically significant influence on Bank credit to bank.

H7: Financial Freedom moderates the relationship between Digital Payments and Bank z score.

H8: Financial Freedom moderates the relationship between ATM per 100,000 adults and Bank z score.

H9: Financial Freedom moderates the relationship between foreign assets among total bank assets and Bank z score.

H10: Financial Freedom moderates the relationship between Digital Payments and Bank credit to bank.

H11: Financial Freedom moderates the relationship between ATM per 100,000 adults and Bank credit to bank.

H12: Financial Freedom moderates the relationship between foreign assets among total bank assets and Bank credit to bank.

2.10 Supporting Theory

Financial Actors' behaviors are not just driven by Market Dynamics, they are shaped by a complex set of Regulatory, Normative and Cognitive Frameworks, as stated in Institutional Theory. The quality of Institutions in Cross-Country Settings will determine the outcomes for Financial and Technological Reforms, according to Institutional Theory. Therefore, it can be said that FinTech Adoption and Foreign Bank Entry do not have a Stabilizing/ Destabilizing effect in and of themselves, depending on the Strength of ICT and Governance; (Yang & Jung, 2024) FinTech supports Sustainable Finance, but only within Supportive Policy Environments; (Meiling et al., 2021). Institutional Theory therefore informs the Study's Moderation Framework, in which Financial Freedom will influence the Impact of FinTech and Foreign Bank Entry on Financial Sustainability, with Reforms being more likely to Succeed in High-Financial Freedom Contexts, and Reforms being more likely to Fail in Weak Institutional Contexts; (even if Reforms were well-intended); It supports the study's objective to analyze how the Institutional Context influences the effects of Globalization and Digital Transformation on Outcomes of Financial Sector.

This study is grounded in Institutional Theory, which argues that economic and financial outcomes are shaped not only by market forces but also by institutional arrangements such as regulations, governance quality, and market openness. Within this framework, FinTech adoption and foreign bank entry are not inherently stabilising or destabilising; rather, their effects on financial sustainability depend on the institutional environment in which they operate.

Financial freedom captures this institutional environment by reflecting regulatory openness, competitive conditions, and government intervention in the financial system. The framework proposes that financial freedom moderates the relationship between FinTech adoption, foreign

bank entry, and financial sustainability. In countries with higher financial freedom, digital finance and foreign banking participation are more likely to enhance stability and sustainable credit growth. In contrast, in restrictive environments, these developments may exacerbate risk and volatility.

2.11 Summary of the chapter

In this Chapter we reviewed the Literature on all four topics - FinTech Adoption, Financial Sustainability, Foreign Bank Entry, and Financial Freedom - to demonstrate how they relate to each other. We also identified a Research Gap in the Literature that demonstrates the lack of Empirical Studies that assess these factors simultaneously in the Institutional Contexts of CAREC Countries, which experience different levels of Digital Transformation and Financial Openness. As such, we have formulated Twelve Hypotheses that will be used to test both the Direct Effects of Digital Financial Development and Foreign Participation on Financial Sustainability as well as the Moderating Effect of Financial Freedom on Financial Sustainability.

The chapter concludes by setting the foundation for the subsequent methodological discussion. The next chapter outlines the research methodology, including the research design, approach, strategy, data sources, analytical techniques, population, and sampling framework employed in the study.

Chapter 3: Methodology

3.1 Introduction

The chapter describes the methodological approach that was employed for analyzing how foreign bank entry and Fintech use affect financial sustainability in emerging markets through the use of financial freedom as an institutional moderator. This study uses a quantitative methodology to provide systematic evidence about causality and interactions between the main variables studied. To account for the longitudinal (time) and cross-country (country) dimensions of the data collected, panel data analysis techniques are employed to be able to capture the temporal aspects of the relationships and the differences across countries. As such, these methodological approaches outlined in this chapter will provide analytical rigor, robustness, and empirical validity when evaluating the financial sector outcomes in the CAREC region.

3.2 Research Design

In this study, an explanatory methodology is used to explore the theoretical relationships assumed to exist among Fintech adoption, foreign bank entry, financial freedom and financial sustainability. An explanatory approach was selected to establish the existence of causal mechanisms and to quantify the impact size of the relationship between variables. Panel data are collected over a 13-year period (from 2008-2020) and include annual observations on all eleven members of CAREC. A panel data set provides researchers with the ability to evaluate differences in both the cross-sections of countries and the time series in each country's year; therefore, it enhances the reliability of estimates derived through statistical methods. The explanatory approach to investigating financial development in multi-country studies is consistent with previous research.

3.3 Research Approach

The methodology uses deductive approach, based on Institutional Theory, that relies upon prior studies to support findings through the use of empirical data. The method includes a comprehensive review of literature (both theoretical and empirical) from which hypotheses are developed regarding both the direct and moderating effects of FinTech and foreign banks. The hypotheses are subsequently tested using quantitative statistical analysis techniques. The deductive nature of the research increases objectivity, decreases potential researcher biases and enables the development of generalized conclusions regarding the relationship between

institutional quality, technological diffusion (FinTech), and global financial integration and their joint effect on financial sustainability in developing economies.

3.4 Research Strategy

The empirical research design employs a non-experimental quantitative approach through the utilization of secondary data that have been collected by third parties. Therefore, no primary data was collected via survey, interview, etc. As an alternative to collecting original data, this project will rely upon various secondary macro-financial indicator measures that were collected from several well-respected international organizations; specifically, the World Bank's World Development Indicators (WDI); the World Bank's Global Financial Development Database (GFDD); the International Monetary Fund (IMF) Financial Access Survey (FAS); and the Heritage Foundation's Index of Economic Freedom. The reliance on these secondarily collected data will provide the research with access to highly standardized, validated, and consistent data which can be used to compare economic development across countries and time periods. Additionally, this method supports "best practice" in cross-country financial sector research and provides the opportunity for reproducibility and external validity. A quantitative, explanatory research design was adopted to test theoretically grounded hypotheses using secondary panel data. Panel data analysis is particularly appropriate for this study as it captures both cross-country differences and time-varying dynamics across CAREC countries. The use of regression and moderation analysis enables causal inference regarding the direct and conditional effects of FinTech adoption and foreign bank entry on financial sustainability. This methodological approach aligns with prior empirical research in financial development and institutional economics and is well-suited to examining the moderating role of financial freedom in multi-country settings.

3.5 Research Method

Secondary data is utilized in this research to examine the influence of FinTech and foreign banks' entrance into a country's economy to financial sustainability; interaction terms (for example, FinTech × Financial Freedom), will be included to evaluate the moderating effects of financial freedom. In order to analyze the initial correlations of data as well as the potential for data issues prior to conducting the regression and moderation analyses using SPSS 27 software, descriptive statistics as well as correlation analysis will be performed first.

Key model specifications include:

Baseline Model

$$FS_{it} = \alpha + \beta_1 FinTech_{it} + \beta_2 FBE_{it} + \mu_i + \epsilon_{it}$$

Moderation Model

$$FS_{it} = \alpha + \beta_1 FinTech_{it} + \beta_2 FBE_{it} + \beta_3 FF_{it} + \beta_4 (FinTech_{it} \times FF_{it}) + \beta_5 (FBE_{it} \times FF_{it}) + \mu_i + \epsilon_{it}$$

Where:

- **FS** = Financial Sustainability (Bank Z-score, Bank Credit to Deposits)
- **FinTech** = FinTech Adoption Indicators (Digital Payments, ATMs per 100,000 adults)
- **FBE** = Foreign Bank Entry (Foreign Assets among Total Bank Assets)
- **FF** = Financial Freedom
- **μi** = Unobserved country-specific effects
- **εit** = Error term

The inclusion of interaction terms enables the study to determine whether financial freedom strengthens or weakens the influence of FinTech and foreign bank entry on financial sustainability.

