The Impact of Regulation, Financial Liberalization, and Mobile Banking on Banking Crises:

Evidence from Cross-Country Data

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ผลกระทบของการกำกับดูแล การเปิดเสรีทางการเงิน และการยอมรับบริการธนาคารบน
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This paper examines how financial liberalization, institutional quality, and mobile banking adoption affect the probability of a banking crisis using a panel of 36 countries over the period 2000 – 2021. Our key inference is that the relationship between financial liberalization and the probability of a banking crisis is depended in institutional quality. In strong institutional quality countries, the impact of financial liberalization on the probability of a banking crisis is a concave curve, increasing the likelihood of a crisis at low to moderate liberalization levels and reducing it at medium to high levels. Conversely, weak institutions do not exhibit an impact. Surprisingly, mobile banking adoption is associated with a decreased likelihood of a banking crisis, showing its benefits. Moreover, mobile banking adoption intensifies the impact of financial liberalization on the probability of a banking crisis only in countries with strong institutional quality. Additionally, in bank-based financial systems, mobile banking adoption can intensify the impact of financial liberalization on the probability of banking crises, aligning with the characteristics of centralized bank-based countries with commercial banks as intermediaries.

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Field of Study:	Finance	Student's Signature	
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Introduction

Recently, Silicon Valley Bank (SVB), one of the most prominent lenders to start-ups and venture capital firms, went bankrupt, becoming the largest bank failure since the global financial crisis in 2008. According to its website, SVB offered banking solutions to approximately 50% of the country's technology and life-science businesses, along with over 2,500 venture capital companies. In response to the significant inflation, the Federal Reserve (Fed) initiated an increase in interest rates as a measure. This meant that US government bond prices fell, and the value of SVB's investments dropped. SVB publicly disclosed its huge loss and also sold $2.25 billion in new shares in order to strengthen its financial position. This caused distress among venture capital firms operating in the tech sector, raising demand to pull out money and resulting in a bank run. The failure of SVB's bankruptcy led to risk in the broader financial system. Signature Bank was shut down by federal regulators two days after the failure of SVB resulted from regulator concern about depositors withdrawing money (The New York Times, 2023). Therefore, it appears that the Federal Reserve's regulations played a substantial role in triggering this banking crisis through interest rate setting. The decision made by it can have a significant impact on the financial sector as well as the entire economy.

Historically, financial market failures have often been the driving force behind regulatory reforms. Regulation undergoes a continuous cycle, where tight regulations are followed by periods of deregulation. The period from 1933 to 1979 is characterized by stringent regulation, which was implemented in response to the Great Depression of the 1930s. This regulation included the enactment of significant legislation such as the Glass-Steagall Act, the establishment of the Federal Deposit Insurance Corporation (FDIC), and the creation of the Securities and Exchange Commission (SEC). The regulatory process shifted towards deregulation from 1980 to 2008 (Dobravolskas & Seiranov, 2011). In other words, the 2008 Global Financial Crisis (GFC), also known as the subprime mortgage crisis, was triggered by the deregulation of financial markets and the subsequent speculation (Bresser-Pereira, 2010; Commission, 2011). It led to the bankruptcy of the investment bank Lehman Brothers, which was the critical event that escalated the subprime crisis into a worldwide financial crisis (Mishkin, 2011).

Financial liberalization, the process of reducing government regulations and restrictions on financial markets and institutions, offers both opportunities and challenges. It can be a catalyst for economic growth, attracting capital and foreign investments as well as facilitates the efficient allocation of financial resources, promoting domestic economic activities. However, it often involves relaxing regulations, enabling financial institutions and investors to take on more risk. In pursuit of higher returns, these entities may engage in risky practices such as lending to borrowers with poor credit or investing in speculative assets, fostering an environment of excessive risk-taking and potentially leading to a crisis. As a result, the relationship between financial liberalization and the probability of banking crises has been extensively researched and analyzed. According to Weller (2001), the probability of banking crises is more likely to increase due to financial liberalization. This is because financial liberalization allows for increased liquidity in an economy, which can be utilized for productive or speculative purposes. What is common to the banking crisis is a significant increase in speculative financing, which in turn raises the probability of borrowers defaulting on their loans. Roy and Kemme (2012) provide evidence to support the claim that financial liberalization is a critical factor that demonstrates a similarity between the ongoing global crisis and past banking crises. Financial liberalization has been the driving force behind excessive speculation, leading to past and current financial crises. For instance, significant capital inflows following the Asian financial crisis have played a role in contributing to global financial crises. Moreover, the effectiveness and outcomes of financial liberalization can be influenced by the quality of institutions. When assessing institutional quality, various criteria are employed by different studies. For example, Alonso and Garcimartín (2013) consider factors such as development level, income distribution, and a robust tax system. In contrast, the World Bank (2021) adopts a more comprehensive approach, encompassing a broader set of criteria, including control of corruption, government effectiveness, political stability, regulatory quality, rule of law, and the presence of voice and accountability, in constructing their institutional quality index. This multi-perspective underscores the intricate relationship between institutional quality and financial liberalization, a relationship that holds significance in the context of financial distress crisis.

The advent of mobile banking, the latest technological innovation, has the potential to disrupt the market significantly, complementing existing traditional banking services such as automated

teller machines (ATMs), tele-banking, credit cards, debit cards, and internet banking. The introduction of mobile banking by retail banks appears to be influencing the market (Safeena et al., 2012). According to the International Telecommunication Union, in 2021, digital payments emerge as a gateway to accessing other financial services, including cash management, saving, and borrowing. The adoption of digital payment methods has experienced a substantial increase in developing countries, rising from 35 percent in 2014 to 57 percent in 2021. Such significant growth highlights the vast potential for mobile banking to expand further and fulfill the depositors' needs.

The increasing popularity of mobile banking can be attributed to its practicality and convenience. Shaikh and Karjaluoto (2015) categorize the main services offered through mobile banking into two parts: financial services and non-financial services. Financial services include payments, transfers, shopping, donations, and mobile balance recharges. Non-financial services include balance inquiries, mini-bank statements, PIN changes, checkbook requests, due alerts for payments, and locating ATMs. Mobile banking has advantages for both banks and customers. From the bank's perspective, mobile banking can enhance customer satisfaction and cost savings. Sampaio et al. (2017) and Malaquias and Hwang (2019) point out a positive correlation between mobile banking and customer satisfaction. Consequently, satisfied customers tend to enhance trust, loyalty, and positive word-of-mouth feedback, leading to the retention of existing customers and reaching out to new customers. Gathu and Njenga (2021) conclude that mobile banking revenues, mobile lending, and customer adoption have a positive association with the bank's performance. By allowing customers to access their accounts, perform transactions, and borrow with ease, mobile banking has the potential to boost a bank's profitability. However, in this paper, we pay attention to the customer's perspective: time savings, convenience, and real time. Mobile banking has a notable impact on enhancing the delivery of banking services, primarily through improved transactional convenience, time savings, and the prompt delivery of transaction alerts (Adewoye, 2013). Customers are able to have immediate and timely access to their banking accounts through the mobile banking service (Malaquias & Hwang, 2019). In other words, mobile banking seems to be a double-edged sword that enables customers to withdraw their funds rapidly and conveniently during times of uncertainty, which can raise the probability of a banking crisis.

Although there are numerous studies examining the impact of regulation on the likelihood of a crisis, a consensus has not been reached. Specifically, empirical research utilizing linear specifications has produced diverse results that depend on factors such as sample size, time period, regulatory dimension, and selected variables. Therefore, our paper has been constructed by initially investigating the relationship between financial liberalization and banking crises, drawing from the research conducted by Marchionne et al. (2022). They utilize a Probit regression model and reveal a non-linear association between regulation and banking crises. Countries positioned at an intermediate level in terms of regulatory measures faced a higher probability of experiencing banking crises, in contrast to countries trapped in either excessive liberalization or regulation. Furthermore, the institutional quality has an impact on that relationship. However, we recognize that those previous papers did not take into account mobile banking adoption. To address this gap and provide a more comprehensive analysis, we also examine how mobile banking adoption influences the likelihood of banking crises and explore its effects on the dynamics between financial liberalization and the probability of banking crises.

Research Question: Does financial liberalization impact the probability of banking crises?

Hypothesis: The probability of a banking crisis increases at the beginning of the stage of financial liberalization, then decreases as the process progresses smoothly. This indicates that the relationship between financial liberalization and banking crises follows a non-linear pattern as an inverted U-shaped curve.

We base our hypothesis on the idea that banks tend to increase their profits by investing in liberalized sectors of the economy as strict regulations are gradually relaxed, but this strategy also involves taking on more risk. In the beginning, there were still too many regulations, so banks could not optimally diversify their investments. As a result, they end up being negatively affected by liberalization instead of reaping the benefits of a diversified investment portfolio. However, as financial liberalization progresses, banks have more opportunities to invest in diverse sectors, which in turn reduces their portfolio risk and leads to a lower probability of banking crises. Accordingly, bank diversification leads to safer portfolios; more diverse banks perform much better in terms of higher returns on assets and lower nonperforming loans (Bebczuk & Galindo, 2008). In our analysis, we utilize the annually published Financial Freedom index (FREEDOM) from the Heritage Foundation. Marchionne et al. (2022) also employ FREEDOM to analyze the

impact of financial liberalization and the probability of banking crises. Additionally, Cubillas and González (2014) investigate the relationship between financial liberalization and bank-risk taking using FREEDOM. Chortareas et al. (2013) use FREEDOM to measure a country's financial freedom and explore its impact on bank efficiency levels. Johnson (2011) utilizes FREEDOM to study its effects on bank performance during the market crisis in 2007-2009. Additionally, we employ the inverse of FREEDOM, referred to as Banking Regulation (REG). This choice is based on the negative relationship between financial freedom and banking regulation: as the level of financial freedom increases, the level of banking regulation decreases, and vice versa. To calculate the value of REG, we subtract the value of FREEDOM from 1.

Research Question: Does institutional quality affect the relationship between financial liberalization and the probability of banking crises?

Hypothesis: Financial liberalization will benefit countries with strong institutional qualities by reducing the likelihood of banking crises, whereas those with weaker institutional qualities may face a higher likelihood of banking crises from such policies.

Our hypothesis is based on the idea that countries with high institutional quality are better equipped to manage the risks associated with financial liberalization, while countries with low institutional quality may be more vulnerable to banking crises because of liberalization. Therefore, the impact of financial liberalization on the probability of banking crises may vary depending on the quality of institutions in each country. Bonfiglioli and Mendicino (2004) suggest that the impact of the relationship between liberalization and crises differs across countries with varying institutional quality and economic development. According to Saidi et al. (2017), countries with improved governance and institutions tend to have better monitoring and transparency, which leads to more effective financial liberalization. Conversely, countries with high levels of corruption and a lack of transparency are unlikely to see any benefits from financial liberalization.

Research Question: Does mobile banking adoption impact the probability of banking crises?

Hypothesis: The adoption of mobile banking may increase the probability of banking crises.

To support our hypothesis, referring to the advantages of mobile banking, customers can access their accounts immediately and timely. On the other hand, it means that customers can transfer their money immediately when they panic or lose trust in their banks. This argument is in accordance with previous studies. For instance, Dijk (2017) experiment on the effects of emotions on depositor behavior, he finds that fear significantly increases the likelihood of withdrawal and a subsequent bank run. Moreover, confidence plays an important role in the banking system. According to Fernando (2020), banking crises often emerge from a lack of confidence and subsequent bank runs. The occurrence of banking distress results in rapid contagion and prompts the withdrawal of deposits by various individuals, thereby undermining public trust in the banking system (Ugwuanyi & Amanze, 2014). Importantly, the widespread availability of electronic transfer options may increase the severity of bank runs. In the age of the internet, transferring money between banks is a simple administrative process that does not require physical branch openings. Consequently, bank runs can occur quickly, even within an hour or over the weekend (Fonteyne et al., 2010). Therefore, it is reasonable to expect that the adoption of mobile banking will potentially lead to banking crises, given the ease of accessing and transferring money through mobile banking accounts.

Research Question: Does mobile banking adoption impact the relationship between financial liberalization and banking crises?

Hypothesis: Mobile banking will intensify the negative impact of financial liberalization on the likelihood of a banking crisis in countries with low institutional quality. Conversely, in countries with high institutional quality, the adoption of mobile banking will enhance the advantages of financial liberalization and decrease the probability of a banking crisis.

	Institutional quality	
	Low	High
No mobile banking (Similar to HYP2)	(1) Financial liberalization can increase the probability of a banking crisis	(2) Financial liberalization can decrease the probability of a banking crisis
Mobile banking	**(3) Higher probability of a banking crisis through financial liberalization compared to (1)**	**(4) Lower probability of a banking crisis through financial liberalization compared to (2)**

To confirm our hypothesis, Goyal (2012) demonstrates that mobile banking facilitates greater accessibility to financial services and enables substantial progress in financial inclusion, which is a key component of financial liberalization. Nkoa and Song (2020) indicate that institutional quality, encompassing political, legal, and governance frameworks, exerts a favorable influence on financial inclusion. Consequently, it is plausible that countries characterized by high institutional quality and the adoption of mobile banking will effectively speed up financial inclusion, leading to financial liberalization in a positive manner. In contrast, Blackburn and Forgues-Puccio (2010) argue that corruption, as an indicator of poor institutional quality, has a detrimental effect on economic development. This negative impact is exacerbated when the economy undergoes liberalization. Therefore, it is possible that in countries with low institutional quality, mobile banking may escalate this negative impact through financial liberalization, potentially resulting in a banking crisis.

After testing our four models, the results reveal that the relationship between financial liberalization and banking crises is contingent on institutional quality. Strong institutions interact with financial liberalization in a concave manner, increasing the likelihood of a crisis at low to moderate liberalization levels and reducing it at medium to high levels. Conversely, weak institutions do not exhibit an impact. Surprisingly, mobile banking adoption is associated with a decreased likelihood of a banking crisis, highlighting its benefits. Furthermore, our findings indicate that mobile banking adoption intensifies the impact of financial liberalization on the probability of a banking crisis only in countries with strong institutional quality. Moreover, when excluding crisis-free countries, our findings hold, underscoring the importance of institutional quality and the benefits of mobile banking. Additionally, in bank-based financial systems, mobile banking adoption can intensify the impact of financial liberalization on the probability of banking crises, aligning with the characteristics of centralized bank-based countries with commercial banks as intermediaries.

The structure of this paper can be outlined as follows: In Section 2, we conduct a literature review on regulation, financial liberalization, institutional quality, mobile bank adoption, and banking crises. In Section 3, we describe the data and methodology employed in our study. Section 4 presents the results of our empirical analysis, and in Section 5, we draw conclusions based on our findings.

Literature review

1.   The Debate on the Relationship Between Financial Liberalization and Financial Crises

Financial liberalization is the term used to describe the process of removing or relaxing government regulations and restrictions on the financial sector. Foreign investors gain opportunities to invest in domestic securities through financial liberalization; they provide both funds and better corporate governance. In contrast, domestic investors have the opportunity to transact in foreign securities to generate wealth. On average, financial liberalization leads to a 1 percent increase in annual real economic growth (Bekaert et al., 2005). Liberalization restrictions on foreign capital flows tend to improve stock market liquidity, which boosts economic growth. Additionally, enabling more foreign banks to operate within a country has positive impacts on the domestic banking system's efficiency, leading to improved services and increased competition. This, in turn, stimulates economic growth (Levine, 2001). Financial liberalization has benefits for the economy, such as the inflow of capital from developed countries to finance investment and growth, reducing consumption volatility, promoting the development of domestic financial systems, and achieving efficient domestic capital allocation. However, the success of financial liberalization is not universal, and it depends on factors such as the level of income, institutional quality, and country classification. In poor emerging countries, capital flows have been generally small or even negative compared to richer countries. Moreover, there is also evidence that financial liberalization causes an unstable domestic financial market and volatile cash flows, which can lead to financial instability and crises (Broner & Ventura, 2010).

