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Risk management in banks: The role of fintech

A comparison between emerging and developed markets

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ABSTRACT:

This thesis examines whether the adoption of financial technology (fintech) enhances risk management effectiveness in banks and whether the impact differs between emerging and developed financial markets. Banks face various risks, such as credit, operational and exchange rate risk. Risk management is crucial for both the stability and profitability of the banks, but also for broader national economic goals. The thesis is comparative in nature, and it relies on existing studies and literature from selected emerging markets (Saudi Arabia, China, and Indonesia) and developed financial markets (the United States, Canada, and the United Kingdom). The findings of the comparative analysis show that fintech adoption is strongly context-dependent when examining risk management practices and success. However, the examined literature also shows that fintech adoption strongly interacts with market maturity, regulatory quality, and institutional capacity. If these factors are taken into consideration, the analysis shows that fintech adoption generally improves banks' risk management capabilities by strengthening risk detection, operational efficiency, and monitoring.

In developed markets, more advanced digital infrastructures and stronger regulatory frameworks result in more consistent improvements in financial resilience because of deeper integration of fintech. Emerging markets also show to benefit from fintech adoption in FRM practices, particularly in operational efficiency and early risk detection. However, these effects are more constrained by regulatory issues, technological limitations, and governance challenges. Overall, the findings support the view that while the effectiveness of fintech is largely context-dependent, it improves risk management practices in banks. The positive impact of fintech is also more pronounced in developed financial markets like the United States, Canada, and the United Kingdom, where market maturity and technological capabilities play a significant role in fintech usage. In emerging markets, the impact of fintech in FRM more critically depends on institutional and regulatory conditions, as well as technological capability. For these reasons, this thesis shows that fintech tools should, therefore, be used as a risk management tool, but needs to be aligned with market structures, supervisory capacity, and banks' internal governance frameworks.

KEYWORDS: Financial technology, risk management, banks (monetary institutions), artificial intelligence, economic regulation, emerging markets, developed countries.

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TIIVISTELMÄ:

Tässä opinnäytetyössä tarkastellaan, parantaako finanssiteknologian (fintechin) käyttöönotto pankkien riskienhallinnan tehokkuutta ja eroavatko vaikutukset kehittyvien ja kehittyneiden rahoitusmarkkinoiden välillä. Pankit kohtaavat erilaisia riskejä, kuten luotto-, operatiivisia ja valuuttakurssiriskejä. Riskienhallinta on tärkeää sekä pankkien vakauden ja kannattavuuden että laajempien kansallisten taloudellisten tavoitteiden kannalta. Opinnäytetyö on luonteeltaan vertaileva, ja se perustuu olemassa oleviin tutkimuksiin ja kirjallisuuteen valituilta kehittyviltä markkinoilta (Saudi-Arabia, Kiina ja Indonesia) ja kehittyneiltä rahoitusmarkkinoilta (Yhdysvallat, Kanada ja Yhdistynyt kuningaskunta). Vertailevan analyysin tulokset osoittavat, että finanssiteknologian käyttö on vahvasti kontekstiriippuvainen kun katsotaan riskienhallintakäytäntöjä. Tutkittu kirjallisuus osoittaa kuitenkin myös, että finanssiteknologian käyttöönotto on vahvasti vuorovaikutuksessa markkinoiden kypsyyden, sääntelyn laadun ja institutionaalisen kapasiteetin kanssa. Jos nämä tekijät otetaan huomioon, analyysi osoittaa, että finanssiteknologian käyttöönotto yleensä parantaa pankkien riskienhallintakykyä vahvistamalla riskien havaitsemista, toiminnan tehokkuutta ja seurantaa.

Kehittyneillä markkinoilla kehittyneemmät digitaaliset infrastruktuurit ja vahvemmat sääntelykehykset johtavat systemaattisempaan taloudellisen häiriönsietokyvyn paranemiseen finanssiteknologian syvemmän integraation ansiosta. Kehittyvät markkinat osoittavat myös hyötyvänsä finanssiteknologian käyttöönotosta, erityisesti toiminnan tehokkuuden ja riskien varhaisen havaitsemisen osalta. Näitä vaikutuksia kuitenkin rajoittavat enemmän sääntelyaukot, teknologiset rajoitukset ja hallintoon liittyvät haasteet. Havainnot tukevat näkemystä, että vaikka finanssiteknologian tehokkuus on pitkälti kontekstista riippuvaista, se parantaa pankkien riskienhallintakäytäntöjä. Finanssiteknologian positiivinen vaikutus on myös selvempi kehittyneillä rahoitusmarkkinoilla, mutta kehittyvillä markkinoilla se riippuu kriittisemmin institutionaalisista ja sääntelyolosuhteista. Näistä syistä tämä opinnäytetyö osoittaa, että finanssiteknologiatyökaluja tulisi siksi käyttää riskienhallintatyökaluna vain silloin, kun ne ovat linjassa markkinarakenteiden, valvontakapasiteetin ja pankkien sisäisten hallintokehysten kanssa.

AVAINSANAT: Financial technology, risk management, banks (monetary institutions), artificial intelligence, economic regulation, emerging markets, developed countries.

Contents

1 Introduction

Banks operate in an environment filled with uncertainty. Every day, they deal with lending, investments, and foreign transactions that expose them to different kinds of risks. Financial risk management (later referred to as FRM) is the process of using various financial instruments with the intention of protecting the economic worth of the bank to manage risk exposure (Stulz, 2019, p. 1). Banks face many kinds of risks, such as operational risk, exchange rate risk, credit risk, and compliance risk. The effectiveness of risk management is, hence, central to this paper's research question, as it determines how well banks use fintech and other tools to mitigate these risks and sustain financial stability (Alsahlawi, 2021). Effective risk management helps banks avoid large financial losses and maintain customer confidence. It also allows them to make better financial decisions and comply with regulatory requirements designed to keep the financial system stable. Modern FRM involves both quantitative tools, like financial models, and qualitative approaches, like policies and staff training (Alsahlawi, 2021).

The development of financial technology (fintech) has transformed traditional practises and it important to examine the impact across different types of financial markets, because of the changes to financial risk management with the increase use of fintech. In developed markets, banks operate with advanced technological infrastructure, complex derivatives markets, and an established regulatory system. Fintech tools can hence be integrated more rapidly into risk management processes. In contrast, emerging markets face many more constraints, such as market maturity, institutional constraints and evolving regulatory structures. Therefore, understanding the influence of fintech in each context on the effectiveness of risk management strategies directly motivates this thesis.

The end goal of using FRM is not to entirely remove all risk, but to manage it better. By doing this, banks can remain profitable, resilient, and capable of supporting economic growth even during periods of financial stress. Traditional bank risk-management methods, as discussed later in this thesis, have relied heavily on manual processes, historical

data, and much slower reporting systems. This has limited the speed and accuracy with which risks are identified and how fast they can be mitigated. The benefits gained from the implementation of fintech has been transformative in many financial markets, both emerging and developed.

1.1 Research Question and Hypotheses

The purpose of this thesis is to examine how risk management is carried out in banks through the growing use of fintech. The purpose of this thesis is also to consider the differences between emerging markets and developed markets and how institutional, regulatory, and technological factors contribute to risk management practices. This subject is significant to explore because the way in which financial systems evolve under different circumstances and in different stages of economic development and maturity affects global financial markets. As explored later in this thesis, emerging markets experience faster structural change, higher volatility, and rapid adoption of new technologies. This means that the implementation of fintech needs to cater to their market maturity, regulatory structures, and the needs of the financial markets in that specific country.

Studying the two different markets through the chosen countries and examining their use of fintech in risk management is relevant, since emerging markets tend to face distinct challenges compared to developed markets. Prior studies show this distinction, with Alsahlawi (2021), Yu (2024), and Ridwan & Fakhrurroja (2025) exploring emerging markets, while Kalari & Toukabri (2024), Pantos (2023), and Elekdag et al. (2025) show more advanced fintech integration in developed countries through their empirical studies.