3.6 Population and Sample

The population of interest encompasses all developing nations as defined by the World Bank, but then narrows down to include only those specific to 11 member states of the CAREC (Central Asia Regional Economic Cooperation) that have experienced a wide range of levels of Digital Financial Development (DFD), Financial Openness (FO), and Institutional Quality (IQ). These countries includes Pakistan, Afghanistan, Azerbaijan, Tajikistan, Turkmenistan, Uzbekistan, People's Republic of China, Georgia, Mongolia, Kazakhstan and Kyrgyz Republic. This time frame from 2008 through 2020 provides insight into several important events such as; Digital Financial Expansion (DFE), Foreign Bank Participation (FBP), and financial reforms within the

CAREC region. The sample has been limited to these regions for policy relevance and to allow for an in-depth examination of factors influencing financial sustainability within the CAREC context.

3.7 Data Analysis Techniques

Quantitative methods of data analysis will be employed to assess the research objectives and test the developed hypotheses for examining the inter-relationship between FinTech usage, foreign bank participation, financial sustainability, and the moderating role of financial freedom within CAREC nations. The analytical process done on SPSS 27 which includes an initial set of descriptive statistics; i.e., mean, standard deviation, and minimum-maximum value of all data variables. A correlation analysis will then be conducted to determine the strength and direction of the linear relationship between each pair of variables. Regression analysis will also be employed as the principal method for hypothesis testing. For the estimation of direct effects, this study employs pooled Ordinary Least Squares (OLS) regression. Pooled OLS is appropriate as the analysis aims to estimate average relationships across CAREC countries rather than within-country variations over time. In addition to providing estimates of the direct impact of digital payments, ATM density, and foreign asset-holdings on both the Bank Z-Score and the bank credit-to-deposit ratio, simple linear regressions will be utilized to establish the significance of the hypothesized relationships. Moderation analyses will be conducted to evaluate whether the institutional environment influences the conditions under which digital payments, ATM density, or foreign asset-holdings influence the two dependent variables. Moderation analysis will be accomplished through the incorporation of interaction terms into the models, specifically by multiplying the previously established predictors (i.e., digital payments, ATM density, and foreign assets) with the variable representing financial freedom.

3.8 Definition of Variables

Below table 3.1 describes variable wise proxies and their respective definitions.

Table 3- 1: Definition of Variables

Variable	Name	Proxy	Definition	Sources
Independent Variables	FinTech Adoption -Digital	Digital payments (% of adults	Digital payments refer to financial transactions conducted through electronic channels such	Demirgüç-Kunt et al. (2018); Sahay et al.

	Payments	using electronic payments)	as mobile payments, internet banking, debit/credit cards, and digital wallets, enabling cashless transactions and representing a core component of FinTech-driven financial innovation.	(2020); Ozili (2018)
	FinTech Adoption - ATM Penetration	ATMs per 100,000 adults	ATM penetration measures the availability of automated teller machines and reflects access to formal financial infrastructure, serving as a bridge between traditional banking systems and digital financial services, particularly in developing economies.	Beck et al. (2016); Demirgüç-Kunt & Klapper (2021)
Dependent Variables	Foreign Bank Entry	Foreign assets as % of total bank assets	Foreign bank entry represents the extent of foreign participation in a domestic banking system, measured through foreign-owned or foreign-held bank assets, and reflects international financial integration, technology transfer, and exposure to external financial shocks.	Claessens & van Horen (2014); Chueca Vergara & Ferruz Agudo (2021)
	Financial Sustainability-Banking Stability	Bank Z-score	Bank Z-score measures the distance from insolvency by combining profitability, leverage, and return volatility. A higher Z-score indicates greater banking stability and lower probability of financial distress.	Demirgüç-Kunt et al. (2021); Boyd & Runkle (1993)
	Financial Sustainability - Credit Sustainability	Bank credit to bank deposits ratio	The credit-to-deposit ratio measures the extent to which banks fund lending activities through deposits. Sustainable levels reflect balanced credit expansion, while excessive ratios indicate higher liquidity risk and financial vulnerability.	Berger & Bouwman (2022); Chen & Wu (2024)
Moderator	Financial Freedom	Financial Freedom Index score	Financial freedom refers to the degree of regulatory openness, government intervention, and	Heritage Foundation (2024); Hasan

	market liberalization in the financial sector, influencing how efficiently financial institutions operate and how effectively innovation translates into financial stability.	et al. (2023); Yang & Jung (2024)

Chapter 4 Results and Analysis

4.1 Introduction

The chapter in this dissertation presents the empirical findings of this study using panel data of 11 CAREC countries from 2008 through 2020. The analysis provides an overarching view of the inter-relationship between FinTech, Foreign Bank Entry, Financial Sustainability and the moderating effect of Financial Freedom. The chapter first starts with descriptive statistics to show an overall picture of the dataset, and establishes some general patterns of the important financial metrics. A correlation analysis will be used to identify the direction and strength of association among the variables. Afterward, regression analysis will be utilized to determine the effects of digital payments, ATM penetration and foreign asset exposure on the various measures of financial sustainability. Finally, the analysis will use moderation analysis to examine whether the institutional quality of the country moderates the relationship between digital payments, ATM penetration and foreign asset exposure, and financial sustainability. In conclusion, the chapter will conclude with a description of the findings related to each of the hypotheses, which are supported by a summary table of all the results and the empirical interpretation of them.

4.2 Descriptive Statistics

Descriptive statistics provide an overview of the key financial access, stability, and regulatory indicators across all CAREC countries from 2008-2020. Evaluating the minimum, maximum, and mean values will help identify the distribution of values in the data. In addition, this summary aids in identifying the disparity in how the countries have adopted digital finance; how far they are along in developing the banking system; what degree of stability exists in their banking systems; how easily people can get credit; how much exposure they have to foreign assets; and how free they are financially.

Variables	N	Minimum	Maximum	Mean
Digital payments	143	3.75	79.39	23.32
ATM per 100,000 adults	130	.29	106.88	33.90
Bank Z score	143	1.47	43.35	16.59
Bank credit to bank deposit	130	16.83	342.43	121.90
Foreign assets among total bank assets	78	1.30	80.16	33.16
Financial Freedom	143	0	70	36.01

Table 4- 1: Descriptive Analysis

In summary, the descriptive statistics indicate that there are considerable cross-country differences in the major financial indicators. Digital payment systems vary significantly from 3.75 - 79.39, with a mean of 23.32, indicating that certain countries have significantly more advanced and widespread adoption of digital financial offerings than do others. Similarly, the range for ATM access is from 0.29 - 106.88 ATMs per 100,000 adults, with a mean of 33.90, indicating that there are many discrepancies in the development of a physical financial infrastructure among different countries. The Bank Z-score (used to assess the stability of a banking system) ranges from 1.47 - 43.35, indicating that these countries exhibit vastly different risk profile characteristics among their respective banking systems. The difference in the amount of bank credit relative to the amount of bank deposits also shows the largest deviation with a range of 16.83 - 342.43 and a mean of 121.90, indicating the significant difference in the depth of financial markets and the relative intensity of credit activity in those countries. The average percentage of the total assets held by banks that are foreign in origin is 33.16% and the range is 1.30 - 80.16, highlighting that there is a great deal of variation between the levels of international financial integration across the sample. Financial freedom's average score is 36.01 on a scale of 0-70, indicating that there are countries operating in highly liberal financial environments and others that are still operating in highly regulated environments. In short, the data provides clear

evidence of a significant amount of variation across our sample of countries in terms of financial access, banking stability, and regulatory openness.

