Assessing Operating Efficiency Gains from Hypothetical Mergers and Acquisitions in the Gulf Cooperation Council Banking Sector: Evidence from a Cross-Regional Analysis

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ABSTRACT

This study examines whether hypothetical mergers and acquisitions (M&As) among banks in the Gulf Cooperation Council (GCC) region can enhance their efficiency relative to that of banks in the European Union (EU), Turkey, and the Middle East and North Africa (MENA). Using a Bayesian data envelopment analysis (DEA) approach, bias-corrected efficiencies and the degree of operating efficiency gains (DOEG) are calculated for the proposed M&A scenarios. The sample includes 42 of the largest GCC banks by asset size, alongside 55 EU and Turkish banks and 31 MENA-based banks. The analysis covers the period from 2018 to 2020. The adoption of the novel Bayesian DEA method ensures robust and valid findings. This study also addresses an understudied topic: the potential impact of M&A activity in the GCC on the performance and competitiveness of consolidated banks compared to those of EU, Turkish, and MENA banks. The results suggest that M&As are likely to benefit consolidated GCC banks within the region. However, mergers involving both efficient and inefficient GCC banks are not expected to significantly enhance their performance when compared to their counterparts in the EU, Turkey, and MENA regions.

Keywords: Banking, Bank Mergers, Efficiency, Data Envelopment Analysis, Bayesian Methods
JEL Classifications: G21, G34, D24, C11.

1. INTRODUCTION

The banking sector plays a crucial role in the economy by injecting liquidity into the market, which affects economic growth by absorbing shocks and smoothing risk (Allen et al., 2019). The banking markets in the US and Europe have been transformed because of the financial systems' globalisation, deregulation, and liberalisation, resulting in a significant increase in competitive pressure (Goddard et al., 2007). A milestone for banks was the global financial crisis (GFC), when governments provided them with substantial assistance to prevent their collapse (de Haan and Poghosyan, 2012). To deal with these challenges, banks have pursued various strategies, such as diversification, cost-

cutting, the selling of assets, and consolidations (Berger and Humphrey, 1997; Goddard et al., 2007; Tsionas et al., 2015). Additionally, banks have emphasised efficiency improvement, as it has been found that efficient banks are more resilient to intense competition, insolvencies, and external shocks, and they are also active in merging with other banks, most commonly inefficient ones (Berger and Humphrey, 1997; Fethi and Pasiouras, 2010; Al Tamimi et al., 2022).

Mergers and acquisitions (M&As) are a popular strategy to improve the efficiency of consolidated banks, increase market power, reduce variable costs (e.g., labour costs), and benefit from economies of scale and scope (Goddard et al., 2007; Fraisse et al.,

2018; Larkin and Lyandres, 2019). The consolidation wave was highlighted by Berger and Strahan (1998).

The US and European banking sectors experienced significant growth in the 1980s and 1990s. Avinadav et al. (2017) and Fraisse et al. (2018) pointed out a new wave of M&As between banks on both sides of the Atlantic Ocean recently. Both large and small banks within and across states in the US have observed M&As (Berger and Hunphrey, 1997). The main objective of bank M&As in the US is profit efficiency improvement (Akhavein et al., 1997). Unlike in the US, cross-border bank M&As and consolidations of large banks are not very common in Europe (Goddard et al., 2007).

Despite the popularity of bank M&As, it is not clear in the literature whether consolidations benefit small or large banks and whether they pay off. Specifically, Akhavein et al. (1997) argued that large bank consolidations lead to significant improvements in their profit efficiency. On the contrary, Berger and Udell (2002), Stein (2002), and Amel et al. (2004) provided evidence to support the notion that small banks benefit more from M&As because of the scale economies generated. Focarelli and Pozzolo (2001) and Halkos and Tzeremes (2013) highlighted the failure of bank M&As to meet top management expectations, such as increased efficiency and profits, reduced operating expenses, economies of scale and scope, and market dominance. Larkin and Lyandres (2019) emphasised the homogeneity and complementarity of consolidated banks as key drivers of successful M&As. Al Tamimi et al. (2022) found that M&As are only beneficial between efficient and inefficient firms. This finding is in line with that of an earlier study by Berger and Humphrey (1997), who pointed out that inefficient banks have a higher chance of being acquired or merged with efficient ones, as the former have considerably greater rates of failure than the latter. Moreover, factors such as bank ownership and size, market structure, national economic conditions, culture, and legal framework affect bank performance and M&As (European Central Bank, 2000; Arpa et al., 2001; Berger et al., 2001; Goddard et al., 2001; Berger et al., 2003; Buch and Heinrich, 2003). Emphasising bank size, de Haan and Poghosyan (2012) identified a non-linear relationship between bank size and earnings volatility. In particular, US banks' return volatility decreases while their size grows up to a threshold (around USD 5 billion), and risk starts increasing when the banks cross this boundary.