Many studies support the idea that financial liberalization increases the probability of financial crises. According to Gluzmann and Guzman (2017) found that in emerging economies, the implementation of measures like opening up capital flows, deregulating financial markets, interest rates, eliminating credit constraints, decreasing market entry barriers, and reducing state control in the banking sector is linked to a higher likelihood of experiencing banking crises. Giannetti (2007) reveals that the liberalization of capital inflows in emerging markets can result in boom-bust crises. As a consequence of the liberalization, asymmetric information may cause certain banks to become insolvent, leading to the accumulation of losses. This, in turn, can disrupt the credit market and have an impact on the overall economy.

Like our hypothesis, Majerbi and Rachdi (2014) indicate that financial liberalization increases the probability of banking crises at the early stages of financial reforms. After the turning point, further liberalization starts reducing the probability of crises. The results differ depending on the type of economy, including advanced and emerging/developing countries. Additionally, factors such as improved banking regulation, strong law enforcement and governance, reduced corruption, efficient bureaucracy, and government stability reduce the probability of banking crises. The magnitude of their impact is determined by the degree of financial liberalization. Moyo and Le Roux (2020) have characterized financial liberalization as involving interest rate reforms and capital account liberalization, which they have measured using the Chinn-Ito index. Their studies found that the impact of financial liberalization on the likelihood of financial crises is mitigated by improvements in regulatory quality. However, financial liberalization may increase the likelihood of financial crises through its effect on financial development, represented by banking credit.

2. The Important of Institutional Quality

Strong institutions, characterized by robust legal systems, impartial public administration, and transparent law enforcement, play a crucial role in mitigating the detrimental consequences of political crises, including violence and corruption. Moreover, these institutions are effective in managing economic crises such as slowdowns and banking crises, as well as addressing corruption and various financial crises such as currency, inflation, and sovereign crises (Saha & Sen, 2023).

Valeriani and Peluso (2011) explore the positive influence of three institutional indicators—individual freedoms, governmental effectiveness, and the count of entities with veto power—on economic growth using both pooled regression and fixed effects models. They find that the marginal impact of these institutional indicators differs between developing and developed countries. Particularly, in developing countries, civil rights have a higher impact on economic growth than in developed countries, where the number of veto players is more important. Butkiewicz and Yanikkaya (2006) also state that the relationship between institutional quality and economic growth depends on the sample selection and methodology used. The rule of law, based on factors such as the quality of bureaucracy, the level of corruption, and other risks associated

with the government, as well as democracy, promotes economic growth, particularly democracy seems to be important for developing countries.

The removal of capital restrictions could indirectly boost the economy. Indeed, financial liberalization exerts a positive influence on both the advancement of financial systems and the mitigation of the detrimental consequences of financial turmoil. Banking crises are significantly detrimental to economic performance. The effects of banking crises are higher in countries with low quality of institutional (less political stability and democracy); a weakening in the institutional quality within the period of the crisis could lead to increased output losses and prolonged economic damage. In other words, the economic consequences of banking crises are highly correlated with changes in the institutional environment during the crisis resolution process (Bonfiglioli & Mendicino, 2004; Sever, 2022). The results point out the importance of institutional quality.

3. Mobile Banking

Mobile banking involves customers connecting to their bank through a mobile device such as a cellphone, smartphone, or tablet. This is different from mobile payments, which allow users to pay for small purchases using their mobile devices at the point of sale. Mobile banking provides advantages over traditional banking methods, such as the ability to conduct banking transactions from any location and at any time, as well as increased efficiency. This convenience makes mobile banking an attractive option for customers who want to manage their finances on-the-go without being restricted by time or location (Laukkanen, 2017). According to Audi (2016), mobile banking serves as a convenient platform that empowers users to execute a wide range of financial transactions, including writing cheques, transferring funds, and paying bills, using the internet on their mobile devices. This technology enables account holders to engage with their banks without having to physically visit a branch. Each individual bank offers a dedicated mobile banking application that grants customers access to their accounts and enables transactional activities using their mobile phones. The primary motivation behind the development of mobile banking technology was to improve the overall efficiency and convenience of banking services for customers. Tiwari et al. (2007) suggest that mobile banking is a type of electronic banking that shares characteristics with traditional banking but also incorporates the unique features of mobile commerce. In recent years, mobile banking has become more popular among different segments

of the population, recovering from the shock of the dotcom burst. Laforet and Li (2005) argue that mobile banking has introduced a new element of mobility to the consumption of banking services, making it possible for customers to access these services from anywhere, including in low-income developing or underdeveloped countries. They suggest that mobile banking is becoming more popular to such an extent that it has become an indispensable component of business operations worldwide, inseparable from the way that businesses operate today. For most studies, the underlying objective is to cover deeper motivations and associations that significantly influenced potential attitudes and intentions toward mobile banking adaptation. Ho et al. (2020) discover that subjective norms play a vital role in influencing individuals' intentions to adopt mobile banking. Compatibility, perceived usefulness, and perceived risk indirectly impact mobile banking adoption through attitudes toward adoption, whereas self-efficacy and facilitating conditions indirectly influence adoption through perceived behavioral control. Kazi and Mannan (2013) point out that social influence plays a significant role in the adoption of mobile banking. Word-of-mouth communication leads to more customers embracing this technology, which ultimately contributes to the growth of the formal banking sector and the country's overall economic growth. According to Elhajjar and Ouaida (2020), individuals' digital literacy levels play a crucial role in determining their propensity to adopt mobile banking. Customers who possess the necessary digital platform skills are more inclined to adopt mobile banking applications. Moreover, the frequency of visits to physical bank branches also has an impact on the intention to use mobile banking. Individuals who frequently visit physical branches are more likely to both use and intend to use mobile banking services. Interestingly, the ease of access to physical bank branches does not appear to discourage customers from using mobile banking.

While specific studies directly examining the impact of mobile banking adoption on the probability of banking crises are limited, we explore the effects of internet banking as a proxy in our investigation. Internet banking and mobile banking have similar functions in the sense that they provide customers with the ability to access their accounts and make transactions rapidly. According to Janson (2009), internet banking does not directly lead to bankruptcy, but it can accelerate the occurrence of bank failure. During times of confusion or when bad news emerges, depositors have the ability to instantly withdraw their money through internet banking without any delay or the need for extensive deliberation. This is in contrast to traditional banking services

where customers must physically visit bank branches, which can introduce a time gap in the withdrawal process. Moreover, Satheesh and Nagaraj (2021) argue that internet banking and mobile banking provide customers with an enhanced experience. However, banks have to trade off between a better bank's profitability and the short-term liquidity risks associated with frequent customer withdrawals, which are prone to unpleasant situations such as bankruptcy.

4. The Determinants of Banking Crises

1) Politics

Nguyen et al. (2022) investigate the impact of political factors on the timing of financial crises in 85 countries from 1975 to 2017. Their findings demonstrate that there is an increased probability of banking and currency crises happening within one year following elections, supporting the honeymoon hypothesis. Typically, there is a 32 percent higher likelihood of experiencing currency and banking crises during the initial year following elections. This can be attributed to the implementation of new policies or reforms shortly after elections, as well as governments potentially delaying the provision of financial assistance to inefficient banks due to concerns regarding wasteful expenditure. Ouedraogo et al. (2022) confirm that conflicts and political instability can lead to the likelihood of banking crises in developing countries. Furthermore, conflicts and political instability within a particular country can adversely impact the banking systems of neighboring countries through spillover effects.

Keefer (2002) also argues that the financial and economic causes of crises differ significantly in countries that exhibit few or many political checks and balances. Therefore, political institutions play a crucial role in preventing banking crises. Rezgallah et al. (2019) and Kordbacheh and Sadati (2022) show that political instability amplifies risk-taking in the banking sector, driven by the presence of corruption and government ineffectiveness.

2) Macroeconomic Factors

On average, a banking crisis is influenced by three key factors: negative GDP growth, high credit growth to the private sector, and elevated real interest rates. Specifically, a 1 percent increase in GDP growth reduces the crisis probability by 0.8 percent, while a 1 percent rise in credit growth increases it by 0.3 percent. Similarly, a 1 percent increase in the real interest rate raises the crisis probability by 0.1 percent (Klomp, 2010). Banking crises typically occur in a weak economic environment characterized by low GDP growth and high inflation. Also, the presence of systemic

issues in the banking sector is linked to higher real interest rates, and countries with weak regulatory oversight tend to be at a higher risk (Demirgüç-Kunt & Detragiache, 1998).

3) Deposit Insurance

Deposit insurance is commonly offered as an integral component of the financial system's safety net, aiming to guarantee stability, so there is much established literature supporting the idea that deposit insurance can ensure confidence in depositors and prevent bank runs. According to Talley and Mas (1990), the establishment of deposit insurance serves three main objectives. Firstly, it aims to prevent the occurrence of contagious bank runs. Secondly, it provides a formal national mechanism for effectively managing failing banks. Finally, it offers protection to small depositors, ensuring they are safeguarded from financial losses in the event of bank failures. Suljić Nikola et al. (2022) also point out that deposit insurance serves as a banking regulation mechanism that guarantees not only the stability of individual banks but also the overall stability of the financial system. In contrast, some studies demonstrate that deposit insurance can cause banks to take more excessive risks, leading to banking crises. Anginer et al. (2014) affirm that deposit insurance has been linked to heightened bank risk and systemic vulnerability in the period preceding the global financial crisis; it also exacerbates moral hazard and increases the vulnerability of financial systems to crises during normal times. However, during times of turbulence, deposit insurance can foster confidence and diminish the likelihood of contagious bank runs. Hoque et al. (2015) demonstrate that deposit insurance contributes to higher moral hazard, resulting in increased risk-taking by banks, particularly during the sovereign debt crisis. In addition, the partial deposit insurance does not appear to effectively prevent bank runs. To successfully prevent panic, complete deposit coverage is necessary. Even with a deposit coverage rate of 75 percent, the measures remain insufficient, and in fact, reducing the coverage rate to 25 percent exacerbates the severity of bank runs (Madies, 2006).

4) Social Network

Depositors' decisions can be influenced by others' actions. According to Kiss et al. (2014), they conduct an experiment on how visibility of actions affects bank runs. Their model incorporated the concept that depositors can only observe the actions of other depositors if they are connected within the network. The findings demonstrate that when actions are more visible, it makes a bank run more likely to happen, with depositors' decisions being greatly influenced by the actions they

observe. Specifically, when depositors witness withdrawals taking place, it increases the probability of bank runs occurring.

Li and Li (2016) discover that the size of depositor networks has a substantial influence on the incidence of bankruptcy. This influence is closely connected to the number of depositors who are impatient or withdraw their money at the earliest opportunity. Not only the networks of depositors but also the networks of CEOs are associated with bank runs. Dbouk et al. (2020) demonstrates a favorable relationship between the social network of a bank's CEO and the risks undertaken by the bank. The CEO's social network plays a significant role in influencing their decision-making, leading them to engage in higher levels of risk-taking. Consequently, this increased risk-taking behavior contributes to unfavorable financial performance for the bank.

Data and Methodology

Data

The panel dataset covers the years 2000 to 2021 and includes 21 developed countries and 15 developing countries; see Appendix A for more detail. We collect data from several sources on an annual basis. Data on banking crises is sourced from Laeven and Valencia (2020). The Financial Liberalization Index (FFI) is obtained from the Heritage Foundation (2022). The percentage of internet users is retrieved from the International Telecommunication Union (ITU) (2021). Additional data, including institutional quality (IQI), GDP, inflation (INF), current account balance (CAB), income inequality index (GINI), total assets held by the five largest commercial banks (TOP), and total assets held by deposit money banks (BAS), is sourced from the World Bank (2021).

- Dependent Variables

The dependent variable CRISIS is a binary variable set to one in the event of a banking crisis and zero in all other instances. According to Laeven and Valencia (2020), the characterization of a banking crisis encompasses two specific conditions:

1) Notable signs of banking system turmoil include bank runs, losses within the banking industry, and/or instances of bank closures.

2) Significant policy intervention when substantial losses occur in the banking sector.

Moreover, the authors provide two conditions which are present in serious loss cases: (1) dramatic losses in a country's banking sector result from the proportion of non-performing and total loans exceeding 20 percent, or (2) if more than 5 percent of the country's GDP represents the fiscal restructuring costs of the banking sector. Moreover, they include 151 banking crises, 236 currency crises, and 79 sovereign crises, as well as monthly crisis dates for a subset of all types of crises. Also, many studies use this database to determine the banking crisis as a binary variable set to one in the event of a banking crisis and zero in all other instances (Belkhir et al., 2022; Marchionne et al., 2022; Nakatani, 2020). However, the database only covers the period from 1970 to 2017, leaving out the period of mobile banking adoption, which is between 2014 and 2021. For this reason, we have compiled the database from Laeven and Valencia (2020) from 2000 to 2017. We have obtained the non-performing loan to gross loan ratio from the World Bank database for the years 2018 to 2021, with non-performing loans greater than 20% of gross loans being banking crises; see Appendix A for more detail.

- Independent Variables

1. The Financial Freedom Index (FFI) obtained from the Heritage Foundation encompasses five areas of financial services: (1) the level of government regulation in financial services; (2) the extent of state intervention in banks and other financial institutions through direct or indirect ownership; (3) the degree of financial and capital market development; (4) the influence of government on credit allocation; and (5) the level of openness to foreign competition. The regulatory index (REG) used in this study is calculated as 100 minus the Financial Freedom Index (FFI). The REG ranges from 0 to 100, with higher values indicating a more regulated financial sector. Based on our sample data, Denmark and the United Kingdom exhibit the lowest average REG scores, with their REG scores being 17. On the other hand, Ukraine and Russia have higher average REG values of 64 and 67 respectively. These averages were calculated over the period from 2000 to 2021; more detail is in column 7 of Appendix A. We estimate that financial liberalization (FFI) will raise the likelihood of banking crises during the early stages of the process, but this probability decreases when countries become trapped in regulation or have a higher level of regulatory quality (REG). Additionally, the influence of FFI on the probability of a banking crisis is contingent upon institutional quality (IQI).

2. The institutional quality index (IQI) for each country is determined by six measures of institutional quality: (1) control of corruption; (2) government effectiveness; (3) political stability and absence of violence or terrorism; (4) regulatory quality; (5) rule of law; and (6) voice and accountability. The six indicators are aggregated to produce a single IQI score for each country, with the lowest score of 0 and the highest score of 1. Institutional quality can insulate against banking crises in both developing and developed countries. A high level of institutional quality indicates the transparency and capacity of the government to enhance and enforce policies aimed at preventing crises (Marchionne et al., 2022; Valeriani & Peluso, 2011)

3. To investigate the impact of mobile banking adoption on the likelihood of banking crises, we employ the percentage of respondents who report using a mobile phone for bill payments from the Global Financial Inclusion data as a proxy for mobile banking. The mobile banking variable (MOBILE) is defined as a dummy variable, with a value of one assigned from the year mobile banking was introduced until 2021, and a value of zero for the years prior to its launch. Mobile banking offers customers a convenient means to transfer funds, particularly during periods of financial uncertainty. Consequently, the widespread adoption of mobile banking has a positive influence on mitigating banking crises.