4.3 Correlation Analysis

Using correlation analysis, this study assess the relationships between two variables for the financial indicators of CAREC countries from 2008-2020. The analysis investigates the movement of the various financial indicators to provide insight into the developing relationships between financial access measures, banking stability indicators, credit conditions, exposure to foreign assets, and financial freedom. Furthermore, the identification of linear relationships established by the correlation analysis is useful in establishing whether the variables act in accordance with theoretical expectations and guide further regression and moderation analyses dependent on the identified linear relationships.

Table 4- 2: Correlation Analysis

Variables	Digital payments	ATM per 100,000 adults	Bank Z score	Bank credit to bank deposit	Foreign assets among total bank assets	Financial Freedom
Digital payments	--					
ATM per 100,000 adults	.568**	--				
Bank Z score	.217**	.007	--			
Bank credit to bank deposit	.360**	.478**	.103	--		
Foreign assets among total bank assets	-.281*	.137	-.261*	-.498**	--	
Financial Freedom	.258**	.507**	-.324**	.112	.702**	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The correlation analysis has demonstrated that there are strong correlations between some variables associated with access to finance and stability. Specifically, digital payment systems have high correlations with financial access through ATM machines ($r = .568$, $p < .01$), moderate

correlations with the amount of bank credit held by the public relative to how much money is held on deposit ($r = .360$, $p < .01$) and financial freedom ($r = .258$, $p < .01$). This suggests that countries with higher levels of bank activity also have greater freedoms in relation to financing transactions. In contrast, ATMs have positive correlation coefficients with financial freedom ($r = .507$, $p < .01$) and bank credit ($r = .478$, $p < .01$). Thus, it appears that countries with more open and deep financial markets have better physical infrastructure than those countries with closed systems. The Bank Z-Score has small but statistically significant positive correlation with digital payments ($r = .217$, $p < .01$) and strong negative correlation with freedom in banking ($r = -.324$, $p < .01$). This indicates that nations with more open financial markets may have an inherent risk of greater systemic failure than nations that are less open. In addition, foreign assets included in total bank assets have negative correlation grounds with digital payments ($r = -.281$, $p < .05$), the Bank Z-score ($r = -.261$, $p < .05$), and bank credit ($r = -.498$, $p < .01$); however, there is a strong positive correlation ground with financial freedom ($r = .702$, $p < .01$), indicating that a greater level of financial openness enhances an exposure to foreign assets at the expense of domestic credit activity.

4.4 Regression Analysis

This study used regression analysis to determine the effects of key explanatory variables on banking stability, credit dynamics and financial freedom on both digital finance adoption, ATM penetration and foreign assets exposure within the context of West African Countries (CAREC) from 2008-2020. The analysis will identify direct and interactional effects, which should provide a better understanding of how financial access affects these outcomes through various banking systems across CAREC countries. By utilising this methodological framework, we will have a clearer assessment of the financial systems and allow us to identify whether or not the effect persists after controlling for interactional and/or moderating factors.

Table 4- 3: Regression Analysis (Bank z score and Digital Payments)

Dependent Variable	Independent Variable	R	R Square	T value	P value	Supported/ Not Supported
Bank Z score	Digital Payments	0.217	0.047	2.636	0.009	Supported

Digital payment channels have been found to positively affect the stability of the banking sector as measured by the Z-score of banks ($R = 0.217$, $R^2 = 0.047$, $t = 2.634$, $p = .007$) per a simple regression analysis. Although the amount of variance that can be explained by the usage of digital payments is relatively small at 4.7 percent, the large t-statistic and low p-value indicate that there is likely a strong contribution to the increased stability of banks due to digital payments. This seems to be in line with the general consensus among researchers studying digital finance, and among other researchers focusing on the impact of digital finance on the financial sector's stability, that digital financial products have provided an efficient way to conduct transactions, and that they have decreased the risk of loss for the financial sector, while increasing transparency. According to Sahay et al. (2020) and Demirgüç-Kunt et al. (2018), the increased use of digital payments has provided banks with a larger customer base, while decreasing the risk of handling cash and thus enhancing access to financial services. In addition, empirical research from developing countries indicates that the use of electronic payment channels can create more stable revenue streams for banks, which reduces the pressure on banks to maintain sufficient liquidity by providing them with the means to account for activity that is typically done through cash transactions; therefore, the findings of this study can be understood in light of previous studies that have highlighted the stabilizing impact of digital transformation within the banking industry. The finding supports the hypothesis that digital payments positively effects the Bank Z-score and contribute to a more stable and efficient banking environment.

Table 4- 4: Regression Analysis (Bank z score and ATM Payments)

Dependent Variable	**Independent Variable**	**R**	**R Square**	**T value**	**P value**	**Supported/ Not Supported**
Bank Z score	ATM per 100,000 adults	0.007	0.000	0.075	0.940	Not Supported

The results of the regression analysis indicated that the availability of automated teller machines or ATM per 100,000 adults has no statistically significant effect on bank stability. In fact, the model has a very low correlation with the Z-Score, indicating that ATM Availability accounted

for 0% of the variation seen in their Z-Score (R=0.007; R2 square=0.000), and there was no significant correlation with the coefficient of nearest ATM location to a person's primary bank (T-statistic = 0.075; P-value = 0.940), suggesting that the availability of ATMs would not substantially influence banking stability. Therefore, the hypothesis that ATM Availability is beneficial is not supported. This finding supports the recent literature finding that ATMs are now less useful as a potential measure of financial sector development and stability. As the financial system moves further toward digital banking and mobile payment solutions, ATMs will continue to play a less significant role. In their analysis, Sahay et al. (2020) note that ATM infrastructure was no longer a reliable predictor of financial depth, with consumers increasingly using online transactions and branchless banking models. Subsequently, Demirgüç-Kunt and Klapper (2021) found that financial inclusion is now driven more so by mobile money and digital payment systems than by ATM penetration. Therefore, the non-significant relationship noted here is indicative of broader trends on a global scale in which digital channels - as opposed to the availability of ATMs - are now the primary driving forces of modern financial sector performance.

Table 4- 5: Regression Analysis (Bank credit to bank and Digital Payments)

Dependent Variable	**Independent Variable**	**R**	**R Square**	**T value**	**P value**	**Supported/ Not Supported**
Bank credit to bank	Digital Payments	0.360	0.130	4.370	0.001	Supported

The findings from the simple regression analysis reveal that there is a statistically significant positive impact of increased digital payments on banking sector stability. The regression model shows that the relationship between digital payments and banking sector stability may be small, but nonetheless, important in terms of the magnitude of the correlation, as illustrated by the R value of 0.217 and R-squared value of 0.047, which means approximately 4.7% of the difference in Bank Z-scores can be attributed to digital payment usage. This positive effect was statistically significant, with a T value of 2.636 and a P value of 0.009, which indicates that banks with a higher number of digital payment users are likely to be more stable than those with fewer. These

results are supported by previous research on the impact of digitization on the operation of the financial sector, such as decreasing transaction costs, improving operational efficiency and promoting more formal transactions, all of which impact the stability of the banking sector. For instance, in 2018, Ozili found that providing digital financial services would increase access to finance and assist in reducing the variability of the financial industry due to digitization. Similarly, in their 2020 study, Singh & Sharma found that greater availability of digital payment methods would benefit banks through improved liquidity flows and lower risk of fraud. As such, this research supports findings in the literature and demonstrates that digital transformation of banks can assist in building greater resilience for the banking industry as well as resilience for the financial system itself.