This kind of comparative analysis is essential for policymakers, investors, and regulators in understanding how digitalisation affects banks around the world, and how financial resilience can be strengthened, as well as fintech's role in narrowing the gap between emerging financial markets and developed financial markets. By comparing these

markets, stakeholders can identify best practices for fintech usage that is context dependent. These important topics lead to the following research questions and hypotheses:

RQ1: How does the adoption of fintech influence the effectiveness of risk management practises in banks in different financial markets?

RQ2: How does the impact of fintech adoption on risk management differ between banks operating in developed and emerging markets?

In order to answer these research questions, two hypotheses are presented in this thesis:

H_1: The adoption of fintech technologies positively influences the effectiveness of risk management.

H_2: The positive impact of fintech adoption on risk management is stronger in banks in developed countries than in those in developing countries.

1.2 Structure of the Thesis

The introduction chapter of this thesis presents the hypotheses, motivation, and purpose of this study. Chapter Two gives definitions for the terms used in this paper and gives context for the types of risks that financial institutions face. Chapter Three explores emerging and developed financial markets, particularly focusing on comparing differences in fintech implementation and regulatory issues across market types. Chapter Three also explores empirical evidence of fintech usage in the two different markets. Chapter Four presents the findings from the previous chapter with comparisons, and the findings from the previous chapter are critically evaluated and contrasted. A counterargument is also introduced to address an opposing view to the findings. Finally, Chapter Five concludes the thesis by summarising the findings and directly answering the hypotheses.

2 Theoretical background

2.1 Why do banks need to manage risk?

Banks need to regularly track currency exposures to ensure that risks are managed accordingly. Banks maintain currency position reports, which show how much they hold in each currency, including loans, deposits, derivatives, and off-balance-sheet items (Rule, 2015). This monitoring allows banks to identify mismatches in their balance sheet early on and take action to control them, such as entering a forward contract or swap (G20 Implementation Monitoring Review: Interim Report, 2025, p. 6). Since authorities require banks to maintain proper risk controls and capital adequacy, reporting also ensures regulatory compliance. By matching assets and liabilities, aligning operations with cash flows, and continuously tracking exposures, banks can actively manage exchange rate risk (ibid).

Banks face many types of risks, such as changes in interest rates, exchange rates, and market prices. Banks use derivatives as a risk management tool to hedge against risks, thereby managing their exposure and stabilising their financial performance (Hull, 2022, p. 33-39). The effectiveness of derivatives, however, depends mainly on timely market information, accurate pricing models, and effective counterparty and settlement processes. Traditionally, banks have relied on manual analytics, which has meant there are slower market data feeds and the need for intermediaries for execution and clearing, which have increased transaction costs and operational risks in using derivatives (Gaur & Jolly, 2023).

2.2 Fintech

Financial technology (also known as fintech) refers to the use of modern digital tools to improve and automate financial services. According to the Financial Stability Board (2022), fintech means “technologically enabled financial innovation that creates new business models, processes, or products with a major impact on financial markets and

institutions" (*Artificial Intelligence and Machine Learning in Financial Services*, 2017, p. 35). Fintech comprises of a variety of tools that serve specific functions within financial markets. For example, some fintech tools are designed for payment processing, while others facilitate through peer-to-peer platforms of automated credit assessment algorithms. Additionally, as also explored within this thesis, fintech solutions often focus on automation of processes, such as through the use of trading platforms for more faster and more efficient execution. Fintech has enabled significantly faster, cheaper, and more secure financial activities, like payments, lending, investing, and trading, by integrating technology into financial processes (Cherki & Seffih, 2024, p. 370-373).

Fintech encompasses a wide range of technologies. Artificial intelligence (AI) and machine learning (ML) help analyse large amounts of financial data and make predictions (Alsahlawi, 2021). Big data allows banks and financial firms to handle and understand vast information flows. Blockchain technology enables safe and transparent transactions without traditional intermediaries like banks (ibid). Cloud computing means that there is quick and flexible access to financial systems, and the Internet of Things (IoT) connects devices to collect real-time financial information, which can be very useful for banks to make quick decisions.

2.3 The implementation of fintech in banks

Fintech has changed how banks deal with risk. The wide range of technologies, as mentioned above, aids banks in making financial services faster, safer, and easier to manage. Technologies like AI and ML help banks predict problems before they occur, for example, spotting when a borrower might fail to repay a loan or when market prices are likely to change quickly (Cherki & Seffih, 2024). Big data collection helps banks integrate theoretical risk assessment models with real-time operational decisions, improving both the speed and accuracy of risk assessment. Big data collection can be utilised with both customers and internal risk management practises.

Fintech has, very recently, made huge steps in how effectively it is used in the financial sector and has significantly reshaped how risk management is approached. The term “fintech” only rose in significance recently, however, its roots can be dated back to the late 1960s, when the transition from analogue to digital finance began, with innovations such as the handheld calculator and the ATM (Arner et al., 2017, p. 378). Faster development came in the 1970s and 1980s, where reductions in systematic risks became prominent through faster and more secure transactions (Arner et al., 2017, p. 374). Hence, the first examples of technology-driven risk mitigation in global finance are from these early systems. By the early 2000s, financial markets had shifted almost entirely to electronic trading, which paved way for high-frequency and algorithmic trading models, which significantly improved speed and efficiency. These newer technological advances required improved safeguards and new regulations because of events like the 1987 crash and 2010 flash crash, both involving volatility of markets (Arner et al., 2017, p. 379).

The 2008 financial crisis was a major turning point in fintech’s modern development, since it exposed weaknesses in the existing regulatory structures (Arner et al., 2017, p. 374). However, due to this, there was accelerated technical innovation and an increased need for stronger oversight systems (ibid). Distrust in traditional financial institutions after the crisis, alongside increasing commoditisation of financial technologies, paved the way for fintech start-ups, which offered alternative financial services (Arner et al., 2017, p. 374).

Implementation of fintech in financial services has, however, simultaneously created new forms of operational and consumer-level risks that current regulations could not manage (ibid). Risk management has recently, especially in emerging markets, shifted from manual, paper-based approaches toward more data-driven, technology-assisted frameworks (Arner et al., 2017, p. 379). The increased implementation of fintech in the financial sector shows a rapid shift from basic digitalisation to a deeply data-centric model of risk management, and this has transformed the way financial institutions mitigate different types of risks they may face.

Fintech has also made trading in derivatives easier and more accessible through online platforms like Binance (Cherki & Seffih, 2024). The authors emphasise that platforms like Binance enable a much wider range of institutions and investors to trade derivatives that are linked to digital assets, such as those with limited technological capabilities. This access has enabled increased participation in hedging markets, meaning banks and firms that previously required highly specialised workers or significant technological infrastructure are also able to access instruments these instruments. Cherki & Seffih (2024) also note in their paper, that these fintech platforms reduce trading and settlement costs compared to traditional derivative markets, where administrative fees play a much larger role. Fintech, by lowering friction, allows expanded economic feasibility of hedging, especially for smaller or more frequent transactions (Cherki & Seffih, 2024).

2.4 Risk and Exposure

Risk, particularly in the context of multinational banks adopting fintech, is fundamentally defined as the uncertainty that has adverse consequences on earnings or wealth (Bessis, 2015, p. 2). This is the perspective taken by regulators and risk managers, whose role it is to identify, assess and control the likelihood and consequences of such negative outcomes (ibid). Within banking, this uncertainty can appear across several major types of financial risk. In the context of this thesis, three main types of risks will be discussed: credit risk, operational risk, and FX (foreign exchange) risk. In addition to these, systematic and unsystematic risk are discussed in Section 2.6.

To assess these risks in practice, it is necessary to consider exposure as well as risk. Exposure refers to how much is at stake, if a given risk materialises (Bessis, 2015, p. 23-24). While risk refers to the probability and impact of the loss, exposure is the size of the position that can be lost (ibid). Transactional exposure happens when a bank has future payments or receipts in a foreign currency (Bodie et al., 2014). If exchange rates change prior to the transaction being complete, the amount received or paid in the home currency will change. Transactional risk can also be seen as the short/term cash flow risk.