- Control Variables

Macroeconomic controls

We have selected a set of control variables (CTRL) that are one-year lagged, chosen based on Marchionne et al. (2022), who mention various factors that can affect the probability of such crises.

The selected variables are included in our model and are as follows:

1. GDP per capita (GDP) represents the economic output per person, we anticipate a negative impact of GDP on crises. In terms of financial development, GDP per capita has a positive and statistically significant correlation with three indicators - domestic credit, market capitalization, and stock traded - across the 30 OECD countries. Additionally, in both the EU and OECD countries, GDP per capita has exhibited a negative correlation with the global economic and financial crisis (Afonso & Blanco Arana, 2018).

2. In essence, inflation (INF) denotes the general escalation in the prices of goods and services associated with the cost of living. The Consumer Price Index (CPI) is commonly used as a

measure of inflation, and we expect that inflation will increase the likelihood of a banking crisis. Based on Bittencourt (2011), high and unstable inflation has an adverse impact on financial development, leading to a potentially positive impact on crises.

3. The current account balance (CAB) is a fundamental component of a country's balance of payments, which is an accounting record of its international transactions with the rest of the world. The current account measures the net flow of goods, services, income, and current transfers. A current account surplus can contribute to financial stability and reduce the probability of a banking crisis. Conversely, a persistent current account deficit can make a country vulnerable to external shocks and increase its debt burden, which can lead to a financial crisis or an economic recession (Milesi‑Ferretti & Razin, 1996). We anticipate that a higher current account balance (surplus) will reduce the probability of a banking crisis.

4. The Income Inequality Index (GINI) measures income inequality as announced by the World Bank. Rhee and Kim (2018) propose that there is a correlation between income inequality and domestic credit levels in developing countries. Specifically, they assert that countries with higher income inequality tend to have increased levels of domestic credit. This increase in domestic credit can result in credit booms that may ultimately lead to banking crises. However, Caraballo et al. (2017) show that income inequality positively associates with economic growth in highly developed countries because income inequality encourages rich populations to save and invest, resulting in economic growth. As a result, the influence of income inequality on banking crises appears to diverge between developed and developing countries. Hence, our expectation is that in developed countries, higher income inequality will fuel economic growth and decrease the likelihood of banking crises. Conversely, in developing countries, elevated income inequality will escalate the probability of banking crises due to excessive domestic credit risk, indicating a negative coefficient in developed countries and a positive coefficient in developing countries.

5. For the social network indicator (SOCIAL), we utilize the percentage of individuals using the Internet as a proxy to estimate the number of nodes or network size. Iyer and Puri (2012) highlight that social networks have a significant influence on the likelihood of depositor runs, as certain groups of depositors can trigger contagion bank runs through word‑of‑mouth communication. Consequently, we anticipate that the social network variable (SOCIAL) may increase the probability of a banking crisis.

Microeconomic Controls

6. TOP5 is a proxy for the assets of the five largest banks as a share of total commercial banking assets. A high level of bank concentration is often seen as a sign of careful monitoring, achieved through the implementation of efficient work practices and/or the adoption of good risk management strategies (Cipollini & Fiordelisi, 2009). We expect a negative impact of TOP5 on crises.

7. Total assets held by deposit money banks as a share of GDP (BAS): high deposits held by the banking sector implicitly imply government guarantees. Normally, the expected government support for banks is generally viewed as advantageous for both debt and equity holders, as it reduces the likelihood of financial distress (Correa et al., 2014; Fratianni & Marchionne, 2017). Therefore, we anticipate that BAS can reduce the probability of banking crises.

Methodology

H1. The non-linear hypothesis, we hypothesize that financial liberalization increases the probability of a banking crisis at the beginning, then decreases after banks' portfolios are more diversified, resulting in an inverted U-shaped relationship in a sort of liberalization trap.

$$\text{Equation 1: } CRISIS_{it} = f(\alpha + \beta_1 FFI_{it} + \beta_2 FFI^2_{it} + \gamma IQI_{it} + \Psi CTRL_{it} + \varepsilon_{it})$$

For the model, f(.) is a Probit transformation function. Where CRISIS represents a dummy variable, which is set to one for a banking crisis or zero otherwise. FFI is the level of financial liberalization assessed across five key aspects: (1) government regulation in financial services; (2) state intervention in banks and other associated financial institutions; (3) the degree of development in financial and capital markets; (4) the influence of the government on credit allocation; and (5) the extent of openness to foreign competition. CTRL is the set of control variables that include both macroeconomic factors (such as GDP per capita, inflation, account deficit, income inequality, and social network) and microeconomic factors (including the assets of the top five largest banks relative to total commercial bank assets and deposit money banks relative to GDP). ε represents the idiosyncratic error term, i denotes the country, and t represents the time period. We expect that the effect of financial liberalization on the likelihood of a banking crisis will follow an inverse U-shaped curve with a positive β_1 and a negative β_2.

H2. We hypothesize that in countries with strong institutional quality, financial liberalization reduces the probability of banking crises. Conversely, in countries with weaker institutional quality, minimizing the likelihood of crises can be achieved through regulatory policies.

$$\text{Equation 2.1: } \text{CRISIS}_{it} = f\,(\alpha + \beta_1\text{FFI}_{it} + \beta_2\text{FFI}^2_{it} + \gamma\text{IQI}_{it} + (\Psi_1\text{FFI}_{it} * \text{IQI}_{it}) + (\Psi_2\text{FFI}^2_{it} * \text{IQI}_{it}) + \Psi\text{CTRL}_{it} + \varepsilon_{it})$$

IQI stands for institutional quality, which encompasses indicators such as corruption, government effectiveness, political stability, regulatory quality, rule of law, and voice and accountability. FFI_{it} * IQI_{it} represent the interaction of financial liberalization and institutional quality. We expect that in countries with strong institutional quality, the curve will be flatter. As a result, Ψ_1^{STRONG} will have a lower positive value compared to Ψ_1^{WEAK}, while Ψ_2^{STRONG} will have a higher negative value compared to Ψ_2^{WEAK}.

In accordance with the second hypothesis, we aim to compare the results between countries with strong and weak institutions. Subsequently, we run separate models for these countries based on the level of IQI, which leads to the exclusion of IQI and its interaction terms, such as FFI * IQI and FFI^2 * IQI. Therefore, our equation will be as follows:

$$\text{Equation 2.2: } \text{CRISIS}_{it} = f\,(\alpha + \beta_1\text{FFI}_{it} + \beta_2\text{FFI}^2_{it} + \Psi\text{CTRL}_{it} + \varepsilon_{it})$$

We anticipate that β_1^{STRONG} will have a lower positive value compared to β_1^{WEAK}, and β_2^{STRONG} will have a higher negative value compared to β_2^{WEAK}.

H3. The adoption of mobile banking can increase the probability of a banking crisis.

$$\text{Equation 3: } \text{CRISIS}_{it} = f\,(\alpha + \beta_1\text{FFI}_{it} + \beta_2\text{FFI}^2_{it} + \gamma\text{IQI}_{it} + \partial\text{MOBILE}_{it} + \Psi\text{CTRL}_{it} + \varepsilon_{it})$$

Where MOBILE is a dummy variable that takes a value of 1 from the year of mobile banking adoption until 2021 and 0 otherwise, we anticipate that mobile banking services tend to increase the probability of a banking crisis, indicating that ∂ is positive.

H4. Mobile banking will exacerbate the negative impact of financial liberalization in countries with low institutional quality, thereby increasing the probability of a banking crisis. On the other

hand, in countries where institutional quality is high, the adoption of mobile banking can enhance the advantages of financial liberalization and decrease the likelihood of a banking crisis.

Equation 4.1: $\text{CRISIS}_{it} = f\left(\alpha + \beta_1 \text{FFI}_{it} + \beta_2 \text{FFI}^2_{it} + \gamma \text{IQI}_{it} + (\Psi_1 \text{FFI}_{it} * \text{IQI}_{it}) + (\Psi_2 \text{FFI}^2_{it} * \text{IQI}_{it}) + (\gamma_1 \text{FFI}_{it} * \text{IQI}_{it} * \text{MOBILE}_{it}) + (\gamma_2 \text{FFI}^2_{it} * \text{IQI}_{it} * \text{MOBILE}_{it}) + \gamma_3 \text{MOBILE}_{it} + \Psi \text{CTRL}_{it} + \varepsilon_{it}\right)$

Where $\text{FFI}_{it} * \text{IQI}_{it} * \text{MOBILE}_{it}$ and $\text{FFI}^2_{it} * \text{IQI}_{it} * \text{MOBILE}_{it}$ represent the interaction among financial liberalization, institutional quality, and mobile banking adoption. We expect that in countries with strong institutions and mobile banking, the inverted U-shaped relationship is likely to be flatter than in countries without mobile banking. This implies that γ_1^{STRONG} will have a lower positive value compared to γ_1^{WEAK}, while γ_2^{STRONG} will have a higher negative value compared to γ_2^{WEAK}.

According to the fourth hypothesis, we aim to compare the results between countries with strong and weak institutions. Subsequently, we run separate models for these countries based on the level of IQI, which leads to the exclusion of IQI and its interaction terms, such as FFI * IQI, FFI^2 * IQI, FFI * IQI * MOBILE, and FFI^2 * IQI * MOBILE. Therefore, our equation will take the following form:

Equation 4.2: $\text{CRISIS}_{it} = f\left(\alpha + \beta_1 \text{FFI}_{it} + \beta_2 \text{FFI}^2_{it} + (\gamma_1 \text{FFI}_{it} * \text{MOBILE}_{it}) + (\gamma_2 \text{FFI}^2_{it} * \text{MOBILE}_{it}) + \gamma_3 \text{MOBILE}_{it} + \Psi \text{CTRL}_{it} + \varepsilon_{it}\right)$

We anticipate that γ_1^{STRONG} will have a lower positive value compared to γ_1^{WEAK}, and γ_2^{STRONG} will have a higher negative value compared to γ_2^{WEAK}.

Since our dependent variable is binary, denoted as CRISIS_t (1 = a banking crisis occurs, 0 = no banking crisis), where t = 1, 2, ..., T, there are only two widely used models: the Probit and the Logit models. These two models differ in their functional forms. The Probit model employs the standard normal distribution function, while the Logit model uses a logistic function with an S-shaped curve (Jacobs & Kuper, 2007). We have chosen to employ a multivariate Probit model, pooling all available data across countries and time periods, and estimate the model using maximum likelihood to test our four hypotheses. This decision is based on the fact that many previous studies investigating the effects of financial liberalization on banking crises have

employed a Probit model, including studies by Shehzad and De Haan (2009), Hamdaoui and Maktouf (2019), and Marchionne et al. (2022). Moreover, the Probit model, along with its multivariate generalizations, is a commonly employed tool in econometric analysis. It is estimated using the maximum likelihood method, which involves maximizing a log-likelihood function (Davidson & MacKinnon, 1984). We also include macroeconomic and microeconomic independent variables to mitigate endogeneity problems. To address potential reverse causality biases, we estimate the model by lagging the regressors by one period. Following the observations of Eichengreen and Arteta (2002), they emphasize that crises tend to be recognized with a lag, providing the rationale for implementing a one-period lag for the regressors.

Empirical results and Discussions

Table 1(A): **Descriptive statistics**

Variables	Observation	Mean	Std. Dev.	Min	Median	Max	Coeff. Var.
Crisis	792	0.1465	0.3538	0	0	1	2.4156
FFI	782	59.2327	17.4104	10	60	90	0.2939
FFI^2	782	3811.2532	2056.3823	100	3600	8100	0.5396
IQI	756	0.6633	0.2328	0.2039	0.7339	0.9842	0.3510
Mobile	792	0.3485	0.4768	0	0	1	1.3682
GDP	792	2.3300	2.0587	0.0441	1.7406	10.0172	0.8835
INF	791	4.3170	6.6107	-4.4781	2.6284	96.0941	1.5313
CAB	780	-0.9344	6.0256	-43.7712	-0.8603	17.4742	-6.4488
GINI	622	0.3442	0.0637	0.2320	0.3380	0.5640	0.1850
Social	788	53.2607	29.4746	0.4847	58.4035	98.8659	0.5534
TOP5	768	77.7634	16.1295	28.1183	81.0425	100	0.2074
BAS	774	83.2570	48.0581	7.4909	74.1648	225.3264	0.5772

NOTES: CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; IQI is institutional quality index; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; GDP is per capita (current US$ divided by 10000); INF is inflation (annual %); CAB is current account balance (% of GDP); GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet (% of population); TOP5 is assets of five largest banks as a share of total commercial banking assets (%); BAS is deposit money banks' assets to GDP (%). See Appendix A: Table B for the complete all variables definitions and sources.

Our sample comprises an unbalanced panel of 36, spanning the years 2000 to 2021, resulting in a total of 792 annual observations. Table 1 presents the descriptive statistics, revealing that banking crisis episodes constitute approximately 0.1465 of the dataset. FFI ranges from 10 to 90, with an average of around 59, implying that the countries in the dataset tend to have a moderate level of

financial liberalization. However, the standard deviation of 17 suggests that there is variation in the degree of financial liberalization among the countries, with some having significantly higher or lower FFI values compared to the average. The Financial Freedom Index exhibits a gradual rate of change over time, as indicated by its low coefficient of variation, which is 0.2939. FFI^2 is the squared version of FFI, as indicated by its mean and standard deviation. Institutional quality scores in the dataset vary between a minimum value of 0.2039 and a maximum value of 0.9842, reflecting a wide range of institutional quality levels among different countries. On average, the institutional quality is approximately 0.6633, with a standard deviation of 0.2328. This indicates that, on average, the institutions in these countries are quite strong and effective. The relatively low standard deviation further suggests that the scores are not highly volatile, as they are closely clustered around the mean. Mobile banking is represented as binary (0 or 1), signifying its presence or absence. The mean suggests that mobile banking is present in our dataset approximately 34.85% of the time. Turning to our control variables, first, GDP has an average value of approximately 2.33 US\$ divided by 10000, with a relatively high coefficient of variation (0.8835) indicating significant variability relative to the mean. Second, for INF, the mean implies an average inflation rate of around 4.3170% . Third, negative mean of current account balance (CAB) (-0.9344) points to a current account deficit. The standard deviation (6.0256) highlights significant volatility in the current account balance across observations, suggesting that some periods or countries exhibit larger deficits or surpluses than others. Fourth, GINI's mean is 0.3442, showing moderate income inequality among our observations. Fifth, the Social variable reveals that approximately 53.2607% of the population in our samples uses the internet for social interaction. The relatively high standard deviation (29.4746) suggests significant volatility among countries or time periods, with some showing low internet usage for social interaction while others exhibit high usage. Sixth, regarding TOP5, the five largest banks in our observations hold approximately 77.7634% of the total assets in the commercial banking sector. This suggests a relatively high level of concentration in these largest banks. Lastly, BAS reveals that, on average, assets generated from deposits by banks represent approximately 83. 2570% of GDP, underscoring the significance of banks within these economies. The standard deviation of 48.0581 indicates high volatility among our observations.