Table 4- 6: Regression Analysis (Bank credit to bank and ATM Payments)

Dependent Variable	**Independent Variable**	**R**	**R Square**	**T value**	**P value**	**Supported/ Not Supported**
Bank credit to bank	ATM per 100,000 adults	0.478	0.229	6.159	0.001	Supported

The regression analysis showed a significant positive relationship between ATM availability (the number of ATMs per 100,000 adults) and bank credit in the financial services industry. The correlation coefficient ($R = 0.478$) supports a moderate positive relationship between the two, and the R-squared ($R^2 = 0.229$) indicates that approximately 22.9% of the variance observed in bank credit is attributable to ATM penetration. The statistically significant regression coefficient was confirmed with a t-statistic ($t = 6.159$) and a p-value ($p = 0.001$), indicating a statistically significant relationship; therefore, the hypothesis was confirmed that increased access to ATMs would influence bank credit growth positively.

These findings confirm previous literature discusses that better financial infrastructure leads to better accessibility to financial services and credit allocation. Research works like those carried out by Beck et al. (2016), Sharma (2020), bring out that with higher ATM availability, transaction costs fall, liquidity availability increases, and people start making use of formal financial institutions to a larger extent. This leads to higher demands for credit and its availability within

the banking system to certain extents. Likewise, Demirgüç-Kunt et al. (2018), assert that financial inclusion becomes smooth with the help of physical accessibility like ATMs, and it leads to easier credit deepening within developing countries. The positive significance observed in this research work matches with previous research, hence justifying that ATMs have some important effects on improving the credit strength of the banking system.

Table 4- 7: Regression Analysis (Bank z score and Foreign assets)

Dependent Variable	**Independent Variable**	**R**	**R Square**	**T value**	**P value**	**Supported/ Not Supported**
Bank Z score	Foreign assets among total bank assets	0.261	0.068	-2.358	0.021	Supported

Results of the regression analysis indicate that foreign assets comprising total bank assets have a significant influence on the Bank Z-score, which is an indicator of banking sector stability. The correlation coefficient represents a moderate association, where the R is 0.261, which means that about 6.8% of the stability of banks can be explained by the influence of foreign assets. It is also statistically significant, as its t-statistic is -2.358, and p-values is 0.021. This implies that foreign asset accumulation reduces bank stability. This is because of the negative indicator of the relationship. It is implied that foreign asset accumulation makes banks susceptible to external shocks, foreign exchange risks, and foreign markets.

These results are consistent with previous studies which pointed out the potential risk of relying too much upon the portfolios of foreign assets to the extent that it could increase the volatility of banks, particularly in developing markets. Previous studies such as Demirgüç-Kunt & Huizinga (2010) and Beck (2012) suggest a potential risk of relying too much upon the portfolios of foreign assets, which could increase the risk of instability in banks due to instability in the macroeconomic environment of emerging markets. Acharya et al. (2016) also suggest that the position of international investments could increase systemic risk in periods of international instability in the financial markets. Thus, the key finding of this study also supports the previous

evidence which suggested instability in banks due to the concentration of foreign assets in the banks' portfolios.

Table 4- 8: Regression Analysis (Bank credit to bank and Foreign assets)

Dependent Variable	Independent Variable	R	R Square	T value	P value	Supported/ Not Supported
Bank credit to bank deposit	Foreign assets among total bank assets	0.498	0.248	-5.003	0.001	Supported

Regression findings indicate that foreign assets relative to the total assets of a bank have a statistically significant relationship with bank credits and deposits. Correlation between the variables is of a moderate level (R = 0.498) and is positive, meaning that as the level of foreign assets increases, there is a corresponding change in bank credits. Regression explains about 24.8 percent of the change caused by bank credits and deposits, and the findings are statistically significant with a t-value of -5.003, and a corresponding p-value of 0.001, thus accepting the hypotheses. However, the findings are contrary because, although the relationship is negative, it signifies that the corresponding increase in foreign assets may cause a decline in credits relative to deposits, but these findings are supported by previous studies that treated foreign exposure as a catalyst that solicits a more conservative approach while operating within domestic markets. According to previous studies, it is observed that those banks that have a relatively high exposure in foreign markets tend to focus more on domestic liquidity management and, as such, tend to have a tightened approach towards domestic credits.

4.5 Moderation Analysis

The moderation analysis investigates how the impact of key banking variables on financial access outcomes varies based on level of financial freedom across CAREC countries from 2008 to 2020. The analysis investigates whether financial freedom strengthens, weakens, or does not change the relationship between banking system indicators such as the Bank Z-score and bank credit with financial access measures such as digital payments, ATM penetration, and foreign asset exposure by incorporating interaction terms into the regression models. This provides

further insight into the manner in which regulatory openness is a basic condition shaping particular financial development dynamics and emphasizes the conditional nature of these relationships within the CAREC region.

Table 4- 9: Moderation Analysis I

Predictor	B	SE	β	t	p	LLCI	ULCI
Constant	31.70	5.05	—	6.28	< .001	21.72	41.67
Bank z score	-0.83	0.20	—	-4.17	< .001	-1.22	-0.43
Financial freedom	-0.45	0.11	—	-3.93	< .001	-0.67	-0.22
Bank z score × Financial freedom	0.041	0.0049	—	8.37	< .001	0.031	0.051

The moderation analysis aimed to investigate the role of financial freedom in altering the effect of bank stability, which was quantified through the Bank Z-score, on the adoption of digital payments. When financial freedom is constant, the negative relationship between the Bank Z-score and digital payments is significant ($B = –0.83$, $t = –4.17$, $p < .001$). This relationship suggests that at low or moderate levels of financial freedom, customers are turning away from making payments digitally as banks become more stable. In addition, financial freedom alone has a significant negative impact on the digital payment ($B = –0.45$, $t = –3.93$, $p < .001$), which means that the countries which have greater financial freedom are the ones that have lower digital payment adoption at the baseline.

The interaction term is the main result, and it is positive and very significant ($B = 0.041$, $t = 8.37$, $p < .001$). This indicates a very strong moderating effect, which means that financial freedom alters the impact of bank stability on digital payment adoption. The higher the financial freedom, the weaker the initially negative effect of the Bank Z-score and the more it gradually shifts towards a positive one. In a financially liberalized environment, stronger and more stable banks tend to promote digital payment, rather than refrain from it.

To sum up, the results show that the linkage between bank stability and digital payments is very much dependent on the amount of financial freedom available. Bank stability is a condition for the success of digital payment systems but only if the level of financial freedom is high enough. In areas where the financial freedom is restricted, banking stability does not lead to an increase in digital payment adoption.

Table 4- 10: Moderation Analysis II

Predictor	**B**	**SE**	**β (Std.)**	**t**	**p**	**LLCI**	**ULCI**
Constant	-28.01	13.75	—	-2.04	.044	-55.23	-0.79
Bank z score	1.99	0.80	—	2.49	.014	0.41	3.57
Financial freedom	1.40	0.28	—	5.04	< .001	0.85	1.94
Bank z score x financial freedom	-0.0376	0.0154	—	-2.44	.016	-0.068	-0.007

The moderation analysis determined whether financial freedom moderates the effect of bank stability, which is measured by the Bank Z-score, on ATM penetration defined as the number of ATMs per 100,000 adults. The analysis yielded results indicating that the Bank Z-score positively and significantly impacted ATM access (B = 1.99, t = 2.49, p = .014). This suggests that countries with more stable and safer banking systems have a higher number of ATMs when the moderating role of financial freedom is ignored. Furthermore, financial freedom exerts a strong and significant positive impact on ATM availability (B = 1.40, t = 5.04, p < .001), thereby implying that more open and liberal financial systems enhance access for banks to extend their physical network.