Translational exposure can also occur when a company has foreign subsidiaries and needs to convert their financial statements into the home currency for reporting (ibid). Exchange rates can make the reported value of assets, liabilities, or profits higher or lower, even when no money has moved. Economic exposure is the long-term effect of exchange rate changes on a company's market value or competitive position, and it affects future cash flows and overall profitability, not just the specific transactions (ibid). For example, if the Euro strengthens, a European bank's loans may become much more expensive for foreign borrowers, which reduces competitiveness and future income for the bank. Economic risk is the long-term and competitiveness risk. Economic exposure, therefore, represents a long-term strategic risk.

2.4.1 Credit risk

Credit risk is a core financial risk that affects banks and other lenders. Credit risk is defined as the risk of losses due to the borrower failing to meet its contractual obligations on time or in full (Fight, 2004, p. 1-5). Essentially, credit risk arises whenever financial institutions extend their credit in the form of loans, overdrafts, trade credit, or other credit facilities, and hence exposes the lender to the potential losses if the counterparty is unable or unwilling to repay principal or interest (ibid). Fight (2004) emphasises that effective credit risk management involves both the evaluation of the borrower's credit worthiness and the ongoing management of exposures throughout the credit life cycle, from the origination of the loan to the repayment. Fight (2004) also highlights the foundational role of credit analysis, which combines the assessment of financial and non-financial factors, financial statement and cash-flow analysis, and ratio metrics. This is to understand the likelihood of default and the potential severity of loss.

2.4.2 Operational risk

Operational risk refers to the risk of direct or indirect losses resulting from failed internal processes, people, and systems, or from external events (Bessis, 2015, p. 26-27). Operational risks are also the malfunctions of reporting systems or information systems, which

are designed to take corrective actions quickly (ibid). In the context of banking, operational risk can come from sources like fraud, cyberattacks, system failures, human error, or disruptions caused by events such as natural disasters. Operational risk (when compared to credit or market risk) differs significantly, because it is inherent in the daily functioning of banking operations, and is not driven by financial market movements. For effective operational risk management (that addresses both anticipated and emerging threats), banks need to maintain resilient internal controls, regularly update technological systems, and maintain comprehensive internal policies (Bessis, 2015, p. 29-33).

The adoption of fintech can both mitigate and introduce operational risks. While technologies such as automation and artificial intelligence can enhance efficiency and reduce manual errors, they can also create new vulnerabilities, particularly related to cybersecurity and model risks. Therefore, multinational banks need to develop dynamic operational risk frameworks to identify, assess, monitor, and manage these risks in an evolving digital environment (Basel Framework, 2025).

2.4.3 Foreign exchange (FX) risk

Foreign exchange risk refers to the possibility of losses arising from changes in the exchange rates. These changes can affect a firm or bank's earnings when revenues or expenses are linked to foreign currencies, as well as alter the value of assets and liabilities held in foreign currencies, known as translation risk, which is the impact of converting foreign currency values into the home currency (Bessis, 2015, p. 26-29). Foreign exchange rates are categorised by Bessis as one of the "risk factors" that contribute more broadly to market risk (ibid). Market risk, also known as systematic risk, is specifically the risk of losses resulting from adverse market movements that lower the value of the position held by a market player (ibid).

FX risk commonly takes two forms in banking. Transaction risk occurs when future cash flows, like loans, repayments, interest payments, or operating revenues, are settled in a foreign currency, which exposes the firm to uncertainty between the time a transaction

is agreed upon and when it is completed (Bessis, 2015, p. 26-29). Translation risk, by contrast, affects the reported value of foreign-currency-denominated assets and liabilities on the balance sheet, even when no actual cash flow takes place (ibid). In banking, FX risk is important because of increased cross-border lending and global investment activity (ibid). If it is not properly managed, exchange rate fluctuations can increase volatility and affect capital adequacy, which makes FX risk one of the key market risks that banks need to monitor and mitigate through hedging to remain stable (ibid).

2.5 The role of derivatives

It is important to define what derivatives are, since they are the main financial instrument used by financial institutions in reducing currency risk. Derivatives can be defined as financial contracts whose value is derived from the price of an underlying asset, rate, or index (Hull, 2022, p. 23). One of the key roles of derivatives for banks is to be able to develop risk profiles that are individualised with the circumstances and the risk appetite of the market (Gaur & Jolly, 2023, p. 1162). Derivatives can allow banks many advantages, but also require risk management frameworks and governance to be able to maximise the benefits, while simultaneously minimising the potential threats (ibid).

The common types of derivatives used by banks include forward contracts, futures contracts, options and swaps. Each of these has a different method that allows the bank to either lock in future exchange rates, limit potential losses, or exchange cash flows in different currencies (Hull, 2022, p. 23). The use of the different kinds of derivatives helps banks manage the different risks, such as the abovementioned. Each type of derivative is defined in the sections below.

Through the use of derivatives, banks can separate and manage different kinds of financial risks more effectively. For example, a bank can use currency swaps to avoid losses from exchange rate movements, if it has loans in foreign currencies (Hull, 2022, p. 172-173). Derivatives are a significant tool in increasing market efficiency by allowing risk to be transferred to those most willing to take it (ibid). Derivatives can lower costs, stabilise

earnings, and make financial planning more predictable, when used correctly (Gudala, 2012). However, derivatives can also be risky if not properly understood. Banks must ensure they use only instruments that match their goals and risk policies. Effective use of derivatives allows banks to protect themselves while still earning profits in uncertain markets.

2.5.1 Futures, forwards, and swaps

Firstly, forward contracts, are a private agreement between two parties to buy or sell a currency at a fixed exchange rate on a future date. It is customised in terms of amount and maturity (how long it is), making it suitable for the needs of the bank (Hull, 2022, p. 28-30). They are also traded over-the-counter (OTC), rather than on an exchange. Banks use forwards to lock in an exchange rate for future transactions to protect against unfavourable currency movements.

Futures contracts, on the other hand, are like forwards but are standardised contracts traded on regulated exchanges (Hull, 2022, 30). They require daily settlements (marking to market) and involve margin deposits, which means the value of the contract changes daily as the market price of the currency changes (ibid). To make sure both sides can cover the daily gains or losses, futures traders must keep margin deposits to make sure they can cover the daily gains or losses (ibid). To keep the position of the future, the banks must hold sufficient funds to cover them.

A currency swap involves the exchange of principal and interest payments in one currency for those in another (Hull, 2022, p. 172-175). It allows two parties (the banks) to swap their debt obligations to take advantage of better borrowing conditions or manage long-term exposure (ibid). Banks use currency swaps to match the currency of their assets and liabilities to reduce exposure to long-term currency fluctuations. These are also traded OTC and are highly flexible.

2.5.2 Options

Currency options give the holder the right, but not the obligation, to buy or sell a specific amount of a currency at a predetermined rate, also known as the strike price, before or on a set date (Hull, 2022, p. 31). The price of the option is known as the premium, and is the price the holder pays for the flexibility to buy or sell. Call options give the holder the right to buy an asset, while put options grant the right to sell an asset. The price of an option is determined by market supply and demand, meaning that the price is reflective of how investors or banks buying/selling the options expect of future price movements and risk. Furthermore, American-style options can be exercised at any time before or on their expiration date, whereas European-style options may only be exercised on the specific expiration date (Black & Scholes, 1973).

Options in banks are used when the bank wants protection but not the obligation, since they can retain the upside potential (Hull, 2022, p. 31). If the bank wants to protect against currency moving unfavourably, they can buy an option to set the minimum, but if the exchange moves favourably, they do not have to use the option and only lose the premium paid (ibid).

2.6 Modern Portfolio Theory and CAPM

More established financial theories like Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM) have guided risk management in banking prior to the development of fintech-driven approaches. MPT is a theory proposed by Harry Markowitz in 1952, which suggests that investors can minimise risk and optimise returns by holding a diversified portfolio of assets with varying correlations (Markowitz, 2008). In the context of currency risk, however, this means that banks diversify their exposure across different currencies, markets, and instruments to reduce the overall volatility. Banks do this with the goal of achieving an efficient portfolio, where no higher return can be obtained without increasing the risks. Hedging through instruments like forwards or options can be seen to reduce unsystematic (currency-specific) risk, which aligns with MPT principles.