Table 1(B): Descriptive statistics with separate strong and weak institutional quality

Variables	Observation		Mean		Std. Dev.		Min		Median		Max		Coeff. Var.	
	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak
Crisis	462	330	0.1688	0.1152	0.3750	0.3197	0	0	0	0	1	1	2.2212	2.7763
FFI	461	321	67.1800	47.8193	15.7241	12.7566	10	20	70	50	90	80	0.2341	0.2668
FFI^2	461	321	4759.8698	2448.9097	1985.4731	1223.0113	100	400	4900	2500	8100	6400	0.4171	0.4994
IQI	441	315	0.8411	0.4144	0.0893	0.1122	0.6310	0.2039	0.8474	0.4149	0.9842	0.7512	0.1061	0.2707
Mobile	462	330	0.3442	0.3545	0.4756	0.4791	0	0	0	0	1	1	1.3820	1.3513
GDP	462	330	3.5749	0.5872	1.8261	0.5427	0.3362	0.0441	3.5535	0.4064	10.0172	3.2128	0.5108	0.9241
INF	462	329	2.2626	7.2019	2.4521	9.0836	-4.4781	-1.7359	1.8634	5.1314	19.3797	96.0941	1.0838	1.2613
CAB	450	330	0.2826	-2.5939	5.1609	6.6956	-20.9575	-43.7712	0.4965	-1.9744	14.3243	17.4742	18.2598	-2.5812
GINI	370	252	0.3210	0.3783	0.0455	0.0710	0.2320	0.2400	0.3180	0.3735	0.4640	0.564	0.1416	0.1877
Social	462	326	67.2848	33.3860	22.7298	26.3645	6.3191	0.4847	73.8956	27.61	98.8659	90.9200	0.3378	0.7897
TOP5	462	306	81.1549	72.6431	14.5052	17.1026	28.1183	29.9384	85.0441	72.0355	100	100	0.1787	0.2354
BAS	446	328	105.1869	53.4376	46.7336	30.6536	16.6192	7.4909	107.2797	42.7157	225.3264	152.018	0.4443	0.5736

NOTES: CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; IQI is institutional quality index; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; GDP is per capita (current US\$ divided by 10000); INF is inflation (annual %); CAB is current account balance (% of GDP); GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet (% of population); TOP5 is assets of five largest banks as a share of total commercial banking assets (%); BAS is deposit money banks' assets to GDP (%).

In Table 1(B), we categorized 36 countries into strong and weak institutional quality groups based on the mean IQI (0.6633). Strong institutions have IQI scores above the mean, while weak institutions have scores below. The countries with strong institutional quality include Switzerland, Sweden, Denmark, Netherlands, Austria, Ireland, Germany, the United Kingdom (UK), Belgium, Japan, the United States of America (USA), France, Portugal, Slovenia, Cyprus, Spain, Uruguay, Hungary, the Slovak Republic, Latvia, and Italy, totaling 21 countries. Conversely, the countries with weak institutional quality comprise Greece, Mongolia, Georgia, Thailand, Turkey, India, Mexico, Morocco, the Dominican Republic, Moldova, Indonesia, Kazakhstan, Ukraine, Ecuador, and Russia, totaling 15 countries.

When comparing strong and weak institutional quality, strong institutions experience a slightly higher mean crisis occurrence (0.1688) compared to the weak institutions (0.1152). In terms of FFI, strong institutions consistently demonstrate higher FFI scores (67.18), indicating greater financial liberalization and economic openness. Turning to the IQI, where countries are segmented based on their institutional quality, strong institutions have significantly higher mean IQI scores (0.8411), signifying better institutional quality, regulation, political stability, governance, and the rule of law. In the realm of mobile banking adoption, the pattern appears

relatively consistent between strong and weak institutions. Shifting the focus to GDP, strong institutions showcase a higher mean (3.5749), implying larger and more prosperous economies. This outcome aligns with the notion that strong institutional quality fosters a stable and predictable environment for both domestic and foreign investors due to confidence in property rights protection, contract enforcement, and the rule of law. Regarding INF, the strong group experiences lower inflation rates (2.2626%), reflecting stable economic environments compared to the weak group, which has higher inflation rates (7.2019%) with a higher standard deviation (9.0836). In terms of CAB, the strong group have a current account surplus (0.2826%), while the weak group grapples with a current account deficit (-2.5939%). Moving on to the Social variable, the strong group exhibits a higher mean percentage of the population using the internet for social interaction (67.2848%), implying greater digital connectivity and social engagement. As for TOP5, the strong group indicates a more concentrated banking sector (81.1549%). Finally, with regard to BAS, the strong group shows a higher mean (105.1869%), highlighting the importance of the banking sector in these economies.

Table 2(A): Correlation matrix of all variables

	Crisis	FFI	FFI^2	IQI	Mobile	L.GDP	L.INF	L.CAB	L.GINI	L.Social	L.TOP5	L.BAS
Crisis	1											
FFI	0.0370	1										
FFI^2	0.0374	0.9858	1									
IQI	0.0553	0.6298	0.6377	1								
Mobile	-0.1756	-0.0691	-0.0783	-0.0073	1							
L.GDP	0.0761	0.5802	0.6046	0.8121	0.1239	1						
L.INF	0.1656	-0.2849	-0.2696	-0.4284	-0.1690	-0.3659	1					
L.CAB	-0.0771	0.0739	0.1102	0.2248	0.0903	0.3540	-0.0622	1				
L.GINI	-0.1225	-0.3014	-0.2966	-0.4462	-0.0856	-0.3820	0.2597	-0.1398	1			
L.Social	0.0262	0.3987	0.4074	0.5986	0.5269	0.7130	-0.4073	0.2908	-0.4259	1		
L.TOP5	0.0137	0.3020	0.2837	0.3634	-0.0155	0.1923	-0.1340	-0.0460	-0.3028	0.2070	1	
L.BAS	0.1275	0.4977	0.5069	0.6416	-0.0014	0.6534	-0.3649	0.2882	-0.3755	0.4948	0.1801	1

NOTES: The above table shows correlations using control variables lagged by one year. CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; IQI is institutional quality index; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; GDP is per capita; INF is inflation; CAB is current account balance; GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet; TOP5 is assets of five largest banks as a share of total commercial banking assets; BAS is deposit money banks' assets to GDP.

For our models, we employ a Probit model with the maximum likelihood method and include a one-year lag for control variables to address reverse causality biases. Our control variables consist of L.GDP, L.INF, L.CAB, L.GINI, L.SOCIAL, L.TOP5, and L.BAS, where L. denotes a one-year lag. Table 2(A) presents the correlation matrix among the variables used in our four models. There is a slightly positive correlation between crisis and financial liberalization with FFI (0.0370) and FFI^2 (0.0374). For IQI, it exhibits a positive correlation with FFI (0.6298). Moreover, we observe a high correlation between L.GDP and IQI (0.8121). This significant correlation may lead to Multicollinearity problems. Therefore, we have decided to exclude L.GDP from our control variables when testing our four models. Next, mobile exhibits a weak negative correlation with other variables, such as FFI (-0.0691), FFI^2 (-0.0783), and IQI (-0.0073), as well as with Crisis (-0.1756), suggesting that mobile banking adoption is weakly associated with a lower occurrence of crises. However, the correlation between MOBILE and L.SOCIAL is approximately 0.5269, suggesting that there is a moderate positive relationship. Lastly, L.INF displays negative correlations with most variables except Crisis and GINI.

Table 2(B): Correlation matrix of strong institutional quality

	Crisis	FFI	FFI^2	IQI	Mobile	L.GDP	L.INF	L.CAB	L.GINI	L.Social	L.TOP5	L.BAS
Crisis	1											
FFI	0.0479	1										
FFI^2	0.0333	0.9853	1									
IQI	-0.0774	0.4266	0.4613	1								
Mobile	-0.3022	-0.1671	-0.1670	-0.0563	1							
L.GDP	0.0133	0.3845	0.4056	0.7079	0.2104	1						
L.INF	0.1964	-0.1581	-0.1291	-0.2973	-0.2907	-0.4739	1					
L.CAB	-0.1792	0.1202	0.1395	0.5218	0.2162	0.4861	-0.3888	1				
L.GINI	0.0293	-0.2140	-0.1763	-0.2602	-0.0126	-0.1302	0.2814	-0.3634	1			
L.Social	-0.0437	0.1349	0.1488	0.3224	0.5800	0.6251	-0.4365	0.4601	-0.2680	1		
L.TOP5	-0.0302	0.1378	0.1282	0.2026	0.0186	-0.0169	0.0221	0.1690	-0.4597	0.0551	1	
L.BAS	0.0934	0.3183	0.3231	0.4752	-0.0991	0.4789	-0.3729	0.3254	-0.1760	0.2546	0.0759	1

NOTES: The above table shows correlations using control variables lagged by one year. CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; IQI is institutional quality index; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; GDP is per capita; INF is inflation; CAB is current account balance; GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet; TOP5 is assets of five largest banks as a share of total commercial banking assets; BAS is deposit money banks' assets to GDP.

Table 2(C): Correlation matrix of weak institutional quality

	Crisis	FFI	FFI^2	IQI	Mobile	L.GDP	L.INF	L.CAB	L.GINI	L.Social	L.TOP5	L.BAS
Crisis	1											
FFI	-0.1252	1										
FFI^2	-0.1226	0.9911	1									
IQI	-0.0187	0.3824	0.3622	1								
Mobile	0.0303	0.1043	0.1160	0.0762	1							
L.GDP	0.1519	0.1174	0.1008	0.4136	0.2017	1						
L.INF	0.2930	-0.1482	-0.1419	-0.2404	-0.2040	-0.2008	1					
L.CAB	-0.0015	-0.2789	-0.2654	-0.3544	-0.0347	-0.0970	0.1142	1				
L.GINI	-0.2568	0.0895	0.1016	-0.0166	-0.1658	-0.0270	0.0877	0.1571	1			
L.Social	0.0237	0.1403	0.1500	0.0969	0.7399	0.4983	-0.2856	-0.0447	-0.1440	1		
L.TOP5	0.0263	0.2956	0.2863	0.4047	-0.0384	0.1324	-0.0782	-0.3942	0.0043	0.0880	1	
L.BAS	0.1175	0.2330	0.2300	0.4263	0.2109	0.4101	-0.2647	0.0469	-0.2126	0.3085	0.0228	1

NOTES: The above table shows correlations using control variables lagged by one year. CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; IQI is institutional quality index; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; GDP is per capita; INF is inflation; CAB is current account balance; GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet; TOP5 is assets of five largest banks as a share of total commercial banking assets; BAS is deposit money banks' assets to GDP.

Comparing the correlation results between strong and weak institutions in Table 2(B) and Table 2(C), FFI and FFI^2 have a slightly positive correlation with CRISIS in strong institutions, contrary to weak institutions where higher values of FFI and FFI^2 are associated with a lower likelihood of a banking crisis. However, the correlation between IQI and CRISIS in both strong and weak institutions indicates a very weak negative relationship. Regarding MOBILE, there is a negative relationship between strong institutions and the probability of a crisis, while weak institutions show a positive relationship. As for the control variables, L.GDP, L.INF, L.CAB, and L.BAS have similar signs and no significant change in value between strong and weak institutions. However, L. GINI, L. SOCIAL, and L. TOP5 show different signs between strong and weak institutions. Moreover, we observe a high correlation between IQI and L.GDP in both strong and weak institutions, equal to 0.7079 and 0.4136 respectively, confirming the exclusion of L.GDP from our analysis.

For standard deviation, we conducted a Breusch–Godfrey test and found serial correlation. Subsequently, we employed Heteroskedasticity and Autocorrelation Consistent (HAC) standard errors, also known as Newey-West standard errors.

To analyze the impact of regulation, financial liberalization, and mobile banking on banking crises, we have formulated four hypotheses. Our first hypothesis posits that financial liberalization initially increases the probability of a banking crisis, followed by a decrease, resulting in an inverted U-shaped curve. The second hypothesis suggests that financial liberalization is beneficial for countries with strong institutions, as it reduces the probability of a banking crisis, while countries with weak institutions face a higher probability of such crises. Next, we introduce mobile banking adoption to investigate its impact. Our third hypothesis proposes that the adoption of mobile banking increases the probability of a banking crisis. Finally, our fourth hypothesis theorizes that mobile banking amplifies the benefits of financial liberalization by decreasing the probability of a banking crisis in countries with strong institutions. Conversely, mobile banking intensifies the negative impact of financial liberalization by increasing the probability of a banking crisis in countries with weak institutions. We conduct tests for all four hypotheses, and the results are presented in Table 3.

Table 3: Regression Analysis Results Using Panel Data

Variables	HYP 1	HYP 2	HYP 3	HYP 4
Constant	-0.0690	3.1179	0.3030	2.2541
	(-0.060)	(-1.133)	(0.255)	(0.821)
FFI	0.0053	-0.0996	0.0045	-0.0711
	(0.202)	(-0.834)	(0.171)	(-0.596)
FFI^2	-0.0001	0.0005	-0.0001	0.0003
	(-0.345)	(0.382)	(-0.592)	(0.214)
IQI	0.9465	-6.3005	-0.5166	-11.3999
	(1.489)	(-1.708)*	(-0.817)	(-2.308)**
MOBILE			-1.1721	0.3549
			(-4.946)***	(0.497)
FFI*IQI		0.2181		0.3511
		(1.444)		(2.040)**
FFI^2*IQI		-0.0014		-0.0023
		(-0.916)		(-1.477)
FFI*IQI*MOBILE				0.1082
				(1.615)
FFI^2*IQI*MOBILE				-0.0025
				(-2.673)***
L.INF	0.0798	0.0803	0.0605	0.0669
	(3.324)***	(3.347)***	(2.992)***	(2.818)***
L.CAB	-0.0584	-0.0658	-0.0631	-0.0628
	(-3.386)***	(-3.457)***	(-3.541)***	(-2.960)***
L.GINI	-6.0500	-5.1860	-5.7650	-4.6544
	(-3.401)***	(-2.824)**	(-3.191)***	(-2.571)***
L.SOCIAL	0.0020	0.0017	0.0212	0.0106
	(0.504)	(0.430)	(3.870)***	(1.747)*
L.TOP5	-0.0089	-0.0070	-0.0060	-0.0067
	(-1.288)	(-1.032)	(-0.866)	(-1.027)
L.BAS	0.0069	0.0066	0.0057	0.0058
	(2.727)***	(2.548)**	(2.231)**	(2.204)**
Pseudo R-square	0.1390	0.1527	0.2037	0.2818
Log-Likelihood	-220.49	-216.99	-203.92	-183.92

Equation 1: $CRISIS_{it} = f\,(\alpha + \beta_1 FFI_{it} + \beta_2 FFI^2_{it} + \gamma IQI_{it} + \Psi CTRL_{it} + \varepsilon_{it})$

Equation 2: $CRISIS_{it} = f\,(\alpha + \beta_1 FFI_{it} + \beta_2 FFI^2_{it} + \gamma IQI_{it} + (\Psi_1 FFI_{it} * IQI_{it}) + (\Psi_2 FFI^2_{it} * IQI_{it}) + \Psi CTRL_{it} + \varepsilon_{it})$

Equation 3: $CRISIS_{it} = f\,(\alpha + \beta_1 FFI_{it} + \beta_2 FFI^2_{it} + \gamma IQI_{it} + \partial MOBILE_{it} + \Psi CTRL_{it} + \varepsilon_{it})$

Equation 4.1: $CRISIS_{it} = f\,(\alpha + \beta_1 FFI_{it} + \beta_2 FFI^2_{it} + \gamma IQI_{it} + (\Psi_1 FFI_{it} * IQI_{it}) + (\Psi_2 FFI^2_{it} * IQI_{it}) + (\gamma_1 FFI_{it} * IQI_{it} * MOBILE_{it})$
$+ (\gamma_2 FFI^2_{it} * IQI_{it} * MOBILE_{it}) + \gamma_3 MOBILE_{it} + \Psi CTRL_{it} + \varepsilon_{it})$

NOTES: The table above exhibits the results of testing hypotheses using all 36 countries. CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; IQI is institutional quality index; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; GDP is per capita; INF is inflation; CAB is current account balance; GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet; TOP5 is assets of five largest banks as a share of total commercial banking assets; BAS is deposit money banks' assets to GDP; FFI* IQI is the interaction term of financial liberalization and institutional

quality; FFI^2* IQI is the interaction term of financial liberalization squared and institutional quality; FFI^* IQI* MOBILE is the interaction term of financial liberalization, institutional quality, and mobile banking; FFI^2*IQI*MOBILE is the interaction term of financial liberalization squared, institutional quality, and mobile banking. Pseudo R^2 and Log-likelihood show McFadden's R^2 and the log-likelihood function of the model. Z-statistics are in parentheses. ***p<0.01, **p<0.05, *p<0.1.