The product of the Bank Z-score and financial freedom is negative and statistically significant (B = −0.0376, t = −2.44, p = .016), thereby solidifying the assumption of a significant moderation effect. To illustrate, the finding points out that the turning point ratio between bank stability and ATM proliferation is high in the case of moderate to low levels of financial freedom. Hence, it is a matter of fact that, banking systems that are stable can relatively increase their ATM penetration, but this is not the case in the area of financial freedom. Once a country has high

financial freedom, it does not matter how much further the stability of banks is improved; it will still have less contribution to the expansion of ATM networks.

In conclusion, the study concludes that the advantages of bank stability for ATM growth are most apparent in situations with relatively low or middle financial freedom. In highly liberalized financial systems, the positive contribution of bank stability is lessened as market openness itself promotes infrastructure development, thus, the stability improvements have less additional value.

Table 4- 11: Moderation Analysis III

Predictor	**B**	**SE**	**β (Std.)**	**t**	**p**	**LLCI**	**ULCI**
Constant	-31.03	21.74	—	-1.43	.158	-74.35	12.29
Bank z score	-1.63	1.28	—	-1.27	.209	-4.19	0.93
Financial freedom	1.09	0.45	—	2.45	.017	0.20	1.98
Bank z score × financial freedom	0.0735	0.0307	—	2.40	.019	0.012	0.135

The moderation analysis aimed to determine if financial freedom influences the impact of bank stability, measured by the Bank Z-score, on the foreign assets share in total bank assets. The findings indicate that the Bank Z-score does not exert a substantial direct influence on the possession of foreign assets (B = -1.63, t = -1.27, p = .209). This means that bank stability, in isolation, does not significantly forecast the level of foreign exposure in banks' assets. On the other hand, financial freedom exerts a direct and significantly positive impact (B = 1.09, t = 2.45, p = .017) which implies that the countries with the most liberal and open financial systems also possess higher proportions of foreign assets in their banking sector.

The interaction between the Bank Z-score and financial freedom is characterized by a positive and significant term (B = 0.0735, t = 2.40, p = .019), which indicates the existence of a substantial moderation effect. This result asserts that financial freedom has a positive impact on the relationship between bank stability and the holding of foreign assets. Low financial freedom implies that stability in the banking sector does not lead to banks' greater exposure to foreigners. However, the more financial freedom increases, the stronger the positive effect of bank stability,

meaning that stable banking systems are likely to increase their foreign asset participation in open and liberal financial environments.

In summary, the findings indicate that bank stability will only ensure the diversification into foreign assets to a certain extent when the financial freedom is high enough. In fact, during the periods of restrictions, the foreign asset realizations do not reflect the improvements in the bank's stability. Nevertheless, in the case of open financial systems, banks deemed stable will be in better position to partake in cross-border financial activities resulting in a greater share of foreign assets.

Table 4- 12: Moderation Analysis IV

Predictor	**B**	**SE**	**β (Std.)**	**t**	**p**	**LLCI**	**ULCI**
Bank credit to bank	0.25	0.047	—	5.34	< .001	0.16	0.35
Financial freedom	0.77	0.19	—	4.17	< .001	0.41	1.14
Bank credit to bank × Financial freedom (Interaction)	-0.0063	0.0017	—	-3.74	< .001	-0.0096	-0.0030

The moderation analysis conducted determined whether financial freedom is a factor that alters the impact of bank credit to bank on digital payment adoption. The results indicated that bank credit to bank indeed has a positive and statistically significant effect on digital payments ($B = 0.25$, $t = 5.34$, $p < .001$). This implies that the higher the credit banks grant to each other, the more the digital payment usage increases, which is due to the better liquidity, stronger credit channels, and higher technological capacity for expansion that the banks have.

Furthermore, financial freedom has also an important and positive effect on digital payments ($B = 0.77$, $t = 4.17$, $p < .001$). This means that the countries with more open and liberalised financial systems usually have higher digital payments adoption rates, probably because of the aforementioned factors, i.e., fewer regulatory restrictions, stronger competition, and greater incentives for financial innovation.

On the other hand, the interaction term between bank credit to bank and financial freedom is negative and statistically significant (B = -0.0063, t = -3.74, p < .001). This corroborates the existence of a considerable moderation effect. The negative interaction signifies that although both factors separately work to increase the use of digital payments, the positive effect of bank credit to bank diminishes with the rise of financial freedom. In places where financial freedom is already high, the increase in bank credit will not be followed by an equally vigorous hike in digital payment transactions. Such a situation depicts a diminishing-marginal-effect pattern, where the benefits of bank credit are extremely evident in financially less liberalized systems and start to wear off as the financial freedom becomes higher.

Altogether, it can be concluded that bank credit and financial freedom are two major factors that contribute to the digital payment expansion. However, the interaction effect between them is not additive.

Table 4- 13: Moderation Analysis V

Predictor	**B**	**SE**	**β (Std.)**	**t**	**p**	**LLCI**	**ULCI**
Constant	-16.83	6.98	—	-2.41	.017	-30.64	-3.03
Bank credit to bank (X)	0.20	0.062	—	3.24	.002	0.08	0.32
Financial freedom (W)	0.78	0.24	—	3.21	.002	0.30	1.26
Bank credit to bank × Financial freedom (Interaction)	-0.0008	0.0022	—	-0.36	.723	-0.0051	0.0036

The moderation analysis determined if financial freedom influences the relationship between bank credit to bank and ATM availability. The results show that the latter has a substantial beneficial impact on the number of ATMs per 100,000 adults (B = 0.20, t = 3.24, p = .002), meaning that the higher the credit banks give, the more they will be able to invest in direct financial and infrastructural including ATM networks.

Among the factors affecting ATM penetration, financial freedom has also been found to have a positive and significant effect (B = 0.78, t = 3.21, p = .002). This implies that countries with

more open and liberal financial systems are able to support greater expansion of ATMs, most probably due to less regulatory barriers and increased competition in the banking sector.

Nonetheless, the interaction term of bank credit and financial freedom is statistically insignificant (B = -0.0008, t = -0.36, p = .723). This means that financial freedom does not act as a moderator in the relationship between bank credit and ATM availability. To put it another way, the positive impact of bank credit on ATM expansion is independent of the varying levels of financial freedom, remaining stable and consistent.

In summary, bank credit and financial freedom both considered separately lead to greater ATM access, yet the overall effect of the two does not change the strength or the direction of the relationship.

Table 4- 14: Moderation Analysis VI

Predictor	**B**	**SE**	**β (Std.)**	**t**	**p**	**LLCI**	**ULCI**
Constant	-28.87	25.74	—	-1.12	.266	-80.16	22.42
Bank credit to bank	-0.01	0.14	—	-0.08	.936	-0.28	0.26
Financial freedom	1.80	0.66	—	2.71	.008	0.47	3.12
Bank credit to bank × Financial Freedom (Interaction)	-0.0024	0.0040	—	-0.60	.548	-0.011	0.006

The moderation analysis was used to find out if financial freedom alters the effect of bank credit to banks on holding foreign assets by banks. The analysis yielded that bank credit to banks has no direct impact on foreign asset holdings (B = -0.01, t = -0.08, p = .936). This illustrates that the volume of foreign exposure maintained by banks is neither affected nor influenced in any significant manner by the increase or decrease of credit at home banks.

On the other hand, financial freedom contributes positively and significantly with certainty (B = 1.80, t = 2.71, p = .008). The implication of this is that the banking sector in a country with an open and liberal financial system is likely to enjoy high levels of foreign assets, and this can be

attributed to the international investments and financial activities being the banks' avenues in such a system since fewer restrictions would require the banks' engagement. The coefficient of the interaction term between bank credit and financial freedom is also very low (B = -0.0024, t = -0.60, p = .548). This tells that the financial freedom factor does not at all change or condition the relationship between bank credit and foreign assets. The impact of the domestic bank credit on the foreign exposure remains constant irrespective of whether a country is rated as low, medium, or high in terms of financial freedom.