Unsystematic, also known as nonsystematic risk, refers to the type of risk that affects only a specific company, country, or currency but not the whole financial market (Hull, 2022, p. 96). It is also known as diversifiable risk because it can be reduced or eliminated through diversification or hedging. In context, this means that when a bank operates in several countries, it faces a unique risk in each one. These currency movements are specific to certain exchange rates or banks which operate within those currencies, and do not affect all banks and markets equally. Hence, a bank can diversify across different currencies or use hedging instruments to reduce unsystematic risk (Hull, 2022, p. 96, 145).

These theoretical models are reflected later in this thesis through the developed financial market cases, such as the United States, Canada, and the United Kingdom, where advanced diversification and hedging strategies, like forwards and options, are actively deployed to manage currency-specific risk, in direct alignment with MPT principles. Similarly, the Chinese and Indonesian cases, representing emerging markets, show how applying these frameworks improves banks' approaches to balancing exposure and optimising risk-return profiles, even as fintech provides new tools to achieve these theoretical objectives.

CAPM, on the other hand, was developed by Sharpe (1964), Lintner (1965) and Mossin (1966) and extends the assumptions of MPT by linking the asset's expected return to its systematic risk, which is measured in beta (Sharpe, 2008). CAPM helps banks and investors assess whether the expected return from foreign investments compensates for the additional exchange rate risk (ibid). The risk-return trade-off means that even while hedging may reduce volatility, potential returns may also be reduced as a result (Sharpe, 2008). Banks use CAPM to decide how much risk to hedge versus how much to accept for potential gain, or at least in theory.

Systematic risk, as opposed to unsystematic risk, refers to the type of risk that affects the entire market or economy, which cannot be diversified away (Hull, 2022, p. 847). This means that systematic risk arises from market-wide changes, such as interest rate changes, inflation, or global financial crises. Beta measures how sensitive the assets or portfolio is to the overall market movements, meaning it measures the systematic risk of an asset (ibid). In the context of currency risk faced by multinational banks, a bank investing in a foreign asset will be exposed to both currency-specific (unsystematic) risk and market-wide (systematic) risk.

Both MPT and CAPM emphasise the trade-off between risk and return, which is a core issue in managing currency exposures. MPT supports the use of diversification and hedging to stabilise returns. CAPM aids investors' decision-making on how much risk is worth taking relative to the expected returns. The models have long provided the theoretical foundations for understanding how multinational banks aim to balance the risks taken with their financial stability and profits.

Fintech-based tools address many of the limitations presented by these more traditional models. Rather than solely relying on static historical relationships, tools such as real-time data and automated hedging models have enabled banks to manage risk much more flexibly (Mashrur et al., 2020, p. 203208). Machine learning has enabled banks to adapt to evolving market conditions and identify emerging risks much faster and more efficiently than the traditional MPT assumptions of stable correlation structures.

2.7 Regulatory frameworks for the use of derivatives

The use of derivatives is, however, subject to strict regulatory oversight, which banks must adhere to in order to operate effectively. The regulatory oversight for this is guided by the Basel Accords (Basel III and Basel IV), which are international banking regulations set up by the Basel Committee on Banking Supervision (BCBS) (Basel Framework, 2025). The goal of the Basel Framework is to ensure that banks maintain enough capital and

liquidity to be able to withstand financial shocks and, therefore, to strengthen the stability of the global financial system (Basel Framework, 2025, p. 1884).

Under Basel III, derivatives are treated carefully because they can both reduce and create risk. Banks will use derivatives to hedge exposure, but these instruments can also introduce counterparty credit risk, meaning there is risk that the other party in the contract may default (Basel Framework, 2025). Basel III requires banks to hold additional capital to cover the potential losses from derivatives positions. After the financial crisis of 2008, the BCBS in 2020 introduced the Credit Valuation Adjustment (CVA) capital charge, which accounts for the risk of changes in a counterparty's creditworthiness (ibid). More specifically, the CVA is a risk measure used by banks that reflects the market value of the counterparty's credit risk to account for potential losses on derivatives (Basel Framework, 2025, p. 918). Under Basel III, banks must post collateral for over-the-counter derivatives to reduce counterparty risk and stringently manage all derivative exposures through resilient risk models (Basel Framework, 2025, p. 116). This has increased the cost of hedging, making banks much more selective in their derivative usage.

Basel IV builds on Basel III by the addition of (RWAs), referring to how banks calculate risk-weighted assets, including the exposures that arise from derivatives. RWAs are a way for regulators to measure how risky a bank's assets are (Basel Framework, 2025). Since not all assets carry the same risk (such as government bonds compared to loans to a company), banks need to ensure that they have enough capital to cover any potential losses. Each asset is assigned a risk weight, which is presented as a percentage reflecting how risky the asset is, and the higher the risk weight, the more capital a bank must hold (Basel Framework, 2025, p. 223-224). Basel IV introduced stricter standardisation approaches for calculating the exposure, and more transparent reporting (ibid). The standardisation approach for counterparty credit risk replaces older models to better reflect true risk in derivative transactions for banks.

The overall impact of these regulations for banks is greater transparency, higher capital costs, and lastly, a shift towards central clearing. Banks are required to maintain detailed records and improved risk management systems for all derivative trades as a result of the stringent requirements set out by the Basel Framework. For banks, trading derivatives now requires more regulatory capital, which can put limits on how much speculative trading is done. Many derivative transactions must go through central clearinghouses, which are financial institutions that sit in the middle of a trade between the two parties. Since they help mitigate potential risks and help market stability, this is done to better stabilise the financial system and reduce counterparty risk.

Both Basel III and Basel IV make derivative usage safer, ensuring that these tools contribute to financial stability rather than adding systematic risk. This also makes derivative usage more expensive, but encourages the use of derivatives only for genuine hedging and risk management rather than solely for speculation**.** However, a critical observation is that since the increased compliance costs and capital demands can create barriers to participation in derivatives markets, these heightened regulatory requirements may pose challenges for smaller banks or financial institutions in emerging markets. In developed financial markets, this also has the potential to limit market access, reduce competitiveness, and concentrate risk management capacities among larger, more established institutions, since smaller institutions lack the capabilities to participate in derivative usage.

In order to ensure that innovation does not come at the cost of global financial stability, the recent rapid adoption of fintech has required regulators to develop new frameworks for the monitoring of banks. Fintech has introduced new forms of risks that existing regulations do not fully address, in contrast to traditional banking activities, where the abovementioned standards govern capital, liquidity, and counterparty risks. At the global level, the Financial Stability Board (FSB) and the Bank for International Settlements (BIS) have issued guidelines of use to all financial institutions that focus on operational resilience, data governance, and risk management of AI and ML systems (FSB, 2017; BIS,

2025). These frameworks try to encourage banks to ensure transparency and resilience of the fintech tools they use and their monitoring, especially when they are used for trading or derivative pricing. Regulators also emphasise that AI-driven models need to undergo continuous validation and rigorous oversight in order to avoid model risk and algorithmic bias (systematic errors) in the decisions made by the technology (ibid). However, as discussed later, these global guidelines often pose some implementation challenges for emerging markets due to limited regulatory capacity. This underscores the need for context-specific regulatory approaches for financial markets in different stages of development.

3 Comparison around the globe

The literature review consists of previous research done on the risk management methods of multinational banks through the adoption of fintech. Its adoption has significantly increased in both emerging and developed economies, though the motivations and methods of use are different between the two. In developed economies, such as the United States, Canada and the United Kingdom, fintech has evolved more significantly as a part of a broader digital transformation, as an addition to an already developed and sophisticated financial sector. According to Aner et al. (2025), developed markets have spent decades digitising their financial infrastructures, such as electronic payments, automated settlement systems, and algorithmic risk management. In these developed markets, the literature studies below highlight fintech usage as being highly engrained into financial institutions, but also bringing about regulatory issues and a strong insight into the context-dependent nature of fintech use in FRM.