According to HYP1, we expected a positive coefficient for FFI and a negative coefficient for FFI^2, implying an inverted U-shaped curve. In column 1 of Table 3, while FFI and FFI^2 exhibit the expected positive and negative signs, respectively, they are not statistically significant. Therefore, we cannot conclude that financial liberalization impacts the probability of a banking crisis. Similarly, for institutional quality, it does not show any impact on the probability of a banking crisis. For the control variables, firstly, the positive coefficient of INF implies that inflation has a positive impact on banking crises, consistent with our prediction. Second, the negative sign of CAB indicates that a higher current account balance can reduce the probability of a banking crisis, aligning with our notion that a current account surplus contributes to financial stability and lowers the likelihood of a banking crisis. Third, GINI exhibits a negative coefficient, supporting our notion that it encourages wealthy individuals to invest, thus fostering economic growth. Fourth, SOCIAL has an insignificantly positive coefficient, while TOP5 has an insignificantly negative coefficient. Although their signs align with our expectations, neither variable affects the probability of a banking crisis. Lastly, for BAS, we anticipated that larger bank sectors, as measured by deposit money assets, would imply a government implicit guarantee, reducing the likelihood of a banking crisis. However, the coefficient of BAS is significantly positive, indicating that it can increase the probability of a banking crisis. To substantiate our finding, Boyd and Gertler (1994) argue that banks with substantial total assets tend to play a disproportionately influential role in accumulating aggregate loan losses, ultimately contributing to banking crises. This explanation corroborates the common understanding that a core liability for banks is deposit, while their core asset is loans. Consequently, when banks have larger deposit, they are better positioned to extend more loans, which can have significant implications for the instability of the financial system.

Regarding HYP2 in column 2 of Table 3, we conducted the model with all 36 countries in our sample. However, we did not find a significant impact of financial liberalization on the probability of a banking crisis, nor did we find an impact of institutional quality on the relationship between financial liberalization and banking crises. This could be attributed to the

combination of countries with both strong and weak institutional quality. Therefore, we have decided to run our second models by distinguishing between strong and weak institutional quality countries, excluding the IQI, as well as interaction terms like FFI*IQI and FFI^2*IQI. The results are presented in Table 4.

To support the separation between strong and weak institutional quality, Marchionne et al. (2022) examined how institutional quality influences the relationship between regulation and banking crises. However, they caution against including interaction terms in the Probit model, as this can lead to misinterpretation, given that the magnitude of the interaction effect in nonlinear models does not equal the marginal effect of the interaction term, as demonstrated by Ai and Norton (2003). Hence, instead of incorporating interaction terms into the model, they utilize adjusted predictions while keeping all control variables at mean values, with the exception of regulation and institutional quality. They construct a curve by ranking regulation on a scale from low to high (0-100) and considering levels of institutional quality (0-1). They also categorize subgroups into non-European Union and European Union countries and incorporate dummy variables to distinguish between different time periods: pre-Great Financial Crisis, during the Great Financial Crisis, and post-Great Financial Crisis. As a result, they observe that countries with lower institutional quality exhibit steeper curves, suggesting a higher risk of banking crises, particularly in European Union countries. Indeed, different approaches can lead to different results and conclusions.

Table 4: Hypothesis 2 - We hypothesize that countries with strong institutional quality will gain advantages from financial liberalization, resulting in a reduced probability of a banking crisis. Conversely, countries with weak institutional quality experience a higher probability of a banking crisis.

Variables	HYP 2	
	Strong	Weak
Constant	-5.0372	1.5807
	(-2.069)**	(0.614)
FFI	0.1046	0.0222
	(2.051)**	(0.216)
FFI^2	-0.0007	-0.0005
	(-1.919)*	(-0.436)
L.INF	0.1177	0.0759
	(1.876)*	(4.673)***
L.CAB	-0.0511	-0.0214
	(-2.124)**	(-0.926)
L.GINI	-0.4214	-12.7917
	(-0.135)	(-3.643)***
L.Social	-0.0008	0.0041
	(-0.152)	(0.752)
L.TOP5	-0.0006	-0.0007
	(-0.066)	(-0.066)
L.BAS	0.0055	0.0172
	(2.028)**	(3.353)***
Pseudo R-square	0.1078	0.3759
Log-Likelihood	-154.32	-53.87

Equation 2.2: $CRISIS_{it} = f(\alpha + \beta_1 FFI_{it} + \beta_2 FFI_{it}^2 + \Psi CTRL_{it} + \varepsilon_{it})$

NOTES: The table above presents the results of testing hypotheses, distinguishing between 21 strong institutions and 15 weak institutions. CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; INF is inflation; CAB is current account balance; GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet; TOP5 is assets of five largest banks as a share of total commercial banking assets; BAS is deposit money banks' assets to GDP. Pseudo R^2 and Log-likelihood show McFadden's R^2 and the log-likelihood function of the model. Z-statistics are in parentheses. ***p<0.01, **p<0.05, *p<0.1.

For countries with strong institutional quality (column 1 of Table 4), we observe a positive coefficient for FFI and a negative coefficient for FFI^2, implying a concave relationship between financial liberalization and the probability of a banking crisis, aligning with our expectations. This suggests that initially, financial liberalization increases the probability of a banking crisis, but as banks diversify, this probability decreases. These results are also consistent with the findings of Marchionne et al. (2022). For control variables, the inflation rate, current account balance, and deposit money banks' assets have a positive, negative, and positive impact on the probability of a banking crisis, respectively, while the Social and TOP5 variables still have no impact on the probability of a banking crisis. This pattern is consistent with HYP2 in column 2 of Table 3. However, income inequality does not have an impact on the probability of a crisis for

strong institutions, indicating a different result in this context. For countries with weak institutional quality (column 2 of Table 4), FFI and FFI[2] have insignificant coefficients, indicating that financial liberalization does not influence the probability of a banking crisis in a concave relationship. Nevertheless, the inflation rate and deposit money banks' assets have a positive impact on the probability of a banking crisis, aligning with the results observed in countries with strong institutional quality.

To make it more evident, we also use the results from HYP2 in Table 4, column 1, to create a graph illustrating the impact of financial liberalization on the likelihood of a banking crisis. The predicted probabilities are calculated with all control variables held at their mean values; see Fig 1.
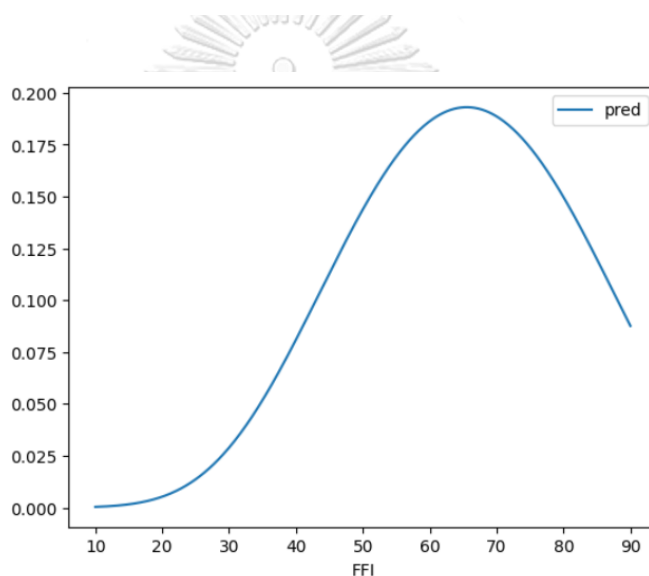
Fig 1. Impact of financial liberalization impact on banking crisis probability. Graph based on column 1 of Table 4

In Fig. 1, the probability of a banking crisis exhibits a continuous increase from an FFI of 10 to 60, culminating in a peak probability of nearly 20% when FFI values fall within the 60 to 70 range. This observed trend supports our hypothesis, indicating that during the initial stages of financial liberalization, there is an inadequacy in banking diversification. This inadequacy heightens the vulnerability of the banking sector to economic fluctuations, leading to an increased probability of a crisis. As financial liberalization progresses beyond the threshold of 70, a decline in the probability of a banking crisis becomes evident due to improved diversification. This reduction in probability continues until FFI reaches 90, at which point the probability stabilizes at 10%, mirroring the level observed at an FFI value of 40.

To summarize, columns 1 and 2 of Table 4 present different results due to our division between strong and weak institutions. The expected results are observed only in countries with strong institutions, where financial liberalization influences the probability of a banking crisis in the form of an inverted U-shaped curve. In contrast, countries with weak institutions do not exhibit this pattern, confirming our second hypothesis that the relationship between financial liberalization and the probability of a banking crisis depends on the level of institutional quality.

Moving to HYP3 in column 3 of Table 3, MOBILE has a statistically significant negative coefficient, suggesting that mobile banking can reduce the probability of a banking crisis—a result contrary to our initial expectations. However, these findings align with prior research conducted by Bhuvana and Vasantha (2019), who argue that mobile banking offers potential banking services in a cost-effective manner. In their study aimed at understanding the achievement of financial inclusion through mobile banking services, considering the behavioral intentions and attitudes of rural respondents, they discovered that rural individuals lacking sufficient financial knowledge developed increased awareness of financial services and financial inclusion through mobile banking services. Consequently, banks should establish innovative delivery channels to facilitate rural access to mobile banking services. We conclude that mobile banking adoption provides educational resources and tools for financial literacy. An informed and financially literate population is better equipped to make sound financial decisions, reducing the likelihood of risky behavior that can lead to crises.

In addition, central banks exercise regulatory oversight over mobile banking both before and after its launch to safeguard depositors' interests. For instance, prior to the introduction of M-PESA services in Kenya, the Central Bank of Kenya (CBK) conducted thorough assessments evaluating the safety, efficiency, integrity, and effectiveness of the M-PESA system. Subsequently, the CBK continues to maintain vigilant supervision of M-PESA operations and analyze depositor behavior, thereby ensuring enhanced transparency in financial transactions (Sultana, 2 0 0 9). This transparency serves as a crucial tool for promptly identifying irregularities and proactively preventing fraudulent activities, which could potentially contribute to banking crises. Furthermore, during periods of financial distress or crises, mobile banking can facilitate faster responses. Governments and central banks can use digital channels to disburse emergency funds, stabilize the financial system, and support affected individuals and businesses more efficiently.

Table 5: Hypothesis 4 – In countries with low institutional quality, mobile banking intensifies the negative impact of financial liberalization, increasing the probability of a banking crisis. Conversely, in high institutional quality countries, mobile banking enhances the benefits of financial liberalization, reducing the likelihood of a banking crisis.

Variables	HYP 4	
	Strong	Weak
Constant	-7.0420	-0.4993
	(-2.481)**	(-0.182)
FFI	0.1031	0.0901
	(1.667)*	(0.857)
FFI^2	-0.0008	-0.0009
	(-1.822)*	(-0.802)
MOBILE	-116.4977	2.0454
	(-7.947)***	(0.467)
FFI*MOBILE	4.7170	-0.0001
	(7.713)***	(-0.001)
FFI^2*MOBILE	-0.0481	-0.0009
	(-7.844)***	(-0.439)
L.INF	0.0244	0.0785
	(0.417)	(5.223)***
L.CAB	-0.0957	-0.0131
	(-3.093)***	(-0.572)
L.GINI	1.7252	-13.1805
	(0.523)	(-3.792)***
L.Social	0.0335	-0.0012
	(3.786)***	(-0.133)
L.TOP5	0.0033	-0.0009
	(0.363)	(-0.075)
L.BAS	0.0031	0.0179
	(1.144)	(3.621)***
Pseudo R-square	0.3097	0.4182
Log-Likelihood	-119.40	-50.219

Equation 4.2: $\text{CRISIS}_{it} = f\,(\alpha + \beta_1 \text{FFI}_{it} + \beta_2 \text{FFI}^2_{it} + (\gamma_1 \text{FFI}_{it} * \text{MOBILE}_{it}) + (\gamma_2 \text{FFI}^2_{it} * \text{MOBILE}_{it}) + \gamma_3 \text{MOBILE}_{it} + \Psi \text{CTRL}_{it} + \varepsilon_{it})$

NOTES: The table above presents the results of testing hypotheses, distinguishing between 21 strong institutions and 15 weak institutions. CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; INF is inflation; CAB is current account balance; GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet; TOP5 is assets of five largest banks as a share of total commercial banking assets; BAS is deposit money banks' assets to GDP; FFI* MOBILE is the interaction term of financial liberalization and mobile banking; FFI[2]*MOBILE is the interaction term of financial liberalization squared and mobile banking. Pseudo R[2] and Log-likelihood show McFadden's R[2] and the log-likelihood function of the model. Z-statistics are in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Referring to HYP4 in column 4 of Table 3, we incorporate IQI and its interaction terms − FFI* IQI, FFI[2]* IQI, FFI* IQI* MOBILE, and FFI[2]* IQI* MOBILE - into testing the fourth model. However, we do not observe a significant impact of financial liberalization on the probability of a banking crisis. We find that IQI has a negative coefficient, indicating that better institutional quality reduces the probability of a banking crisis, consistent with our initial thought.

Furthermore, FFI*IQI has a positive coefficient. In countries with strong institutional quality, the relationship between financial liberalization and the probability of a banking crisis is positive. This implies that as financial liberalization increases in these countries, there may be a higher likelihood of experiencing a banking crisis. Moreover, FFI^2* IQI* MOBILE shows a negative coefficient, implying that the combination of extremely high financial liberalization, good institutional quality, and widespread mobile banking adoption appears to have a mitigating effect on the likelihood of a banking crisis. Nevertheless, FFI^2*IQI and FFI*IQI*MOBILE do not have the expected impact on the probability of a banking crisis. This discrepancy might be due to mixed data from both strong and weak institutions. Consequently, it was more appropriate to conduct our fourth equation by dividing countries into those with strong and weak institutional quality.