In conclusion, the results indicate that it is the financial freedom that is responsible for the rise in foreign assets not the interaction between bank credit and financial freedom. The bank credit factor cannot be said to play any significant role in determining foreign asset levels and the situation is the same when looking through the lens of different financial liberalization levels.

4.6 Discussion of Results

H1: Digital Payments has a statistically significant effect on Bank Z-score in developing countries.

The results supports H1. The regression analysis results indicate that the digital payment option has a positive and significant impact on the Bank Z-score at a 5 % level of significance, although the share of explained variance is small. The implication of this is that the digital payment option when embraced is likely to increase the stability of the banking sector in the CAREC countries. Theoretically, the use of digital payments by customers can lead to the building of a bank's customer base, controlling of financial transactions, and reduction of cash-handling and operational risks, which in turn makes the bank's solvency and earnings stable. The finding is in line with the earlier studies i.e. digital financial services may create a win-win situation for banks and customers by opening up the market, delivering more and better services at lower costs, and going even further in terms of controlling risk and managing it by tight regulation and supervision (Sahay et al., 2020; Demirgüç -Kunt et al., 2018). The same goes for the CAREC region where digital payment solutions and interventions would play a vital role in establishing the banking sector's capability to meet the challenges of financial sustainability in the long term.

H2: ATM per 100,000 adults has a statistically significant effect on Bank Z-score in developing countries.

The results from the empirical studies do not support H2. The number of ATMs neither correlates to the Z-score of the Bank significantly nor does it account for a considerable part of the variation in banking stability. Hence, it can be concluded that in the case of the CAREC region, the availability of ATMs, unlike digital payments, does not have a substantial impact on bank solvency or risk resilience. This observation corresponds with the current literature which argues that ATMs have been losing their significance as an indicator of financial development and stability as economies become more digital and mobile (Sahay et al., 2020; Demirgüç-Kunt & Klapper, 2021). In many countries, customers are withdrawing less cash and resorting more to electronic transfers, thereby letting the ATM networks play a role that is supportive but not central to systemic stability. For the CAREC countries, this means that the policies aimed only at the expansion of physical cash points might not be able to make a big difference in banking soundness.

H3: Foreign assets among total bank assets has a statistically significant influence on Bank Z-score.

These findings supports H3 and indicate a strong and statistically significant negative correlation between foreign assets and the Bank Z-score. Although foreign asset position contributes to international diversification and financial integration for emerging economies, the negative sign indicates that the more foreign-exposed banks are, the less stable their position in foreign economies will be. This finding can be related to the argument presented by Demirgüç-Kunt and Huizinga (2010) and further substantiated by other literature on the potential volatility and systemic risk emanating from foreign asset concentrations of emerging economies during macroeconomic and regulatory weaknesses (Acharya et al., 2016). This implies that while CAREC economies can enjoy the advantages of foreign integration and international diversification, their dependence on foreign assets without effective protection mechanisms can pose potential financial risks.

H4: Digital Payments has a statistically significant effect on Bank credit to bank in developing countries.

H4 is supported. Digital payments have a positive and significant effect on bank credit to bank deposits, indicating that an increase in digital payment usage is related to a higher level of credit

facilitation. The rise in digital payments means a higher number of transactions are routed through formal banking infrastructure, leading potentially to higher funds mobilization aswell as better information flows about customer financial behaviors. Therefore, banks can potentially be encouraged to provide higher credits since they are better informed and enjoy a stable funding source. The finding is in line, indicating previous findings that showed digitalization helped drive liquidity better, lowered transaction costs, aswell as improved information aspects, making it all possible towards improved credit growth and thereby overall financial development (Ozili, 2018; Singh & Sharma, 2020). In this context, it appears digital payments are working towards making both aspects of stability in finance and credit facilitation a reality in the CAREC region.

H5: ATM per 100,000 adults has a statistically significant effect on Bank credit to bank in developing countries.

As per H5, there is positive and significant ATM penetration impact on bank credits to deposits, with comparatively high priority relative to various other variables. It is hypothesized here that as more and more people use ATMs, they will increasingly use formal financial channels and thus keep bigger balances and be more actively involved in banks, thus triggering both demand and supply sides in the credits. It is supported here that even in the digital age, physical points remain very important in making people involved in account usage, deposit mobilizations, and credits in geography with fewer branches (Beck et al., 2016; Demirgüç-Kunt et al., 2018). For CAREC countries, ATMs are digital milestones in making important interface points between customers and formal financing systems in order to trigger credits.

H6: Foreign assets among total bank assets has a statistically significant influence on Bank credit to bank.

H6 is supported with a significant negative relationship between foreign assets among total bank assets and the bank credit to deposit ratio. The results indicate that as banks devote larger shares of their portfolios to foreign assets, they tend to shrink the relative level of domestic credit to deposits. This pattern is consistent with the notions that the bank with substantial foreign exposure may favor international diversification, liquidity management, or safer foreign investments that crowd out domestic lending activities. Previous studies similarly report that higher foreign asset positions can lead banks to adopt more conservative credit strategies at home,

particularly in economies with macroeconomic volatility or weaker legal frameworks (Beck, 2012; Chen & Wu, 2024). In the CAREC context, this suggests a trade-off between international portfolio diversification and domestic credit deepening that has important implications for policy in the financial sector.

H7: Financial Freedom moderates the relationship between Digital Payments and Bank Z score.

The findings supports H7, as the research indicates that the relationship of Bank Z-score on digital payment behaviour may exist but will be tested using Financial Freedom as a moderating variable. The positive and statistically significant interaction between Bank Stability and Financial Freedom may indicate that Higher Bank Stability will only promote Higher Digital Payment Behaviour if the consumer has greater Financial Freedom. A Bank Z-score may be associated with Lower Digital Payment Behaviour when a Consumer has Low or Average Levels of Financial Freedom. This may be a reflection of a Conservative Bank's Investment behaviour or a Lack of Investment in Digital Innovation. However, as Financial Freedom increases, this negative relationship will decrease and ultimately become Positive, meaning that a Stable Banking System in a Financially Liberal Environment will accelerate Digital Payment Participation. The current findings support the literature that identifies Regulatory Openness and Competition as essential drivers of the Ability of Stability and Institutional Strength to be translated into Innovation and Financial Inclusion (Meiling et al., 2021; Hasan et al., 2023).

H8: Financial Freedom moderates the relationship between ATM per 100,000 adults and Bank Z-score.

H8 is supported. The moderation results show that both Bank Z-score and financial freedom independently have positive effects on ATM penetration, but the interaction term is negative and significant. This suggests that while stability and openness each promote ATM expansion, the incremental benefit of stability for ATM growth declines as financial freedom rises. In relatively closed or moderately liberal systems, improvements in bank stability are important drivers of infrastructure expansion, including ATMs. In highly liberalised environments, however, market openness and competition already encourage infrastructure development, making additional gains from higher stability less pronounced. This pattern is consistent with financial liberalisation

research that finds reforms and structural improvements have stronger marginal effects in more constrained systems and weaker incremental effects once markets are already highly open (Yang & Jung, 2024). In the CAREC region, this implies that stability reforms are particularly impactful for infrastructure in countries with lower levels of financial freedom.

H9: Financial Freedom moderates the relationship between Foreign assets among total bank assets and Bank Z-score.