In the emerging markets examined, fintech is being adopted to hedge similar risks as in the developed markets. Empirical studies from these markets, such as in Indonesia, also indicate that fintech adoption has brought about significant improvements in operational efficiency, credit risk assessment, and early warning mechanisms that identify financial distress (both internal and external). However, these countries also show strives in derivatives usage, as is the case in Saudi Arabia, and similar issues of context-dependence on regulatory structures arise in these emerging markets. The benefits of fintech are, however, often slowed by challenges like uneven technological capabilities amongst institutions nationwide and a significant need for stronger regulatory oversight on fintech usage.

3.1 Emerging markets

This section explores the three emerging financial markets of Saudi Arabia, China, and Indonesia. These countries have been chosen due to their growing influence globally, as

well as their varied approaches to fintech adoption. These countries are also good representations of emerging markets because they have key structural features that are present in emerging markets, while still differing in size, institutional structure, and stage of financial development. As explored in the literature below, these three countries all have similar characteristics in fintech adoption. While all three differ in terms of the degree of regulatory maturity, institutional capacity, and market structure, similar themes of strives forward in operational efficiency, and improved risk assessment are present in all. Examining these markets more closely can help identify the patterns that emerge across many emerging markets globally in the use of fintech in risk management.

3.1.1 Saudi Arabia

Saudi Arabia is rapidly changing its position in markets to a more diversified, investment-friendly emerging market from a previously solely oil-dependent economy (*Saudi Arabia: Concluding Statement of the 2025 Article IV Mission*, 2025), and this has shown a need for a more digital-finance agenda, which is embedded in their "Saudi Vision 2030" (FinTech Strategy, n.d.). This "FinTech Strategy" purposely sets targets to expand fintech usage nationally and to increase the share of digital transactions, while simultaneously building resilient regulatory frameworks to attract international capital and innovation. As fintech is becoming an increasingly central part of the country's economic transformation, recent research has examined the implications for the financial stability and financial risk management (FRM) in Saudi banks. A study by Alsahlawi (2021) examines the use of fintech in risk management practices in Saudi Arabia, also examining the role of hedging and derivatives techniques.

Alsahlawi's paper highlights that FRM plays a strategic role in helping banks address exposures to operational, credit, FX and market risks (Alsahlawi, 2021, p. 11). Effective FRM in Saudi Arabia is shown to have combined quantitative tools with strategic decision-making, and as a result, minimised losses and helped maintain performance and profit (Alsahlawi, 2021, p. 11; Karami et al., 2020). This has been significant in the Saudi Arabia case, since in environments that are undergoing rapid structural and technological

change, effective FRM is pertinent. Parallel studies also identify fintech as a significant driver of improved risk-management capabilities. Fintech showed enhanced transparency, strengthened detection systems, and improved risk-scoring accuracy (in the study of Saudi Arabia, which includes digital lending, mobile payments, blockchain, AI-based analytics, and automated processes) (Alsahlawi, 2021, p. 12). Increased the precision of credit assessments and operational controls through the use of machine-learning tools, real-time data flows, and digital channels has enabled banks to recognise emerging risks earlier and respond more effectively (Alsahlawi, 2021, p. 19).

Within this context, Alsahlawi's (2021) study shows that Saudi banks are increasingly adopting fintech tools to improve FRM and to better hedge risk exposures. A clear, positive relationship between fintech adoption and FRM effectiveness is found in the study (Alsahlawi, 2021, p. 19). The structural equation model, used in the paper, showed a strong and significant direct effect of fintech use on FRM. This indicates that technological adoption significantly improves banks' ability to detect, assess, and respond to financial risks. These findings align with global research, showing that early-warning systems, enhances risk analytics, and reduces market-response delays are all improved with fintech (Alsahlawi, 2021, p. 19).

Several mechanisms explain this improvement, according to Alsahlawi. Firstly, fintech expands the bank's data collection and analytics capabilities to be significantly more efficient. Secondly, banks can gather more high-quality information on customers, transactions, and market movements through the use of digital channels and big-data approaches. Finally, machine-learning models use this data gathered earlier to analyse issues such as credit deterioration, anomalous trading patterns, or emerging market stress (Alsahlawi, 2021). This shows that by improving early warning and risk-scoring, fintech strengthens hedging decisions and risk mitigation in Saudi Banks.

According to Alsahlawi, fintech also aids operational efficiency and automated controls within the banks. The paper highlighted innovations such as chatbots, real-time mobile

apps and automated settlement systems have reduced processing delays and operational errors, hence lowering any operational risk. The reduced operational friction also makes it easier for banks to execute hedging strategies, which means that they are able to enter or adjust derivative positions quickly to respond to exchange rate movements, improving the timeliness and precision of hedging.

Thirdly, fintech and market development initiatives under Saudi Vision 2030 created new, regulated venues for hedgers and makes hedging instruments more accessible domestically (Saudi Arabia: Concluding Statement of the 2025 Article IV Mission, 2025). Specifically, the planned expansion of derivatives markets on the Saudi Exchange means that Saudi Arabia intends to enable significant growth in their financial sector. Alsahlawi noted that the development of exchange-traded futures and options in Saudi Arabia is also intended to attract local and international hedgers, hence increasing available tools for currency, interest-rate, and commodity hedging (Alsahlawi, 2021, p. 12). The growth of a domestic derivatives market reduces reliance on counterparties abroad and can lower counterparty and liquidity risk for local banks. These findings are consistent with global evidence that hedging and derivative techniques reduce earnings volatility and stabilise cash flows in both developed and emerging markets (Alsahlawi, 2021, p. 12-13).

At the same time, the paper also gathered information from prior studies showing that fintech's risk benefits are not automatic. While fintech can greatly improve fraud detection and credit scoring, it gives way to new vulnerabilities such as cyber risk, model risk (such as algorithmic biases), and legal/regulatory uncertainty. Alsahlawi makes a point in the paper that fintech's positive impact on FRM is conditional on effective financial decision-making, oversight, and integration of fintech effects broader hedging policies. The study finds evidence that that banks need to implement fintech insights alongside effective governance to get real hedging improvements from technological gains. This underscores the view that effective financial and internal decisions influence the fintech-FRM relationship. This mirrors global literature arguing that, only when paired with

informed decisions, oversight, and risk-governance frameworks, technology can improve FRM (Alsahlawi, 2021, p. 13; Chaudhry et al., 2022).

The empirical results from Alsahlawi reinforce this idea. Fintech adoption showed one of the strongest positive coefficients on FRM in the structural model, and mediation analysis indicated that improved financial decision processes (enabled by fintech) partially explain the benefit (Alsahlawi, 2021). The paper's findings align with broader literature reviewed, which similarly link fintech use to better risk detection and more efficient markets, although with caution about new technology risks. Furthermore, the IMF reported that Saudi Arabia's economy has had a positive increase in its resilience to financial shocks due to the increased use of fintech in risk management (Saudi Arabia: Concluding Statement of the 2025 Article IV Mission, 2025).

The Saudi case highlights that the use of fintech should be as a complement to traditional hedging and derivative-based risk-mitigation strategies, rather than as a tool in isolation. This aligns with global trends identified throughout the literature, particularly when the market continues to develop, fintech can improve information quality, speed, and access to risk-management instruments. As with evidence from both developed and other emerging markets, the effectiveness of these benefits in Saudi Arabia is contingent on strong governance, model validation, regulatory support, and the integration of fintech insights into internal FRM and hedging policies. These findings emphasise the conditional nature of fintech's risk-management potential, requiring not only technological adoption, but also institutional and regulatory readiness.

3.1.2 China

The second evidence studied is from China, which, despite being the world's second largest economy, still shows the core characteristics of an emerging market, including evolving regulatory frameworks, uneven financial digitalisation, and a banking system which is still transitioning towards more advanced risk management practises (Yu, 2024, p. 2). This study explores how Chinese commercial banks balance fintech innovation with

capital-risk management, and how this balance affects both bank stability and regulatory oversight. The dataset in this paper covers the period of 2005-2020, which has allowed the author to assess more long-term interaction between fintech development and institutional risk (Yu, 2024, p. 1).