Acknowledging the effect of exogenous factors on bank performance, the literature highlights differences in the US and European bank sectors. Specifically, Berger and Humphrey (1997) pointed out that the liberalisation and integration of the US banking system facilitated cross-state M&As and thus led to considerably larger banks. The size of some US banks has raised concerns among some scholars due to the decreasing returns to scale, increasing earnings volatility, and inability to absorb crises, such as the subprime housing crisis, without requesting government financial support (de Haan and Poghosyan, 2012). The European banking system has not yet reached the integration level of the corresponding US system, as significant barriers across EU member states remain, e.g., national economic conditions, language, and culture (Berger et al., 2003; Tsionas et al., 2015). Consequently, cross-border bank M&As in Europe have not been

as popular as in the US (Goddard et al., 2007). Additionally, cross-continental bank expansion and efficiency improvement through M&As have been limited (Bos and Kolari, 2005).

In this study, we examined whether hypothetical mergers and acquisitions (M&As) among banks in the Gulf Cooperation Council (GCC) region can enhance their efficiency relative to that of banks in the European Union (EU), Turkey, and the Middle East and North Africa (MENA). The objective was to identify the relative standing of banks based in these three regions from 2018 to 2020. We decided to start our analysis before the COVID-19 pandemic to avoid any distortions in performance due to governmental interventions in the banking system (e.g., government capital injections, asset guarantees, and bailouts). After obtaining banking efficiencies, we investigated whether hypothetical M&As between banks across GCC countries would improve their relative efficiency. We used a novel Bayesian directional distance function (DDF) data envelopment analysis (DEA) approach to obtain bias-corrected efficiencies. We considered both desirable and undesirable variables (e.g., non-performing loans) to estimate bank efficiency, drawing on the intermediation approach (Sealey and Lindley, 1977). To the best of our knowledge, this paper is the first study to estimate bank efficiency using a Bayesian approach, which yields consistent estimates with lower mean square errors (MSEs) and mean absolute errors (MAEs) than other bias correction DEA methods (e.g., DEA smoothed bootstrap, stochastic nonparametric envelopment of data (StoNED), and other Bayesian DEA approaches). Zervopoulos et al. (2023) provide a detailed discussion of the performance of the Bayesian DEA method used in this work and alternative bias correction DEA approaches. In addition to the methodological novelty, this paper is the first study in the literature to investigate the impact of hypothetical M&As between banks across GCC countries on their relative efficiency, with US and European banks considered in the sample under review.

Section 2 presents a discussion of the literature on bank efficiency and its measurement approaches. Section 3 presents the Bayesian DDF DEA method used for the bias correction of efficiencies and the algorithm used to obtain hypothetical M&As and the degrees of operating efficiency gains from M&As and introduces the variables and sample banks used to estimate relative efficiencies. Section 4 presents the empirical results, and Section 5 concludes the paper.

2. LITERATURE REVIEW

The extraordinary pace of merger and acquisition activities in the banking sector has been one of the most prominent changes influencing the industry globally over the past 30 years. Among the causes are improvements in information technology, the globalisation of economic and financial markets, greater shareholder pressure, and financial deregulation, according to a G10 study.

According to Scholtens and deWit (2004), the number of bank mergers increased dramatically in the 1990s; at first, the United States led the way, but Europe and Japan caught up in the latter part of the decade. They concluded that, in principle, a merger

can only benefit the merger party's shareholders if the merging institutions' combined value exceeds their individual value.

Alexakis and Samantas (2020) found that market power in banking is a major subject of concern in the aftermath of the 2007-2008 global financial crisis, as continuing financial integration has shifted significantly toward increasing bank concentration. They found that, after entering developing markets via M&A, well-capitalized banks tend to enjoy large monopolies as a result of cost-cutting strategies. The present study focuses on the impact of efficiency on potential M&As between banks within GCC member states in comparison to existing global and regional efficiency frontiers.