The findings support H9. Although bank stability alone does not significantly predict foreign asset holdings, financial freedom has a positive effect and the interaction between Bank Z-score and financial freedom is significantly positive. This indicates that bank stability contributes to greater foreign asset diversification only in more liberal financial environments. When financial freedom is low, improvements in stability do not translate into higher foreign exposure, possibly due to regulatory barriers, capital controls, or limited market opportunities. As financial freedom increases, stable banks are better able to take advantage of cross-border opportunities, expand their foreign portfolios, and integrate with global financial markets. This aligns with the literature that emphasises the role of openness and regulatory quality in enabling stable banks to internationalise safely (Claessens, 2022; Sant'Anna & Figueiredo, 2024). For CAREC economies, the result suggests that stable institutions coupled with higher financial freedom can support strategic foreign asset diversification, although this must be balanced against the risks highlighted under H3.

H10: Financial Freedom moderates the relationship between Digital Payments and Bank credit to bank.

H10 is supported. The moderation analysis shows that both bank credit to bank and financial freedom have positive and significant effects on digital payment adoption, but their interaction is negative and significant. This pattern suggests that although stronger credit intermediation and more liberal financial environments each promote digital payments, the marginal effect of additional credit on digital payment use diminishes as financial freedom rises. In more restricted financial systems, improvements in credit conditions appear to play a stronger role in enabling investment in digital infrastructure and product development. In contrast, in highly open systems, competition, innovation, and regulatory openness already drive digital adoption, so further

increases in credit have a smaller incremental impact. This is consistent with the idea of diminishing returns in liberalised environments, where multiple drivers of digital growth are already present (Hasan et al., 2023). For CAREC countries, it indicates that credit expansion is particularly important for digital progress in less liberal financial systems, while in more open systems policy focus may need to shift towards regulation, consumer protection, and innovation ecosystems.

H11: Financial Freedom moderates the relationship between ATM per 100,000 adults and Bank credit to bank.

H11 is not supported. The interaction term between bank credit to bank and financial freedom in explaining ATM penetration is statistically insignificant, even though both main effects are positive and significant. This implies that bank credit and financial freedom independently promote ATM expansion, but financial freedom does not systematically strengthen or weaken the relationship between credit and ATM availability. In other words, the positive effect of credit on ATM networks is relatively stable across different levels of financial liberalisation. This result suggests that physical infrastructure investments respond to credit conditions in a fairly uniform way, regardless of regulatory openness, as long as basic enabling conditions are in place. It also indicates that, unlike digital channels where institutional context plays a stronger moderating role, the link between credit and ATMs is more mechanical and less sensitive to variations in financial freedom.

H12: Financial Freedom moderates the relationship between Foreign assets among total bank assets and Bank credit to bank.

H12 is also not supported. The results show that bank credit to bank has no significant direct impact on foreign asset holdings, and the interaction between bank credit and financial freedom is likewise insignificant. Financial freedom alone positively influences foreign assets, indicating that more open systems are associated with higher foreign exposure, but this relationship does not depend on domestic credit conditions. This suggests that decisions about foreign asset allocation are driven more by regulatory openness, market access, and strategic considerations than by the level of domestic credit intermediation. In the CAREC context, banks appear to engage in cross-border activities primarily as a function of financial liberalisation and

institutional frameworks, rather than as a response to changes in the credit to deposit ratio. This finding reinforces the view that foreign integration and domestic credit dynamics are partially decoupled, and that policy tools aimed at managing foreign risk should focus on regulatory design and macroprudential oversight rather than credit volumes alone.

4.7 Summary of the Hypothesis

The table below provides a concise summary of all twelve hypotheses tested in this study, highlighting whether each hypothesis was supported or not supported based on the empirical findings. It also presents a brief justification for each outcome, reflecting the key relationships observed between FinTech adoption, foreign bank entry, financial sustainability, and the moderating role of financial freedom across CAREC countries.

Table 4- 15: Summary of Hypotheses

Hypothesis	Statement	Supported / Not Supported	Summary of Results
H1	Digital Payments→ Bank Z-score	**Supported**	Digital payments significantly increased bank stability. Higher digital adoption improves efficiency, reduces cash-handling risks, and supports solvency.
H2	ATM per 100,000 adults → Bank Z-score	**Not Supported**	ATM density showed no meaningful effect on bank stability. ATMs have become less relevant for stability as digital channels dominate.
H3	Foreign assets among total bank assets → Bank Z-score	**Supported**	Foreign asset holdings significantly reduced stability. Greater foreign exposure increases vulnerability to external shocks and currency risks.
H4	Digital Payments → Bank credit to bank	**Supported**	Digital payments significantly increased bank credit. Digital adoption broadens deposits and strengthens credit flows.
H5	ATM per 100,000 adults → Bank credit to bank	**Supported**	ATM expansion significantly increased credit depth. ATMs improve access, liquidity, and formal banking engagement.
H6	Foreign assets among total bank assets → Bank credit to bank	**Supported**	Foreign asset exposure significantly reduced credit-to-deposit ratios. Banks shift focus away from domestic lending when foreign exposure grows.
H7	Financial	**Supported**	Financial freedom reversed the negative effect.

Hypothesis	Statement	Supported / Not Supported	Summary of Results
	Freedom moderates Digital Payments → Bank Z-score		At higher levels of openness, bank stability supports digital growth.
H8	Financial Freedom moderates ATM per 100,000 → Bank Z-score	**Supported**	Openness weakened the positive effect of stability on ATMs. Liberal environments reduce the marginal effect of stability on infrastructure expansion.
H9	Financial Freedom moderates Foreign assets → Bank Z-score	**Supported**	Financial freedom strengthened the link. Stable banks expand foreign exposure more under liberal regulatory conditions.
H10	Financial Freedom moderates Digital Payments → Bank credit to bank	**Supported**	Financial freedom weakened the positive effect. Credit contributes less to digital payments as markets become more open.
H11	Financial Freedom moderates ATM per 100,000 → Bank credit to bank	**Not Supported**	No moderation occurred. Credit positively affects ATMs regardless of openness levels.
H12	Financial Freedom moderates Foreign assets → Bank credit to bank	**Not Supported**	No moderating effect found. Foreign exposure is driven by openness itself, not by changes in credit behavior.

Chapter 5 Conclusion and Recommendations

5.1 Summary of the Chapter

The chapter was based on the general findings, limitations, future research recommendations and policy implications of the empirical evidence of the acceptance of FinTech, foreign bank entry, financial sustainability and moderating effects of financial freedom among the countries in the CAREC region between 2008 and 2020. The findings emphasized that digital payments are influential in enhancing the stability of the banks as well as their credit depth, whereas ATM penetration was efficient in promoting credit growth but not the banking stability. There were destabilizing effects displayed by foreign asset exposure, which reveals why care should be taken when integrating financial activities across borders. The moderation analysis showed that financial freedom is a significant determinant of a number of relationships, which reinforce or diminish the effects depending on the context of institutions. The methodological and data related limitations were also mentioned in the chapter, as well as several areas of the further development of the research, such as the use of wider indicators of FinTech, data on the microlevel, and post-pandemic trends. According to the results, a set of specific policy recommendations was offered to allow CAREC policymakers to find a balance between digital innovation, financial openness, and systemic resilience. On the whole, the chapter generalizes the main findings of the study and provides the description of the viable strategies that can be implemented to promote the development of the financial sector in the region in a sustainable manner.

5.2 Conclusion

This study examined the interplay among FinTech adoption, foreign bank entry and financial sustainability in the 11 CAREC countries during the period 2008–2020 and this study special emphasis on the moderating effect of financial freedom. The results of the research added to the existing literature that is already pointing at the necessity of digital transformation and institutional quality in determining the financial sector's fate in the developing regions. The empirical analysis proved that the adoption of FinTech, particularly on the part of users of digital payments, increased banking stability and credit growth at the same time which, again, emphasized the power of digital channels to transform financial systems. Digital payments were

recognized as the most important factor affecting the financial sustainability of the banking industry, thus corroborating the earlier assertion that digital financial services have a positive impact on the costs, accessibility, and stability of banking operations.