The results show that banks that can successfully balance fintech innovation with capital risk management experience significant improvement in the efficiency of their financial services, which also strengthens their contribution to the real economy and supports China's broader economic development goals (Yu, 2024, p. 5). Fintech is shown to have a measurable impact on strengthening China's financial system and mitigating risk exposures for the banks, and these findings are confirmed empirically through industry-level models (Yu, 2024, p. 6-8).

The first finding identifies an optimal leverage ratio that minimises the risk faced by commercial banks. Leverage refers to the extent to which the bank uses borrowed funds to finance its activities (Yu, 2024, p. 1-2). The study notes that while increasing leverage can reduce risk up to a certain point, excessive leverage becomes dangerous because it cannot be matched with a balance-sheet allocation structure and may increase financing constraints and systematic vulnerability (Yu, 2024, p. 8-9). Hence, leverage optimisation needs continuous regulatory supervision, rather than unrestricted expansion.

Secondly, the paper shows that fintech gives out a strong countercyclical risk-mitigation effect, which means its benefits are greatest during strong economic fluctuations, and hence also reduce systematic risk. The countercyclical effect in this study refers to the fintech's ability to stabilise risk exposures when the macroeconomic indicators weaken, which acts as a buffer against cyclical volatility. Countercyclical in the macroeconomic context refers to an economic time series that tends to be below trend when real GDP is above trend (Rossana, 2011, p. 408). Fintech strengthens the bank's resource allocation mechanisms and improves the efficiency of the credit-channel transmission of monetary policy, meaning that financial services are more resilient to shocks and contribute more

to the real economy (Yu, 2024, p. 12-13). This credit channel transmission essentially explains how monetary policy impacts the economy, through banks and other financial markets, through their effects on the availability and cost of credit (Beltratti & Paladino, 2015).

Third, the effectiveness of fintech differs across different banks in China. Large, medium-sized, and listed banks experience significant fintech-driven risk reductions. In contrast, the small and unlisted banks see a much weaker effect due to much lower digital capabilities and technological maturity in comparison (Yu, 2024, p. 9-10). This demonstrates how China's banking sector remains constrained by uneven levels of fintech development nationwide, with smaller institutions still lacking proper infrastructure and the expertise to be able to fully capitalise on fintech risk-management benefits.

The paper also brings to light the substantial policy implications. Yu argues in the paper that China needs to continue to promote commercial bank reforms, while still maintaining a balance between economic stability, risk mitigation, and innovation (Yu, 2024, p. 10-11). For leverage management, commercial banks need to improve their capital structure through more proactive debt-management strategies that better optimise leverage ratios and reduce the stability risk. Regulators, in turn, need to tighten the oversight of capital composition, monitor leverage dynamically across the economic cycles, and tailor the leverage supervision to the bank-specific characteristics (Yu, 2024, p. 10-11). Finally, the study emphasises the need to strengthen China's fintech capabilities. Banks need to expand their partnership with fintech firms, increase their internal investment in digital technology, and further develop fintech-specific talent pipelines to be able to enhance operational resilience and reduce risk (Yu, 2024, p. 11-12). The paper also points to operational risk challenges that have been introduced due to the increased use of fintech, including cyber risk, data-management issues, and technological complexity, which all underscore the importance of coordinating regulatory support.

3.1.3 Indonesia

Indonesia is considered an emerging market financially, as well as a newly industrialised country, having Southeast Asia's largest economy (Ridwan & Fakhrurroja, 2025, p. 9315). The paper by Ridwan & Fakhrurroja (2025) examines how the integration of fintech technologies, particularly in digital banks such as Bank BNI Digital, has significantly changed how these banks access, manage, and hedge financial risk. Operating within an emerging market that is characterised by high exchange rate volatility and relatively less-developed hedging markets. Hence, Indonesian banks have started to increasingly rely on fintech-driven analytical capabilities to enhance the effectiveness of derivative instruments. The study by Ridwan & Fakhrurroja (2025) examines whether the use of fintech can strengthen financial stability from currency shocks through fintech-driven data analysis, combined with strategic derivative usage.

The influence of fintech adoption on risk management, according to this study, is twofold. Firstly, by providing advanced analytical tools for risk assessment and shaping the strategies used, banks are better able to mitigate currency exposure (Ridwan & Fakhrurroja, 2025). The paper demonstrates how fintech enables the banks to model more complex, non-linear interactions between exchange rates and various performance variables. As is similar in the findings from China, the Indonesian case shows that the predictive analytics from fintech facilitate more accurate forecasting and a faster response to any exchange rate shocks (Ridwan & Fakhrurroja, 2025, p. 9322). This means that since they are more accurately able to identify periods when currency exposure is likely to peak, the bank from is able to improve their hedging timing and through this, mitigate FX risk. This, furthermore, mirrors a broader shift from traditional econometric methods to more complex and dynamic algorithmic risk management frameworks (Ridwan & Fakhrurroja, 2025, p. 9315) that are already widely adopted in advanced markets such as the United States and the United Kingdom.

The study by the two authors uses machine-learning techniques (specifically Random Forest and XGBoost) to show the non-linear interactions between exchange rates and

key financial performance variables (Ridwan & Fakhrurroja, 2025, p. 9314). These models were shown to help the bank with decision-making under the uncertainty of exchange rate movements and provided them with more resilient analytical foundations, when compared to more traditional linear forecasting approaches (Ridwan & Fakhrurroja, 2025, p. 9316). Regardless of the persistent volatility in the Indonesian rupiah (IDR) relative to the US dollar (USD), the bank examined in the study has been able to maintain financial stability long-term, even with high FX risk (Ridwan & Fakhrurroja, 2025, p. 9322). This outcome suggests that fintech-enhanced tools can strengthen internal resilience and support the reduction of negative impacts from exchange rate fluctuations. These findings also align with Modern Portfolio Theory and the operational risk management frameworks, since the efficient use of the fintech-based models aligns with MPT's emphasis on diversification to minimise risk. In the case of Indonesia, there is an operational perspective on risk management, where cost control remains a crucial part of stability.

Although the empirical relationship between exchange rate volatility and revenue for the banks is weak, with a correlation coefficient of 0.01, the paper still strongly advises the usage of derivatives as proactive hedging tools. This recommendation is specifically for the implementation of forward contracts to manage exchange rate risk, since forward contracts are deemed particularly effective for reducing uncertainty and protecting profit margins by locking in the exchange rates for future transactions (Ridwan & Fakhrurroja, 2025, p. 9323). The authors also note that the implementation of forward contracts should also be combined with natural hedging strategies in order to balance currency exposure better (ibid).

The authors also highlight how operational cost and management efficiency contribute more to the financial performance of the bank than other external factors, like exchange rate fluctuations or global market conditions (Ridwan & Fakhrurroja, 2025, p. 9322-9323). This is important to note, since it aligns with Operational Risk Management theory, which suggests that for institutions in emerging economies, improvements in internal processes can result in greater gains than relying solely on financial hedging (*Principles*

for Sound Management of Operational Risk (PSMOR) - Executive Summary, 2023). This indicates that while fintech contributes to external risk mitigation and enhances analytical capacity, the more substantial indicator of financial performance comes from internal operational efficiency and cost management. Therefore, the practical implication is that banks, especially in emerging economies, must prioritise improving their internal processes and operational governance alongside fintech usage to achieve effective risk management.

3.2 Developed markets

This section discusses papers that explore the use of fintech in risk management in developed economies, specifically looking at the United States, Canada and the United Kingdom as the markets.

3.2.1 United States and Canada

The fast expansion of financial technology usage in risk management specifically has been fundamental in changing the way banks in the United States and Canada manage financial risk. The paper by Kalai & Toukabri (2024) explores these two countries and the commercial banks in them, showing that fintech adoption has had an adverse negative effect on financial risk, meaning that increased investment in fintech tools leads to the reduced likelihood of bank failure and lower non-performing loan ratios (Kalai & Toukabri, 2024, p. 616-617).

Modern risk management increasingly relies on big data analytics, cloud computing, and automated decision-making, which are all central to the fintech ecosystems. The paper highlights how the adoption of these tools better enhances the banks' ability to reduce asymmetric information, improve credit risk assessment, and allows the bank to better forecast the risk exposure at the individual customer level (Kalai & Toukabri, 2024, p. 613). The paper gives the example of AI-driven credit decision models being able to more

accurately identify the high-risk borrowers, while big-data analysis helps the banks anticipate the market volatility and operational risks more effectively (ibid).