According to the results for countries with strong institutional quality (column 1 of Table 5), FFI and FFI^2 have positive and negative coefficients, respectively, indicating that financial liberalization increases the probability of a banking crisis initially and then decreases, which is consistent with the results observed for strong institutions in HYP2. As for mobile banking adoption, it has a negative impact on the probability of a banking crisis, consistent with HYP3. FFI*MOBILE has a statistically significant positive coefficient: This means that the combination of higher financial liberalization and more widespread mobile banking adoption is associated with an increased probability of a banking crisis. In contrast, FFI^2* MOBILE has a statistically significant negative coefficient. In this case, the combination of very high financial liberalization (squared term) and mobile banking adoption is associated with a reduced probability of a banking crisis. These findings suggest that the relationship between financial liberalization and the probability of a banking crisis can be intensified by mobile banking adoption. The impact can be either positive (increased crisis likelihood) or negative (reduced crisis likelihood) depending on the specific combination of high or low financial liberalization and mobile banking adoption. Mobile banking enables fast transactions, which can lead to more speculation and increased risk of a banking crisis, especially with lower levels of liberalization. However, stronger regulatory oversight as financial liberalization increases helps reduce this risk. Moreover, in our view, mobile banking demonstrates its impact primarily in countries with strong institutional quality, for three key reasons. Firstly, trust and security, institutional quality plays a crucial role in

establishing trust and confidence in financial systems. A robust legal framework ensures the security of mobile banking services and protects consumers' rights. High institutional quality is essential for building trust in mobile banking platforms. Secondly, the regulatory environment, a component of institutional quality, the regulatory environment can either facilitate or impede the growth of mobile banking. Regulations that are clear, fair, and adaptable to technological advancements can nurture a thriving mobile banking ecosystem. Lastly, innovation and competition, a favorable institutional environment promotes innovation and competition within the financial sector. When institutions are strong and transparent, it becomes easier for new fintech companies to enter the market and offer innovative mobile banking solutions, ultimately benefiting consumers. Subsequently, the efficient adoption of mobile banking demonstrates a significant impact on the relationship between financial liberalization and banking crises only in strong institutional countries.

For countries with weak institutional quality (column 2 of Table 5), we do not observe the impact of financial liberalization on the probability of a banking crisis. Instead, we find that control variables have an impact, including the inflation rate, income inequality, and deposit money banks' assets. The inflation rate and deposit money banks' assets are associated with an increased probability of a banking crisis, while income inequality is linked to a reduced probability of a banking crisis. These findings align with the results presented in HYP4, which encompassed all 36 countries in column 4 of Table 3.

In conclusion, the differences in our results between column 1 and column 2 of Table 5 arise from our separation of strong and weak institutional quality. This highlights the influence of institutional quality on the relationship between financial liberalization and the probability of a banking crisis. However, we were unable to directly compare the impact of mobile banking adoption in the relationship between financial liberalization and the probability of a banking crisis between strong and weak institutions because we observed the impact of mobile banking on this relationship only in countries with strong institutional quality.

Robustness tests

We observed that four countries (Georgia, India, Mexico, and Morocco) did not experience banking crises between 2000 and 2021. In this section, we conducted our four models without including these countries.

Table 6: Regression Analysis Results Using Panel Data

Variables	HYP 1	HYP 2	HYP 3	HYP 4
Constant	-0.1515	2.6275	0.0628	1.7928
	(-0.126)	(0.943)	(0.050)	(0.655)
FFI	0.0067	-0.0817	0.0075	-0.0533
	(0.260)	(-0.675)	(0.287)	(-0.442)
FFI^2	-0.0001	0.0003	-0.0001	0.0001
	(-0.363)	(0.258)	(-0.650)	(0.081)
IQI	0.8645	-5.7557	-0.5908	-11.2011
	(1.376)	(-1.560)	(-0.935)	(-2.263)**
Mobile			-1.1410	0.4314
			(-4.732)***	(0.607)
FFI*IQI		0.1953		0.3405
		(1.287)		(1.968)**
FFI^2*IQI		-0.0012		-0.0022
		(-0.775)		(-1.378)
FFI*IQI*MOBILE				0.1182
				(1.712)
FFI^2*IQI*MOBILE				-0.0027
				(-2.639)***
L.INF	0.0766	0.0775	0.0593	0.0654
	(3.241)***	(3.254)***	(2.939)***	(2.768)***
L.CAB	-0.0615	-0.0688	-0.0654	-0.0642
	(-3.402)***	(-3.449)***	(-3.505)***	(-2.926)***
L.GINI	-5.5502	-4.7469	-5.2268	-4.2008
	(-3.090)***	(-2.611)**	(-2.850)***	(-2.319)**
L.Social	0.0006	0.0005	0.0200	0.0078
	(0.161)	(0.121)	(3.528)***	(1.158)
L.TOP5	-0.0081	-0.0064	-0.0047	-0.0064
	(-1.104)	(-0.891)	(-0.649)	(-0.932)
L.BAS	0.0065	0.0062	0.0054	0.0055
	(2.590)***	(2.430)**	(2.123)**	(2.079)**
Pseudo R-square	0.1316	0.1444	0.1919	0.2725
Log-Likelihood	-215.74	-212.57	-200.77	-180.73

Equation 1: $\text{CRISIS}_{it} = f(\alpha + \beta_1 \text{FFI}_{it} + \beta_2 \text{FFI}^2_{it} + \gamma \text{IQI}_{it} + \Psi \text{CTRL}_{it} + \varepsilon_{it})$

Equation 2: $\text{CRISIS}_{it} = f(\alpha + \beta_1 \text{FFI}_{it} + \beta_2 \text{FFI}^2_{it} + \gamma \text{IQI}_{it} + (\Psi_1 \text{FFI}_{it} * \text{IQI}_{it}) + (\Psi_2 \text{FFI}^2_{it} * \text{IQI}_{it}) + \Psi \text{CTRL}_{it} + \varepsilon_{it})$

Equation 3: $\text{CRISIS}_{it} = f(\alpha + \beta_1 \text{FFI}_{it} + \beta_2 \text{FFI}^2_{it} + \gamma \text{IQI}_{it} + \partial \text{MOBILE}_{it} + \Psi \text{CTRL}_{it} + \varepsilon_{it})$

Equation 4.1: $\text{CRISIS}_{it} = f(\alpha + \beta_1 \text{FFI}_{it} + \beta_2 \text{FFI}^2_{it} + \gamma \text{IQI}_{it} + (\Psi_1 \text{FFI}_{it} * \text{IQI}_{it}) + (\Psi_2 \text{FFI}^2_{it} * \text{IQI}_{it}) + (\gamma_1 \text{FFI}_{it} * \text{IQI}_{it} * \text{MOBILE}_{it})$
$+ (\gamma_2 \text{FFI}^2_{it} * \text{IQI}_{it} * \text{MOBILE}_{it}) + \gamma_3 \text{MOBILE}_{it} + \Psi \text{CTRL}_{it} + \varepsilon_{it})$

NOTES: CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; IQI is institutional quality index; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; INF is inflation; CAB is current account balance; GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet; TOP5 is assets of five largest banks as a share of total

commercial banking assets; BAS is deposit money banks' assets to GDP; FFI*IQI is the interaction term of financial liberalization and institutional quality; FFI^2* IQI is the interaction term of financial liberalization squared and institutional quality; FFI*IQI*MOBILE is the interaction term of financial liberalization, institutional quality, and mobile banking; FFI^2*IQI*MOBILE is the interaction term of financial liberalization squared, institutional quality, and mobile banking. Pseudo R^2 and Log-likelihood show McFadden's R^2 and the log-likelihood function of the model. Z-statistics are in parentheses. ***p<0.01, **p<0.05, *p<0.1.

The results of HYP1 in column 1 of Table 6 do not significantly alter our previous interpretations. FFI and FFI^2 exhibit positive and negative signs, respectively, but lack statistical significance. Consequently, we cannot conclude that financial liberalization affects the probability of a banking crisis, aligning with HYP1, which considers all 36 countries. Furthermore, institutional quality and control variables exhibit consistent signs and significant levels. The inflation rate and deposit money banks' assets have a positive impact on the probability of a banking crisis, while the current account balance and income inequality have a negative impact on the probability of a banking crisis.

Moreover, in HYP3, as shown in column 3 of Table 6, the coefficient of MOBILE is statistically negative. This suggests that an increase in mobile banking adoption can increase the probability of a banking crisis, which aligns with our previous findings.

Table 7: Hypothesis 2 - We hypothesize that countries with strong institutional quality will gain advantages from financial liberalization, resulting in a reduced probability of a banking crisis. Conversely, countries with weak institutional quality experience a higher probability of a banking crisis.

Variables	HYP 2	
	Strong	Weak
Constant	-5.0372	1.6190
	(-2.069)**	(0.585)
FFI	0.1046	0.0317
	(2.051)**	(0.253)
FFI^2	-0.0007	-0.0006
	(-1.919)*	(-0.423)
L.INF	0.1177	0.0715
	(1.876)*	(4.921)***
L.CAB	-0.0511	-0.0276
	(-2.124)**	(-1.165)
L.GINI	-0.4214	-12.2889
	(-0.135)	(-3.811)***
L.Social	-0.0008	0.0021
	(-0.152)	(0.356)
L.TOP5	-0.0006	-0.0048
	(-0.066)	(-0.345)
L.BAS	0.0055	0.0179
	(2.028)**	(3.231)***
Pseudo R-square	0.1078	0.3477
Log-Likelihood	-154.32	-51.96

Equation 2.2: $CRISIS_{it} = f(\alpha + \beta_1 FFI_{it} + \beta_2 FFI^2_{it} + \Psi CTRL_{it} + \varepsilon_{it})$

NOTES: CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; INF is inflation; CAB is current account balance; GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet; TOP5 is assets of five largest banks as a share of total commercial banking assets; BAS is deposit money banks' assets to GDP. Pseudo R^2 and Log-likelihood show McFadden's R^2 and the log-likelihood function of the model. Z-statistics are in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Although the results in column 2 of Table 6 does not reveal the impact of financial liberalization on the probability of a banking crisis, nor does it shed light on the influence of institutional quality. To explore these effects, we divide the data into strong and weak institutions, as presented in Table 7. In strong institutional countries, the relationship between financial liberalization and the probability of a banking crisis remains concave, similar to column 1 of Table 4, due to those four countries (Georgia, India, Mexico, and Morocco) being categorized as weak institutional countries. However, in weak institutional countries, financial liberalization still has no effect on the probability of a banking crisis.

The findings in Table 7 confirms our previous conclusions that institutional quality has an impact on the relationship between financial liberalization and the probability of banking crisis because after separating institutional quality, strong institution reveals the effect while weak institution does not.

Table 8: Hypothesis 4 – In countries with low institutional quality, mobile banking intensifies the negative impact of financial liberalization, increasing the probability of a banking crisis. Conversely, in high institutional quality countries, mobile banking enhances the benefits of financial liberalization, reducing the likelihood of a banking crisis.

Variables	HYP 4	
	Strong	Weak
Constant	-7.0420	-0.5382
	(-2.481)**	(-0.202)
FFI	0.1031	0.1319
	(1.667)*	(1.216)
FFI^2	-0.0008	-0.0013
	(-1.822)*	(-1.116)
MOBILE	-116.4977	-1.3408
	(-7.947)***	(-0.256)
FFI*MOBILE	4.717	0.2320
	(7.713)***	(0.957)
FFI^2*MOBILE	-0.0481	-0.0038
	(-7.844)***	(-1.420)
L.INF	0.0244	0.0773
	(0.417)	(5.046)***
L.CAB	-0.0957	-0.0266
	(-3.093)***	(-1.011)
L.GINI	1.7252	-12.9056
	(0.523)	(-3.940)***
L.Social	0.0335	-0.0188
	(3.786)***	(-1.651)*
L.TOP5	0.0033	-0.0145
	(0.363)	(-0.885)
L.BAS	0.0031	0.0233
	(1.144)	(4.098)***
Pseudo R-square	0.3097	0.4164
Log-Likelihood	-119.40	-46.481

Equation 4.2: $CRISIS_{it} = f(\alpha + \beta_1 FFI_{it} + \beta_2 FFI_{it}^2 + (\gamma_1 FFI_{it} * MOBILE_{it}) + (\gamma_2 FFI_{it}^2 * MOBILE_{it}) + \gamma_3 MOBILE_{it} + \Psi CTRL_{it} + \varepsilon_{it})$

NOTES: CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; INF is inflation; CAB is current account balance; GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet; TOP5 is assets of five largest banks as a share of total commercial banking assets; BAS is deposit money banks' assets to GDP; FFI* MOBILE is the interaction term of financial liberalization and mobile banking;

$FFI^2*MOBILE$ is the interaction term of financial liberalization squared and mobile banking. Pseudo R^2 and Log-likelihood show McFadden's R^2 and the log-likelihood function of the model. Z-statistics are in parentheses. ***p<0.01, **p<0.05, *p<0.1.

According to the results when we run tests by mixing both strong and weak institutions (column 4 of Table 6), it remains evident that financial liberalization has no impact on the probability of a banking crisis. However, IQI has a significant negative coefficient, indicating that higher institutional quality is associated with a lower probability of a banking crisis. This supports our initial notion that stronger institutions reduce the risk of banking crises. Additionally, the interaction term FFI*IQI exhibits a statistically significant positive coefficient, suggesting that an increase in financial liberalization within high institutional quality countries can lead to a higher likelihood of a banking crisis. Moreover, $FFI^2*IQI*MOBILE$ indicates a negative coefficient, implying that extremely high financial liberalization and better institutional quality, combined with mobile banking adoption, may reduce the likelihood of a banking crisis. However, FFI^2*IQI and FFI*IQI*MOBILE do not have the expected impact on the probability of a banking crisis. This discrepancy may arise from mixed information regarding strong and weak institutions. Consequently, we conducted separate testing before drawing interpretations.

For strong institutions, the results in column 1 of Table 8 are similar to those in column 1 of Table 5 because we use the same dataset, demonstrating that financial liberalization and the probability of a banking crisis exhibit a concave relationship. Furthermore, an increase in mobile banking adoption can reduce the likelihood of a crisis. Regarding the interaction terms, both FFI*MOBILE and $FFI^2*MOBILE$ have statistically significant positive and negative coefficients, respectively. This implies that mobile banking adoption intensifies the impact of financial liberalization on the likelihood of a crisis. However, for weak institutions, the results in column 2 of Table 8 confirm that financial liberalization does not impact the probability of a banking crisis, and mobile banking does not intensify the impact of financial liberalization on the probability of a banking crisis, consistent with the findings in column 2 of Table 5.

Hence, we conclude that excluding countries that have never experienced a crisis from our testing does not alter the results or our previous conclusions regarding the fourth hypotheses. Institutional quality is the key factor that determines whether financial liberalization has an impact on the probability of a banking crisis. Additionally, institutional quality contributes to the varying effects

of mobile banking adoption on the relationship between financial liberalization and the likelihood of a banking crisis.

Bank-Based Vs Market-Based Financial Systems

A financial system can indeed be classified into two main categories: bank-based and market-based. In a bank-based financial system, banks are the primary drivers of economic growth and play a central role in providing financial services and allocating capital. A market-based financial system is a structure in which financial markets, such as stock and bond markets, play a central role in facilitating economic activities, including savings mobility, resource allocation, and corporate control (Demirgüç-Kunt & Levine, 2001). According to Boadi et al. (2019), they use domestic credit to the private sector to GDP as an indicator for bank-based financial development. In terms of market-based financial development, they employ stock market capitalization to GDP as a proxy. While Bats and Houben (2020) use bank credit to non-financial debt and stock market capitalization, bank credit to GDP, non-financial debt market capitalization to GDP, and stock market capitalization.