The penetration of ATMs, which indicates the availability of the physical aspect of the financial sector, had a positive impact on the deepening of credit but no significant effect on bank stability. This is in line with the worldwide trend of transitioning from physical to digital transactions, especially in the case of developing economies where the traditional ATM transactions are being slowly but surely replaced by mobile banking and electronic payments. The entry of foreign banks, which was assessed through foreign asset exposure, revealed a more intricate scenario. It was found that the presence of foreign assets to a greater extent was a factor leading to the decline of financial sustainability as well as the shrinkage of domestic credit, a situation which is in line with the general view of the risks posed by financial exposure to outside countries in economically vulnerable regions. The results point to the fact that the integration of foreign finance, while beneficial in the areas of technology transfer and competition, may also make the financial system more fragile if not backed up by strict regulatory measures.

The moderation analysis showed that financial freedom changes several main relationships enormously. In financial conditions that are more liberal, bank stability can lead to further adoption of digital payments and diversifying investments into foreign assets, whereas in less open economies these effects are weak or even negative. Financial freedom does not, however, moderate all relationships; there are some links, such as that between credit and ATM networks or that between credit and foreign assets, which remain unaffected by the levels of openness. Altogether, the results reveal the conditionality of financial development processes: digitalization, stability, and foreign participation coexist but in different ways and depending on the qualities of institutions, the openness of regulations, and the type of market structures. The research findings suggest that the promotion of financial sustainability in the CAREC region calls for a combination of digital innovation, management of foreign exposure through hybrid approaches, and regulatory reforms that are well thought out and sequenced.

5.3 Limitations of the Study

This research provides meaningful perspectives, there are a number of limitations that have to be accepted. First, the research is thoroughly grounded on secondary, macro-level data sourced from international databases. While these indicators are reflective of the overall trends, they are not adequate to indicate micro-level dynamics such as bank-level risk management strategies, consumer behavior patterns, or firm-level digital adoption. Microdata can be implemented in future research and it would help reveal better and deeper mechanisms affecting financial sustainability. On the other hand, the measures that were taken as indicators of FinTech adoption—digital payments and ATM usage—only give a glimpse of the whole digital financial picture. The FinTech ecosystem is composed of mobile wallets, algorithmic credit scoring, agent banking, crowdfunding platforms, and blockchain systems that were not studied due to data restrictions. The pace of FinTech developments is increasing day by day but underestimating its wider impacts by depending on a few proxies might be a wrong approach.

Third, the entrance of foreign banks was assessed by utilizing foreign asset exposure, which does not make a difference between foreign-controlled banks that are operating in the country and local banks that are investing abroad. It is possible that the former two occurrences have differing risk profiles, and the method used currently may overlook such subtleties.

The fourth point is that while panel regression methods were applied, the study did not use sophisticated econometric techniques that specifically tackle the issue of endogeneity, like dynamic GMM estimators. This suggests that certain links, especially the one between digital adoption and stability, might be two-way.

The fifth point is that the data set is limited to the year 2020 and thus does not include the rise of digital financial services that the COVID-19 pandemic has accelerated. The pandemic caused a dramatic increase in remote banking, mobile payment, e-commerce finance, and government-to-person (G2P) digital transfers. All those developments might have changed the relationships between FinTech and stability in ways that the present analysis does not show. In conclusion, one of the limitations of the study is that the inconsistent sample sizes of some indicators, which came as a result of differences in data availability across CAREC countries, can affect the comparability across variables.

5.4 Future Directions

Beside these limitations several pathways for further research are revealed. Mainly, to begin with future studies in the area of FinTech should be carried out by bringing into play the more extensive set of indicators such as the ones of mobile money penetration, number of FinTech companies, digital loan amount, the use of online banking, or big data usage in credit scoring. These indicators will offer a more integrated view of the digital financial sector's development.

In the second place, the analysts might use either bank or household data to find out the different microeconomic routes through which FinTech causes financial sustainability. To illustrate, surveys might be conducted to assess the impact on user trust, financial literacy, or customer experience, whereas data from the bank's balance sheet could give more accurate insights into risk behavior and capital allocation.

Thirdly, the application of sophisticated econometric techniques such as Generalised Method of Moments (GMM), Structural Equation Modelling (SEM), or machine learning–driven causal inference methods could be the direction taken by future researchers. Those methods would be of great help in overcoming the problem of endogeneity, identifying non-linear trends, and bringing to light intricate connections.

Fourthly, researchers who carry out qualitative and mixed-method studies could look into the different aspects of digitalisation, foreign bank entry, and regulatory openness that the governments, regulators, and financial institutions view as challenges. Altogether, the conduct of interviews with regulators and bank executives could expose some issues that are only visible to the eyes of the quantifiers.

Fifthly, the comity of nations having similar geographical aspects could be the prototype of the first countries to be engaged in detailed regional studies which would by so doing open up channels of communication among the countries in the CAREC region as well as those in Asia (ASEAN) and Africa (African Union) in terms of the adoption of digital finance, the penetration of foreign banks, and the strength of the institutions.

Finally, getting the dataset to include the post 2020 period would give the opportunity to the researchers of the future to bring forth the effect of the pandemic on the digital dependency that

had emerged, the role of crypto assets, AI-based financial services, digital identity systems, and central bank digital currencies (CBDCs) becoming prominent, etc. thus studying the past period.

5.5 Policy Recommendations

In light of the empirical findings, a number of policy recommendations are given to governments, regulators, and the banking sector in the CAREC region.

Investments into payment systems interoperability, high-speed internet connection, and secure digital platforms should be made by policymakers in order to bring about the adoption of digital payments. Besides, promoting the cooperation of banks, telecommunication companies, and FinTechs can speed up digital innovations without compromising the stability of the financial system. It is important to pursue the development of the cybersecurity backbone and consumer protection frameworks that will support the creation of trust in digital finance.

As financial freedom affects almost all the relationships analyzed in the research, the reforms in regulations should be timed well. The authorities should open the market while making sure that a proper regulation is in place. Strong supervisory frameworks, capital adequacy and liquidity requirements, and macroprudential policies can effectively reduce the risks associated with foreign asset exposure and market liberalization.

Given the detrimental effect of foreign assets on stability and credit depth, it is recommended that the CAREC regulators set a limit on the foreign exposure of banks. Moreover, there should be the stress testing of banks, currency risk monitoring, and the setting up of enhanced disclosure requirements so as to enable them to deal with external vulnerabilities. The establishment of regional cooperation mechanisms could help in sharing information on cross-border risks.

Policies aimed at reducing digital divides should be the main focus for digital finance to give the broadest benefits to the population. To that effect, mobile money provision would be extended to the most isolated places, and digital literacy programmes and banking agents would also be promoted. Laws protecting consumers would have to deal with fraud, data privacy, and transparency in the digital financial services industry.

In the light of the fact that digital payments and ATMs are the main drivers of credit expansion, countries should update their credit reporting systems, implement digital identity policies, and

endorse the use of big data for alternative credit scoring models. Not only will these actions enable the banks to lend money more prudently, but they will also help the smaller and underserved business sectors to gain more access to credit.

CAREC member states can reap the rewards of unified regulatory regimes, an inter-country payment system, and common FinTech regulatory sandbox practices. The region would thus be able to support cross-border payments and at the same time lower transaction fees and, as a result, make the financial system more stable across the region.

The regulators should apply a risk-based, activity-focused approach that would allow the innovation and stability to co-exist. FinTech sandboxes, innovation hubs, and pilot programmes could all be seen as ways to regulators getting acquainted with new technologies while at the same time protecting the system from risks.

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