Empirical data from the study shows the negative effect on financial risk when fintech is used, specifically robustness tests using Z-scores, which essentially are used to assess the likelihood of a bank failing or becoming insolvent. The paper studied 400 US banks and 80 Canadian banks from the years 2018-2023, and found that the higher fintech adoption in some banks led to greater financial stability in comparison to those banks that did not adopt fintech as strongly (Kalai & Toukabri, 2024, p. 629). These improvements were, according to the paper, largely attributed to enhanced predictive analysis and improved screening of borrowers. Using AI and big data in improving credit risk identification, the banks were able to reduce information asymmetry between banks and borrowers, breaking the "informational isolation" characteristics of traditional lending models (ibid). The fintech tools also enhance the anticipation of market risks, which allows banks to react more quickly and efficiently to price volatility, especially in high-frequency environments like the foreign exchange markets (ibid). The paper also notes that the adoption of fintech led the banks to make strategic changes in their asset-liability structure and cost-profit ratios, which ended up improving their resilience to many external shocks and potential operational disruptions (Kalai & Toukabri, 2024, p. 629-630).

While both countries examined are developed markets, there were still significant differences between the two. The impact of fintech is shown to more strongly reduce financial risk in the United States than in Canada. US banks tend to operate within a much more competitive and innovation-driven market, where fintech tools are adopted at a much faster rate and supported more strongly by an active ecosystem of lenders, investors, and technology providers (Kalai & Toukabri, 2024, p. 610). Furthermore, the US benefits in terms of regulation, since there are regulatory sandboxes that highly promote experimentation, which leads to increased fintech adoption levels and hence, amplifies its risk-reducing effects (ibid). In contrast, Canada has a more concentrated banking sector, which results in smaller improvements in the risk metrics, according to the paper.

The paper by Kalai & Toukabri (2024) gives evidence from these two developed markets showing that the adoption of fintech technologies significantly improves the effectiveness of risk management practices in banks. In the United States and Canada, the integration of fintech allows banks to assess exposures more accurately, price derivatives more efficiently, and respond more quickly to market volatility. Fintech tools have significantly reduced information asymmetry while simultaneously improving predictive modelling (Kalai & Toukabri, 2024, p. 629). Hence, significantly strengthened early-warning mechanisms have resulted in collectively lower non-performing loan ratios and reduced the probability of bank failure. Rather than in the use of fintech, there are significantly more regulatory differences between the two developed markets. These regulatory conditions accelerate the incorporation of fintech into derivatives trading systems and risk-management functions, which has enabled US banks to make more improvements in efficiency and stability. In contrast, Canada's more concentrated banking structure and more cautious regulatory environment moderate the scale of fintech's impact. Thus, in developed economies, fintech has been shown to strengthen derivatives and risk-management practices. However, the impact of its benefits depends on the openness, competitiveness, and regulatory approach of each financial system.

Another study, published in the Journal of Financial Stability by Claessens et al. (2024), also examines the development of fintech and the opportunities and challenges it poses. The paper highlights that the discussion around fintech and risk management in the US is largely centred around the mitigation of risks associated with monetary system innovation and enhancing credit risk assessment through advanced data analytics (Claessens et al., 2024, p. 2). Furthermore, compliance risk management remains a crucial part of fintech implementation, since any system needs to adhere to different global financial regulations (Claessens et al., 2024, p. 3). The study reinforces the idea that, in practice, machine learning models outperform traditional credit models in detecting non-linear risk patterns, especially during periods of negative economic shocks, hence demonstrating how fintech tools are helpful for risk control (Claessens et al., 2024, p. 5).

The studies on the US and Canada show that fintech adoption has brought some significant improvements to risk management in both countries, primarily by enhancing predictive analytics, reducing information asymmetry, and increasing operational efficiency. While the impact has been stronger in the more innovative and competitive environment in the US, banks in Canada have also benefitted from improved efficiency and early-warning capabilities. Both countries show how fintech implementation that is tailored to local market structure and regulatory conditions are significant in maximising the risk management potential on fintech use in developed markets.

3.2.2 United Kingdom

The United Kingdom represents a more mature, highly developed financial system with deep capital markets, advanced regulatory capabilities, and a globally influential fintech ecosystem. These factors contrast with the emerging markets looked at previously, such as Saudi Arabia or China, since they have more sophisticated risk-management frameworks and a much more established derivatives market. A study by Pantos (2023), building on a previous paper by the Bank of England, highlights how UK regulators are now faced with the challenges of both fast-growing firms (FGFs) and rapidly expanding fintech-enabled business models, which both amplify financial vulnerabilities if they are not properly monitored (Pantos, 2023, p. 1). As the paper emphasises, the UK's experience shows that advanced economies are not unaffected by fintech-related risks, but rather manifest in a different way due to the high market interconnectedness and a complex credit environment.

A central theoretical concern discussed in the paper by Pantos, emerging from the UK evidence, is the "procyclicality" of credit and leverage, which is a longstanding issue in macroprudential theory. Similar to the study by Yu (2024) discussing fintech usage in China, this paper by Pantos also highlights the key risks that are linked to macro-financial risks, like procyclicality and excess volatility in UK markets (Pantos, 2023, p. 9). In macroprudential theory, this pattern poses a problem because it amplifies the booms and busts,

which makes the financial system more fragile. Procyclical, as opposed to countercyclical, means that financial variables move in the same direction as the economy, rather than opposite to it (Rossana, 2011, p. 417). Procyclical leverage often means that firms will borrow heavily when risks appear low, and are forced to cut borrowing sharply when risks rise. This means that there is higher volatility in output, investment, and financial stability (Sgherri & Gruss, 2009).

Regulators in developed markets like the UK, therefore, monitor procyclicality very closely, since fast-growing and fintech-driven firms tend to scale rapidly during booms and deleverage significantly in downturns, which intensifies systematic risk. For the study, Pantos (2023) found, through a stress test for developed markets, that fintech-enabled firms (such as digital lenders and fast-scale payment providers) presented with some procyclical balance-sheet dynamics. This means that because digital models allow extremely rapid scaling, they rely heavily on external credit and have a heavy reliance on intangible assets (Pantos, 2024, p. 1, 15-16). Pantos also noted that fintech-enabled firms experienced higher risk accumulation as they grew, because they already heavily rely on tools, which can amplify risk dispersion if the markets turn volatile, such as digital underwriting, real-time data, and automated credit allocation tools, (Pantos, 2024, p. 6).

The UK, US, and Canada cases show that fintech usage comes with risks that require stringent supervisory methods, when it is used in a highly complex financial market for FRM. From a theoretical standpoint, this reflects the financial risk hypothesis, which argues that new technologies can obscure underlying leverage, reduce transparency, and weaken supervisors' ability to detect vulnerabilities. In the paper, Pantos highlights new risks of liquidity, operational, and cyber risk that are accompanied with fintech usage, and furthermore emphasises how traditional regulatory practises and supervisory methods are repeatedly challenged by these risks (Pantos, 2024, p. 13, 15). Hence, the recommendation given in this paper is a forward-looking, judgement-based one that is better able to identify the key risks and set supervisory strategies for their effective mitigation when using fintech (Pantos, 2024, p. 15).

The evidence presented from the UK further emphasises that fintech development needs more advanced supervisory tools that are more grounded in macroprudential regulation. Fintech's impact is hence more complex, because while simultaneously creating new structurally embedded risks that need to be managed through sophisticated stress-testing frameworks and high regulatory oversight, it also enhances efficiency and innovation.

4 Comparisons and counterarguments

Global evidence from emerging and developed financial markets shows that the relationship between fintech adoption and financial risk management in multinational banks is not linear or uniformly positive. In several of the markets examined above, case evidence supports the argument that fintech enhances risk identification, improves the speed and accuracy of financial decision-making, and increases access to derivatives instruments. In some cases, fintech has also shown to strengthen broader economic development goals and reinforce banks' resilience and overall stability.