We classify countries based on market capitalization. However, classifying countries into purely bank-based or market-based financial systems based solely on market capitalization can be challenging, as the financial systems of most countries are mixed or hybrid systems with elements of both. Market capitalization is just one of many factors to consider in determining the nature of a financial system. Our countries are classified as follows:

No.	Country	Market capitalization (% of GDP)	Classification	No.	Country	Market capitalization (% of GDP)	Classification
1	Austria	28.72	Bank-based	20	Belgium	67.50	Market-based
2	Cyprus	25.18	Bank-based	21	France	80.27	Market-based
3	Denmark	55.75	Bank-based	22	India	78.11	Market-based
4	Ecuador	4.08	Bank-based	23	Japan	83.91	Market-based
5	Germany	47.42	Bank-based	24	Netherlands	92.42	Market-based
6	Greece	36.65	Bank-based	25	Spain	76.03	Market-based
7	Hungary	20.19	Bank-based	26	Sweden	94.08	Market-based
8	Indonesia	36.87	Bank-based	27	Switzerland	215.62	Market-based
9	Ireland	49.08	Bank-based	28	Thailand	76.16	Market-based
10	Italy	36.71	Bank-based	29	United Kingdom	118.95	Market-based
11	Kazakhstan	20.29	Bank-based	30	United States	133.47	Market-based
12	Mexico	30.96	Bank-based		**Average**	**56.60**	
13	Morocco	51.41	Bank-based				
14	Portugal	35.05	Bank-based		Dominican Republic		
15	Russian Federation	41.49	Bank-based		Georgia		
16	Slovak Republic	4.71	Bank-based		Latvia		
17	Slovenia	20.54	Bank-based		Moldova	No data avaliable	
18	Turkiye	26.19	Bank-based		Mongolia		
19	Ukraine	10.31	Bank-based		Uruguay		

NOTES: Countries are categorized into bank-based financial systems based on a mean market capitalization to GDP of 56.60. Countries with market capitalization to GDP scores below the mean are classified as bank-based financial system countries, while those with scores above the mean are classified as market-based financial system countries.

Table 9: Hypothesis 2 and 4 with separate bank-based and market-based countries

Variables	HYP 2		HYP 4	
	Bank-Based	Market-Based	Bank-Based	Market-Based
Constant	0.2091	-431.8864	-0.7793	-815.3315
	(0.055)	(-1.784)*	(-0.195)	(-2.358)**
FFI	0.0401	10.4055	0.1540	20.0578
	(0.240)	(1.642)	(0.819)	(2.286)**
FFI^2	-0.0013	-0.0642	-0.0030	-0.1256
	(-0.693)	(-1.565)	(-1.382)	(-2.255)**
IQI	-3.8332	443.631	-15.6458	853.2428
	(-0.719)	(1.727)*	(-2.384)**	(2.212)**
MOBILE			-1.4234	-30.8675
			(-1.585)	(-0.581)
FFI*IQI	0.0970	-10.9118	0.3405	-21.5749
	(0.460)	(-1.630)	(1.495)	(-2.201)**
FFI^2*IQI	0.0002	0.0673	-0.0005	0.1352
	(0.092)	(1.550)	(-0.209)	(2.177)**
FFI*IQI*MOBILE			0.3832	0.9053
			(3.397)***	(0.515)
FFI^2*IQI*MOBILE			-0.0069	-0.0075
			(-3.685)***	(-0.611)
L.INF	0.0964	0.3044	0.1038	0.1415
	(3.117)***	(1.904)*	(2.917)***	(0.821)
L.CAB	-0.1143	-0.0767	-0.1374	-0.1226
	(-4.857)***	(-1.451)	(-4.865)***	(-1.752)*
L.GINI	-5.4277	17.7897	-5.1467	35.2128
	(-2.224)**	(2.170)**	(-1.993)**	(2.559)***
L.Social	0.0071	-0.0132	0.0185	0.0515
	(1.316)	(-0.965)	(2.178)**	(2.097)**
L.TOP5	-0.0073	0.0483	-0.0082	0.0907
	(-0.703)	(1.756)*	(-0.773)	(2.314)**
L.BAS	0.0069	-0.0026	0.0050	-0.0131
	(1.828)*	(-0.441)	(1.305)	(-1.571)
Pseudo R-square	0.2332	0.3216	0.3521	0.5119
Log-Likelihood	-114.89	-51.72	-97.073	-37.212

Equation 2.1: $CRISIS_{it} = f(\alpha + \beta_1 FFI_{it} + \beta_2 FFI^2_{it} + \gamma IQI_{it} + (\Psi_1 FFI_{it} * IQI_{it}) + (\Psi_2 FFI^2_{it} * IQI_{it}) + \Psi CTRL_{it} + \varepsilon_{it})$

Equation 4.1: $CRISIS_{it} = f(\alpha + \beta_1 FFI_{it} + \beta_2 FFI^2_{it} + \gamma IQI_{it} + (\Psi_1 FFI_{it} * IQI_{it}) + (\Psi_2 FFI^2_{it} * IQI_{it}) + (\gamma_1 FFI_{it} * IQI_{it} * MOBILE_{it})$
$+ (\gamma_2 FFI^2_{it} * IQI_{it} * MOBILE_{it}) + \gamma_3 MOBILE_{it} + \Psi CTRL_{it} + \varepsilon_{it})$

NOTES: CRISIS = 1 for banking crises, 0 otherwise; the Financial Liberalization Index (FFI) ranges from 0 to 100: the higher index, the more liberalized the financial sector; IQI is institutional quality index; Mobile = 1 for the period since mobile banking adoption, 0 otherwise; INF is inflation; CAB is current account balance; GINI is the level of income inequality: the higher index, the higher income inequality; Social is individuals using the internet; TOP5 is assets of five largest banks as a share of total commercial banking assets; BAS is deposit money banks' assets to GDP; FFI*IQI is the interaction term of financial liberalization and institutional quality; FFI^2* IQI is the interaction term of financial liberalization squared and institutional quality; FFI*IQI*MOBILE is the interaction term of financial liberalization, institutional quality, and mobile banking; FFI^2*IQI*MOBILE is the interaction term of financial liberalization squared, institutional quality, and mobile banking. Pseudo R^2 and Log-likelihood show McFadden's R^2 and the log-likelihood function of the model. Z-statistics are in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Focusing on the second hypothesis, we do not observe the impact of institutional quality on the relationship between financial liberalization and the probability of a banking crisis in both bank-based countries (column 1 of Table 9) and market-based countries (column 2 of Table 9). However, in market-based countries, better institutional quality increases the probability of a banking crisis. Abbes (2013) noted that overconfident investors played a role in the financial instability of 2008. This suggests that in market-based economies, where financial systems rely more on securities markets than banks, institutions and investors might exhibit overconfidence, potentially leading to risky behaviors, such as excessive lending or speculative investments, and the accumulation of vulnerabilities that can trigger a crisis.

For fourth hypothesis, in countries with a bank-based financial market (column 3 of Table 9), the coefficient of IQI is statistically significant and negative. This suggests that better institutional quality can reduce the probability of a banking crisis. The interaction terms, FFI* IQI* MOBILE and FFI^2* IQI* MOBILE, are statistically positive and negative, respectively, indicating the amplified impact of mobile banking in bank-based financial market countries. This implies that in countries with strong institutional quality and widespread mobile banking adoption, financial liberalization initially may increase the likelihood of a banking crisis, but after a certain point, it starts reducing the likelihood of a crisis. To clarify, mobile banking can facilitate rapid financial transactions, thereby encouraging speculative behavior, which can increase the risk of a banking crisis, particularly at lower levels of liberalization. However, as financial liberalization increases, regulatory oversight becomes more robust, resulting in risk mitigation. Mobile banking, with its transparency and accessibility, plays a significant role in this risk mitigation process. Moreover, these results align with the characteristics of bank-based financial market countries, where commercial banks are the primary financial intermediaries that gather funds from savers and channel them into loans and investments. Therefore, mobile banking, as a tool of commercial banks, has the potential to intensify the impact of financial liberalization on the probability of a banking crisis. However, in countries with a market-based financial system (column 4 of Table 9), the relationship between financial liberalization and the probability of a banking crisis follows an inverted U-shaped curve. Moreover, IQI is statistically positive, suggesting that better institutional quality can increase the probability of a banking crisis, in contrast to bank-based countries. Both FFI* IQI and FFI^2* IQI interactions are statistically significant, with negative and

positive coefficients, respectively. These findings suggest that institutional quality plays a significant role in the relationship between financial liberalization and the probability of a banking crisis. Stronger institutional quality tends to reduce the likelihood of a crisis associated with financial liberalization. However, at higher levels of financial liberalization (squared term), this effect may change direction. For mobile banking, there is no observed impact on the probability of a banking crisis, nor on the relationship between financial liberalization and the probability of a banking crisis in countries with market-based financial systems. These systems are characterized by decentralized markets and a greater reliance on capital markets, as opposed to traditional banking intermediaries. This distinct characteristic of market-based financial systems could potentially serve as a mitigating factor against the risk-enhancing effects that mobile banking might have on banking crises.

Conclusions

Using panel data from 36 countries, including developed and developing countries, from the year 2000 to 2021, we find that the relationship between financial liberalization and the probability of a banking crisis is concave when we include institutional quality in our analysis. In our first hypothesis, we could not conclude that financial liberalization impacts the probability of a banking crisis. However, after we split between strong and weak institutional quality by the average, we find that the relationship between financial liberalization and the probability of a banking crisis is concave in countries with strong institutions. The probability of a banking crisis increases when financial liberalization is low to medium, then it decreases when financial liberalization is at a medium to high level. In the countries with weak institutional quality, financial liberalization does not impact the probability of a banking crisis. This shows that the impact of financial liberalization on the probability of a banking crisis depends on institutional quality. Surprisingly, the adoption of mobile banking appears to reduce the probability of a banking crisis, contrary to the conventional belief that mobile banking might facilitate deposit withdrawals during periods of depositor panic, potentially triggering a crisis. Mobile banking seems to offer a range of benefits, including providing individuals with access to financial information, promoting financial literacy, enabling more informed decision-making, and facilitating regulatory oversight which contributes to increased transparency and a reduced

likelihood of a banking crisis. Furthermore, our findings indicate that mobile banking adoption intensifies the impact of financial liberalization on the probability of a banking crisis in countries with strong institutional quality, while no such impact is observed in countries with weak institutional quality. This underscores the crucial role of institutional quality in shaping the relationship between mobile banking, financial liberalization, and the probability of a banking crisis.

Despite excluding countries that did not experience a banking crisis between 2000 and 2021, our results remain consistent with our previous interpretations, reaffirming the significance of institutional quality and the benefits of mobile banking adoption.

We observe different results between countries with bank-based and market-based financial systems. Market-based countries show that the relationship between financial liberalization and the probability of a banking crisis follows an inverted U-shaped curve. This implies that financial liberalization initially increases the probability of a banking crisis, but as it progresses, the probability decreases. Moreover, institutional quality can both increase the likelihood of a banking crisis and impact the relationship between financial liberalization and the probability of a banking crisis. On the other hand, in countries with a bank-based financial system, better institutional quality can decrease the probability of a banking crisis. As for the adoption of mobile banking, it intensifies the impact of financial liberalization on the probability of a banking crisis exclusively in bank-based countries. In such systems, where traditional banking intermediaries like commercial banks play a central role, the introduction and widespread use of mobile banking seem to have a more significant effect on various aspects of the financial sector, including the relationship between financial liberalization and the likelihood of banking crises.

Appendix

Table A: Sample of countries

No.	Country	Banking Crises	Classification	FFI	REG	AVG_REG	IQI	MOBILE
1	Switzerland	2008-2009	Developed	90	10	18	97	2014
2	Denmark	2008-2009	Developed	80	20	17	96	2014
3	Netherlands	2008-2009	Developed	80	20	18	94	2014
4	Sweden	2008-2009	Developed	80	20	22	95	2014
5	United Kingdom (UK)	2007-2011	Developed	80	20	17	86	2014
6	United States of America (USA)	2007-2011	Developed	80	20	25	79	2014
7	Austria	2008-2012	Developed	70	30	32	90	2014
8	Belgium	2008-2012	Developed	70	30	30	84	2014
9	France	2008-2009	Developed	70	30	37	82	2014
10	Germany	2008-2009	Developed	70	30	41	89	2014
11	Hungary	2008-2012	Developed	70	30	33	67	2014
12	Ireland	2008-2012	Developed	70	30	22	90	2014
13	Slovak Rep	1998-2002	Developed	70	30	28	71	2014
14	Spain	2008-2012	Developed	70	30	29	75	2014
15	Cyprus	2011-2015	Developed	60	40	37	70	2014
16	Latvia	2008-2012	Developed	60	40	39	78	2014
17	Portugal	2008-2012	Developed	60	40	45	81	2014
18	Japan	1997-2001	Developed	60	40	50	89	2014
19	Greece	2008-2012, 2018-2020	Developed	50	50	52	65	2017
20	Italy	2008-2009	Developed	50	50	40	69	2014
21	Slovenia	2008-2012	Developed	50	50	50	78	2014
22	Morocco	1980	Developing	70	30	45	41	2017
23	Georgia	1991	Developing	70	30	44	61	2017
24	Mexico	1981, 1994	Developing	60	40	40	32	2014
25	Indonesia	1997-2001	Developing	60	40	55	49	2014
26	Thailand	1997-2000	Developing	60	40	42	44	2014
27	Turkey	2000-2001	Developing	60	40	45	35	2014
28	Kazakhstan	2008	Developing	50	50	52	42	2014
29	Moldova	2014-2017	Developing	50	50	50	43	2017
30	Mongolia	2008-2009	Developing	50	50	44	47	2014
31	India	1993	Developing	40	60	63	48	2014
32	Dominican Republic	2003-2004	Developing	40	60	59	50	2014
33	Ecuador	1998-2002	Developing	40	60	58	38	2014
34	Russia	2008-2009	Developing	30	70	67	27	2014
35	Ukraine	2008-2010, 2014-2021	Developing	30	70	64	32	2014
36	Uruguay	2002-2005	Developing	30	70	60	83	2014

The data above includes the Financial Freedom Index (FFI), regulation (REG), and institutional quality index (IQI), which are specific to the year 2021. Additionally, the average regulation (AVG_REG) represents the average value between the years 2000 and 2021. The last column indicates the launch year of mobile banking services.