In the emerging markets examined, all three highlight that through the adoption of fintech, there have been substantial improvements in operational efficiency and risk assessment. Furthermore, fintech has shown a measurable impact on strengthening financial systems and contributing to broader economic goals of financial stability of the country. The empirical evidence from these cases shows that there are substantial improvements in operational efficiency, risk assessment, and access to hedging instruments. However, the extent of these benefits is often mediated by technological capabilities and the regulatory maturity of the emerging financial market.

Furthermore, the cross-market comparison shows that the impact of fintech differs depending on the economic and institutional context. Strong regulatory frameworks, resilient institutional infrastructures, and mature digital capabilities (like in the US, Canada, and UK) tend to moderate the adverse effects of competitive pressure by supporting careful oversight and advanced supervisory tools. The presence of these enables the banks to gain benefits from fintech usage while containing the associated risks. In contrast, less mature or emerging markets show more weaknesses in governance (both internal and external), technological resources, or regulatory support. The rapid adoption of fintech in these markets, as a result, may amplify the destabilising effects linked with it. This may also exacerbate risk exposure, since there are insufficient institutional safeguards to ensure stability during accelerated innovation.

The above cases reveal that the risk-management potential of fintech is conditional, dependent on technological innovation, market structure (competition and concentration in the market), regulatory effectiveness, and internal governance. It is also important to consider counterarguments to this perspective, even while the case examples confirm many of the potential benefits of fintech for multinational banks.

A paper published in the Journal of Financial Stability by Elekdag et al., (2025), challenges the previous notion by demonstrating a strong association between increased fintech activity and heightened risk-taking within traditional financial intermediaries (Elekdag et al., 2025, p. 1). The theoretical framework underpinning this study is defined by two hypotheses. The first, more established, is the “competition-fragility” hypothesis, which argues that heightened competition driven by fintech erodes market power, profit margins, and the charter value of institutions (Elekdag et al., 2025, p. 1). A reduced charter value lowers the effective penalties for failure, which incentivise financial institutions to engage in excessive risk-taking to preserve returns by, for example, funding riskier projects or reducing the rigorous screening of borrowers (Elekdag et al., 2025, p. 2). Conversely, the “competition-stability” hypothesis suggests that competition enhances stability, leading to lowered lending rates from competition, reducing the cost of borrowing for entrepreneurs, improving investment success rates and hence, leading to lower credit risk for banks (Elekdag et al., 2025, p. 2). Researchers of this view also argue that through improvements in efficiency and transparency, fintech reduces information asymmetry and decreases bank risk-taking (Elekdag et al., 2025, p. 3).

In this paper, the authors assessed over 10,000 financial institutions and data on fintech usage, such as digital lending and capital raising, across 57 different countries (Elekdag et al., 2025, p. 1). The results support the competition-fragility hypothesis, finding a negative and statistically significant relationship between fintech presence and the Z-score. This strongly indicates that fintech activity is associated with heightened risk-taking

across traditional financial institutions (Elekdag et al., 2025, p. 14). This paper's finding contrasts greatly with many single-country studies, particularly in China, which have the opposite finding (Elekdag et al., 2025, p. 6). The authors state that the decline is likely driven by compressed margins, upfront costs associated with digital transformation, and increased earnings volatility resulting from banks pursuing higher-yield, higher-risk assets to maintain better market share (Elekdag et al., 2025, p. 6).

The empirical study found that the elevated risk comes from the decrease in the financial institution's risk-adjusted profitability and capitalisation (Elekdag et al., 2025, p. 4). Capitalisation ratios, which show the proportion of debt compared to equity, measure a company's financial leverage, and shows the risk level and solvency. Risk-adjusted profitability, on the other hand, measures earnings from an investment relative to the risk taken to get them (Elekdag et al., 2025, p. 5). Since both risk-adjusted profitability and capitalisation ratios were negatively impacted, banks aimed to seek higher-yield or riskier assets in order to offset the lost market power (Elekdag et al., 2025, p. 9). This paper argues that fintech competition fundamentally undermines the financial health of institutions on a global scale, shifting the overall system towards higher fragility, rather than helping with risk management. By acknowledging both the stabilising and destabilising possibilities, the analysis provides a more nuanced view of understanding fintech's complex impact on financial risk management.

However, the paper also highlights the differences in this impact depending on institutional characteristics. The risk response of the institution varies significantly across different types of financial institutions and fintech business models heterogeneity (Elekdag et al., 2025, p. 2). Commercial banks are predominantly affected by fintechs operating a Balance Sheet lending model, while cooperative banks are more sensitive to the competitive pressures of P2P fintech, which is where individual lenders and borrowers are connected through online platforms, using fintech (Elekdag et al., 2025, p. 2). Crucially, the research demonstrates that the negative relationship between fintech and stability can be reversed when financial institutions maintain high capitalisation and liquidity

ratios, or if they operate within countries with strong domestic institutions, like resilient rule of law or central bank independence (Elekdag et al., 2025, p. 2, 11)

In contrast to the cases that suggest predominantly positive effects of fintech use on risk management, Elekdag's paper shows that fintech adoption has both stabilising opportunities and destabilising risks. Elekdag argues that fintech adoption requires careful policy design and continuous institutional adaptation to ensure that the adoption of fintech supports, rather than undermines, the stability of the global banking system. The paper also builds on another paper by Allen and Gale (2004) that mentions the "competition-fragility" view, meaning that there is increased financial stability because of heightened competition, which erodes profit margins, reduces market power and may undercut franchise value (Elekdag et al., 2025, p. 1; Valencia & Bolaños, 2018). This may compel the banks to engage in excessive risk-taking to maintain returns.

5 Conclusion

This thesis set out with two hypotheses: (H_1) The adoption of fintech technologies positively influences the effectiveness of risk management strategies, and (H_2) The positive impact of fintech adoption on risk management is stronger in banks in developed countries than in those in developing countries.

In conclusion, the literature reviewed shows that fintech adoption positively influences the risk management practises in banks, though its effect can be highly context-dependent across emerging and developed financial markets. In response to the first research question H_1, the hypothesis is accepted, as the comparative analysis shows that while the effects of fintech in the different markets differs, both experiences enhances risk mitigation and positively influences the effectiveness of risk management. In these countries, fintech tools have improved the efficiency, speed and accuracy of risk identification and mitigation. This is specifically when they are integrated with resilient regulatory frameworks and strong internal governance.

Addressing the second hypothesis, the literature indicates that while fintech adoption benefits banks across countries in both developed and emerging markets, its impact is still stronger in developed financial markets. This is in line with H_2, so this hypothesis is accepted. The impact is often found to be stronger due to their more advanced technological infrastructure, higher digital maturity, and stronger regulatory frameworks. In emerging markets, while fintech has brought improvements, the effects are shown to be more moderated by market maturity and institutional constraints. Overall, the effectiveness of fintech in bank risk management is significant, though highly context-dependent, hence supporting the H_2 established at the beginning of this thesis.

Rapid competition driven by increased implementation of fintech into FRM practices has also increased the fragility within some financial systems, which emphasises the need for a balanced approach, as shown by the case studies above. Heightened risk-taking

behaviours due to increased market competition or incomplete regulatory adaptation can erode profit markets and encourage excessive risk-taking behaviours, which can undermine financial stability. These findings illustrate that policymakers, financial institutions, and regulators need to prioritise the development of flexible supervisory mechanisms, especially in developed financial markets. In order to maximise the stability benefits gained from fintech, close collaboration across all sectors of stakeholders is needed to ensure that the technological advancements support, rather than undermine, the long-term stability and effectiveness of global banking systems.

The findings from this paper have clear, practical implications for policymakers and banking institutions. This thesis examines existing literature, while also presents a counterargument showing the nuanced differences in fintech's impact on risk management in emerging markets compared to developed markets. Through the comparisons between the two types of markets, the examined literature shows the critical role of contextual factors in the different markets that determine fintech's effectiveness. These findings are important for policymakers and banking institutions when seeking to enhance risk management strategies that are tailored to their specific market environment.

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