Table B: List of variables, definitions, and sources

Variable	Definitions	Source
BANK_CRISIS	Dummy variable: 1 = banking crises; 0 = no banking crises	Luc Laeven and Fabian Valencia (2020). Systemic Banking Crises Database II; World Development Indicators, World Bank (2021)
FFI	The financial freedom index encompasses five key dimensions: the degree of government regulation in financial services, the level of state intervention in banks and other financial institutions, government influence on credit allocation, the level of financial and capital market development, and the extent of openness to foreign competition. The FFI ranges from 0 to 100, with 0 representing a heavily regulated system and 100 indicating no government intervention in the financial sector. In contrast, the REG index, calculated as 100 - FFI, is used to measure the level of regulation, ranging from 0 (negligible government interference) to 100 (fully regulated)	The Heritage Foundation (2022)
IQI	Average of institutional quality index: control of corruption, government effectiveness, political stability and absence of violence/terrorism, regulatory quality, rule of law, and voice and accountability, with 0 corresponding to the lowest rank and 1 to the highest rank. An increase in the institutional quality index signifies an improvement in the overall quality and effectiveness of a country's institutions.	Worldwide Governance Indicators, World Bank (2021)
MOBILE	Dummy variable: 1 indicates mobile banking adoption; 0 indicates otherwise	Global Financial Inclusion, World Bank (2021)
GDP	GDP per capita is gross domestic product divided by midyear population	World Development Indicators, World Bank (2021)
INF	Inflation as measured by the consumer price index (CPI)	World Development Indicators, World Bank (2021)
CAB	Current account balance (% of GDP), current account balance is the sum of net exports of goods and services, net primary income, and net secondary income	World Development Indicators, World Bank (2021)
GINI	The Gini index is a statistical measure that assesses the level of inequality in the distribution of income or consumption among individuals or households within an economy. A Gini index of 0 signifies a scenario of perfect equality, where every individual or household has an identical share of the total income or consumption. On the other hand, an index of 1 represents a situation of absolute inequality, where a single individual or household possesses all the income or consumption, while others have none	World Development Indicators, World Bank (2021)
SOCIAL	Percentage of internet users	International Telecommunication Union (ITU) (2021)
TOP5	Percentage of total assets held by the five largest banks in a given commercial banking assets	Global Financial Developent, World Bank, (2021)
BAS	Total assets held by deposit money banks as a share of GDP	Global Financial Developent, World Bank, (2021)

REFERENCES

Adewoye, J. (2013). Impact of mobile banking on service delivery in the Nigerian commercial banks. *International Review of Management and Business Research*, *2*(2), 333.

Afonso, A., & Blanco Arana, C. (2018). Financial development and economic growth: a study for OECD countries in the context of crisis. *REM Working paper*, 046-2018.

Alonso, J. A., & Garcimartín, C. (2013). The determinants of institutional quality. More on the debate. *Journal of International Development*, *25*(2), 206-226.

Anginer, D., Demirguc-Kunt, A., & Zhu, M. (2014). How does deposit insurance affect bank risk? Evidence from the recent crisis. *Journal of Banking & finance*, *48*, 312-321.

Audi, M. (2016). Adoption of mobile banking applications in Lebanon.

Bats, J. V., & Houben, A. C. (2020). Bank-based versus market-based financing: Implications for systemic risk. *Journal of Banking & finance*, *114*, 105776.

Bebczuk, R., & Galindo, A. (2008). Financial crisis and sectoral diversification of Argentine banks, 1999–2004. *Applied Financial Economics*, *18*(3), 199-211.

Bekaert, G., Harvey, C. R., & Lundblad, C. (2005). Does financial liberalization spur growth? *Journal of Financial economics*, *77*(1), 3-55.

Belkhir, M., Naceur, S. B., Candelon, B., & Wijnandts, J.-C. (2022). Macroprudential policies, economic growth and banking crises. *Emerging Markets Review*, *53*, 100936.

Bhuvana, M., & Vasantha, S. (2019). Ascertaining the mediating effect of financial literacy for accessing mobile banking services to achieve financial inclusion. *International Journal of Recent Technology and Engineering*, *7*(6), 1182-1190.

Blackburn, K., & Forgues-Puccio, G. F. (2010). Financial liberalization, bureaucratic corruption and economic development. *Journal of International Money and Finance*, *29*(7), 1321-1339.

Boadi, I., Osarfo, D., & Boadi, P. (2019). Bank-based and market-based development and economic growth: An international investigation. *Studies in Economics and Finance*, *36*(3), 365-394.

Bonfiglioli, A., & Mendicino, C. (2004). Financial liberalization, bank crises and growth: Assessing the links. *Economics and Finance Working Paper*(567).

Boyd, J. H., & Gertler, M. (1994). The role of large banks in the recent US banking crisis. *Federal Reserve Bank of Minneapolis Quarterly Review*, *18*(1), 2-21.

Bresser-Pereira, L. C. (2010). The global financial crisis and a new capitalism? *Journal of Post Keynesian Economics*, *32*(4), 499-534.

Broner, F. A., & Ventura, J. (2010). *Rethinking the effects of financial liberalization*.

Butkiewicz, J. L., & Yanikkaya, H. (2006). Institutional quality and economic growth: Maintenance of the rule of law or democratic institutions, or both? *Economic Modelling*, *23*(4), 648-661.

Caraballo, M. Á., Dabús, C., & Delbianco, F. (2017). Income inequality and economic growth revisited. A note. *Journal of International Development*, *29*(7), 1025-1029.

Chortareas, G. E., Girardone, C., & Ventouri, A. (2013). Financial freedom and bank efficiency: Evidence from the European Union. *Journal of Banking & finance*, *37*(4), 1223-1231.

Cipollini, A., & Fiordelisi, F. (2009). The impact of bank concentration on financial distress: the case of the European banking system.

Commission, F. C. I. (2011). *The financial crisis inquiry report: The final report of the National Commission on the causes of the financial and economic crisis in the United States including dissenting views*. Cosimo, Inc.

Correa, R., Lee, K. H., Sapriza, H., & Suarez, G. A. (2014). Sovereign credit risk, banks' government support, and bank stock returns around the world. *Journal of Money, Credit and Banking*, *46*(s1), 93-121.

Cubillas, E., & González, F. (2014). Financial liberalization and bank risk-taking: International evidence. *Journal of Financial Stability*, *11*, 32-48.

Davidson, R., & MacKinnon, J. G. (1984). Convenient specification tests for logit and probit models. *Journal of Econometrics*, *25*(3), 241-262.

Dbouk, W., Fang, Y., Liu, L., & Wang, H. (2020). Do social networks encourage risk‐taking? Evidence from bank CEOs. *Journal of Financial Stability*, *46*, 100708.

Demirgüç-Kunt, A., & Detragiache, E. (1998). The determinants of banking crises in developing and developed countries. *Staff papers*, *45*(1), 81-109.

Demirgüç-Kunt, A., & Levine, R. (2001). Bank-based and market-based financial systems: Cross-country comparisons. *Financial structure and economic growth: A cross-country comparison of banks, markets, and development*, 81-140.

Dijk, O. (2017). Bank run psychology. *Journal of Economic Behavior & Organization*, *144*, 87-96.

Dobravolskas, A., & Seiranov, J. (2011). Financial stability as the goal of post-crisis regulatory

reforms. *Verslo sistemos ir ekonomika*(1), 101-114.

Eichengreen, B., & Arteta, C. (2002). Banking crises in emerging markets: presumptions and evidence. *Financial policies in emerging markets*, 47-94.

Elhajjar, S., & Ouaida, F. (2020). An analysis of factors affecting mobile banking adoption. *International Journal of Bank Marketing*, *38*(2), 352-367.

Fernando, R. (2020). Global impact of loss of confidence in Asian emerging markets. *The World Economy*, *43*(7), 1907-1927.

Fonteyne, W., Bossu, W., Cortavarria-Checkley, L., Giustiniani, A., Gullo, A., Hardy, D., & Kerr, S. (2010). Crisis management and resolution for a European banking system.

Fratianni, M., & Marchionne, F. (2017). Bank asset reallocation and sovereign debt. *Journal of International Financial Markets, Institutions and Money*, *47*, 15-32.

Gathu, R. M., & Njenga, P. (2021). Effect of Mobile Banking on the Performance of Co-operative Bank of Kenya. *Journal of Finance and Economics*, *9*(5), 193-200.

Giannetti, M. (2007). Financial liberalization and banking crises: The role of capital inflows and lack of transparency. *Journal of Financial Intermediation*, *16*(1), 32-63.

Gluzmann, P., & Guzman, M. (2017). Assessing the robustness of the relationship between financial reforms and banking crises. *Journal of International Financial Markets, Institutions and Money*, *49*, 32-47.

Goyal, A. (2012). The future of financial liberalization in South Asia.

Hamdaoui, M., & Maktouf, S. (2019). Overall effects of financial liberalization: financial crisis versus economic growth. *International Review of Applied Economics*, *33*(4), 568-595.

Ho, J. C., Wu, C.-G., Lee, C.-S., & Pham, T.-T. T. (2020). Factors affecting the behavioral intention to adopt mobile banking: An international comparison. *Technology in Society*, *63*, 101360.

Hoque, H., Andriosopoulos, D., Andriosopoulos, K., & Douady, R. (2015). Bank regulation, risk and return: Evidence from the credit and sovereign debt crises. *Journal of Banking & finance*, *50*, 455-474.

Iyer, R., & Puri, M. (2012). Understanding bank runs: The importance of depositor-bank relationships and networks. *American Economic Review*, *102*(4), 1414-1445.

Jacobs, J. P., & Kuper, G. H. (2007). Currency crises in Asia: a multivariate logit approach. In *Asia-Pacific Financial Markets: Integration, Innovation and Challenges* (Vol. 8, pp. 157-173).

Emerald Group Publishing Limited.

Janson, N. (2009). Internet Banking and the question of Bank Run: lesson from the Northern Rock Bank case. *Journal of internet banking and commerce*, *14*, pp. 2-7.

Johnson, W. F. (2011). International economic freedoms, banks and the market crisis of 2007–2009. *Journal of Banking Regulation*, *12*, 195-209.

Kazi, A. K., & Mannan, M. A. (2013). Factors affecting adoption of mobile banking in Pakistan: Empirical Evidence. *International Journal of Research in Business and Social Science (2147-4478)*, *2*(3), 54-61.

Keefer, P. (2002). *Politics and the determinants of banking crises: The effects of political checks and balances*. Banco Central de Chile.

Kiss, H. J., Rodriguez-Lara, I., & Rosa-García, A. (2014). Do social networks prevent or promote bank runs? *Journal of Economic Behavior & Organization*, *101*, 87-99.

Klomp, J. (2010). Causes of banking crises revisited. *The North American Journal of Economics and Finance*, *21*(1), 72-87.

Kordbacheh, H., & Sadati, S. Z. (2022). Corruption and banking soundness: does natural resource dependency matter? *Journal of Financial Crime*, *29*(1), 293-308.

Laeven, L., & Valencia, F. (2020). Systemic banking crises database II. *IMF Economic Review*, *68*, 307-361.

Laforet, S., & Li, X. (2005). Consumers' attitudes towards online and mobile banking in China. *International Journal of Bank Marketing*, *23*(5), 362-380.

Laukkanen, T. (2017). Mobile banking. *International Journal of Bank Marketing*, *35*(7), 1042-1043.

Levine, R. (2001). International financial liberalization and economic growth. *Review of international Economics*, *9*(4), 688-702.

Li, S., & Li, J. (2016). Social network structures and bank runs. *The European Physical Journal B*, *89*, 1-5.

Madies, P. (2006). An experimental exploration of self-fulfilling banking panics: their occurrence, persistence, and prevention. *The journal of business*, *79*(4), 1831-1866.

Majerbi, B., & Rachdi, H. (2014). Systemic banking crises, financial liberalization and governance. *Multinational Finance Journal*, *18*(3/4), 281-336.

Malaquias, R. F., & Hwang, Y. (2019). Mobile banking use: A comparative study with Brazilian

and US participants. *International Journal of Information Management*, *44*, 132-140.

Marchionne, F., Pisicoli, B., & Fratianni, M. (2022). Regulation, financial crises, and liberalization traps. *Journal of Financial Stability*, *63*, 101060.

Milesi-Ferretti, G. M., & Razin, A. (1996). Persistent current account deficits: a warning signal? *International Journal of Finance & Economics*, *1*(3), 161-181.

Mishkin, F. S. (2011). Over the cliff: From the subprime to the global financial crisis. *Journal of Economic Perspectives*, *25*(1), 49-70.

Moyo, C., & Le Roux, P. (2020). Financial liberalisation, financial development and financial crises in SADC countries. *Journal of Financial Economic Policy*, *12*(4), 477-494.

Nakatani, R. (2020). Macroprudential policy and the probability of a banking crisis. *Journal of Policy Modeling*, *42*(6), 1169-1186.

Nguyen, T. C., Castro, V., & Wood, J. (2022). Political environment and financial crises. *International Journal of Finance & Economics*, *27*(1), 417-438.

Nkoa, B. E. O., & Song, J. S. (2020). Does institutional quality affect financial inclusion in Africa? A panel data analysis. *Economic Systems*, *44*(4), 100836.

Ouedraogo, R., Mlachila, M., Sourouema, W. S., & Compaoré, A. (2022). The impact of conflict and political instability on banking crises in developing countries. *The World Economy*, *45*(6), 1937-1977.

Rezgallah, H., Özataç, N., & Katircioğlu, S. (2019). The impact of political instability on risk-taking in the banking sector: International evidence using a dynamic panel data model (System-GMM). *Managerial and Decision Economics*, *40*(8), 891-906.

Rhee, D.-E., & Kim, H. (2018). Does income inequality lead to banking crises in developing countries? Empirical evidence from cross-country panel data. *Economic Systems*, *42*(2), 206-218.

Roy, S., & Kemme, D. M. (2012). Causes of banking crises: Deregulation, credit booms and asset bubbles, then and now. *International Review of Economics & Finance*, *24*, 270-294.

Safeena, R., Date, H., Kammani, A., & Hundewale, N. (2012). Technology adoption and Indian consumers: study on mobile banking. *International Journal of Computer Theory and Engineering*, *4*(6), 1020.

Saha, S., & Sen, K. (2023). Do economic and political crises lead to corruption? The role of

institutions. *Economic Modelling*, *124*, 106307.

Saidi, H., Rachdi, H., & Mgadmi, N. (2017). Revisiting the role of governance and institutions in the impact of financial liberalization on economic growth using the PSTR model. *Panoeconomicus*, *64*(3), 315-336.

Sampaio, C. H., Ladeira, W. J., & Santini, F. D. O. (2017). Apps for mobile banking and customer satisfaction: a cross-cultural study. *International Journal of Bank Marketing*, *35*(7), 1133-1153.

Satheesh, M. K., & Nagaraj, S. (2021). Applications of artificial intelligence on customer experience and service quality of the banking sector. *International Management Review*, *17*(1), 9-17.

Sever, C. (2022). Financial crises and institutional quality. *International Journal of Finance & Economics*, *27*(1), 1510-1525.

Shaikh, A. A., & Karjaluoto, H. (2015). Mobile banking adoption: A literature review. *Telematics and informatics*, *32*(1), 129-142.

Shehzad, C. T., & De Haan, J. (2009). Financial liberalization and banking crises. Conference of the Royal Economic Society, University of Surrey (April 20–22, 2009),

Suljić Nikola, S., Olgić Draženović, B., & Buterin, V. (2022). Deposit insurance, banking stability and banking indicators. *Economic research-Ekonomska istraživanja*, *35*(1), 5632-5649.

Sultana, R. (2009). Mobile banking: Overview of regulatory framework in emerging markets. 4th Communication Policy Research, South Conference, Negombo, Sri Lanka,

Talley, S., & Mas, I. (1990). Deposit insurance in developing countries. *World Bank Policy Research Working Paper*(548).

Tiwari, R., Buse, S., & Herstatt, C. (2007). Mobile services in banking sector: the role of innovative business solutions in generating competitive advantage. Proceedings of the international research conference on quality, innovation and knowledge management,

Ugwuanyi, G. O., & Amanze, P. G. (2014). Banking sector reform: An approach to restoring public confidence on the Nigerian Banking Industry. *Research Journal of Finance and Accounting*, *5*(6), 109-121.

Valeriani, E., & Peluso, S. (2011). The impact of institutional quality on economic growth and development: An empirical study. *Journal of Knowledge Management, Economics and Information Technology*, *1*(6), 1-25.

Weller, C. E. (2001). Financial crises after financial liberalisation: Exceptional circumstances or structural weakness? *Journal of Development Studies*, *38*(1), 98-127.

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