Chortareas et al. (2013) explored the link between financial freedom and bank efficiency in a sample of 2000 banks from 27 Eurozone countries. Their findings showed that the more financial freedom that a bank has, the higher the cost savings and overall efficiency that it may achieve. Conversely, Dell'Atti et al. (2015) investigated the efficiency and drivers of European banking groups and concluded that big banks are "more efficient" than small banks. Bautista Mesa et al. (2014) also investigated the link between bank size and efficiency, finding that, at a certain amount of total assets (USD 25 billion), the efficiency ratio stops increasing. Furthermore, Scholtens and deWit (2004) examined the impact of significant bank mergers on the European and US stock markets, and they found that mergers provide minor positive atypical returns. In addition, Hernando et al. (2009) investigated the factors that influence domestic and cross-border bank acquisitions in the European Union, and their results implied that poorly managed institutions and bigger banks are more likely to be bought by other banks in the same state.

Pawlowska (2016) observed that the adoption of a single currency meant that banks operating in the monetary union freely participated in M&As, especially cross-border M&As, to boost their efficiency and profitability. This conclusion is also supported by the positive impact of M&As in the EU-10 region, as observed and reported in the main findings of a study by Baran and Saikevicius (2015). Altunbaş and Marqués (2008) also reported the same findings; they found a significant positive effect when analysing value variations as a result of mergers and acquisitions in the EU-10 region.

According to Asimakopoulos and Athanasoglou (2013), some M&As in the European Union's banking and financial industries produced beneficial excess returns for shareholders. Rad and Van Beek (1999), Cybo-Ottone and Murgia (2000), Beltratti and Paladino (2013), and Campa and Hernando (2006) all reached the same conclusion. Varmaz and Laibner (2016), however, found that the M&As of European banks failed to create shareholder value for acquiring banks, a result supported by Campa and Hernando (2006).

As M&As have become increasingly common, the literature on them and banking efficiency has soared recently (Avinadav et al., 2017; Fraisse et al., 2018). Cost savings and increased operational efficiency are the primary reasons for bank consolidations

(Larkin and Lyandres, 2019). When there is compatibility and a high degree of homogeneity between the combined enterprises, which is not trivial, M&As are predicted to have a beneficial impact on bank efficiency (Larkin and Lyandres, 2019). Bernad et al. (2010) found that only half of the banks in their study sample increased productivity following M&As. The same research also underscored the importance of the integration process for M&A outcomes. Small banks gain from M&As because scale efficiencies are created, whereas big banks suffer from lower returns to scale following a merger or acquisition (Amel et al., 2004). Rhoades (1993), Focarelli and Pozzolo (2001), and Halkos and Tzeremes (2013) presented signs of poor M&As in the banking sector. Al Tamimi et al. (2022) indicated that M&As are desirable between efficient-only or inefficient-only conventional banks, while those between Islamic banks are likely to be undesirable. Because M&As between conventional and Islamic banks are unlikely to happen due to their basic differences and the strong global presence of conventional banks, GCC Islamic banks were not part of this study.

Sector concentration and the emergence of megabanks are the key reasons for M&As. The deregulation of the banking market in several MENA countries, as well as the privatisation of state-owned institutions, have presented an opportunity for cross-border M&As (Sahut and Milli, 2011). As we investigate the efficiency gains from M&As between banks in the GCC region to apply our methodology to conventional banks operating in the same region, it is important to highlight that banks in the GCC region are largely state-owned and heavily regulated according to Sahut and Milli (2011). Therefore, political influence may affect the M&A decision.

2.1. Theoretical Foundations of Mergers and Acquisitions (M&As): Drivers and Efficiency Gains of M&As

M&A activities in the banking sector have been driven by several factors, including technological advancements, globalisation, financial deregulation, and shareholder pressure (Scholtens and de Wit, 2004). The 1990s saw a dramatic increase in bank mergers, initially led by the United States, followed by Europe and Japan. The primary motivation behind these mergers has been the pursuit of efficiency gains, which are often achieved through cost-cutting strategies and economies of scale (Alexakis and Samantas, 2020). However, the success of M&As in delivering these benefits is contingent upon the compatibility and homogeneity of the merging entities (Larkin and Lyandres, 2019).

Efficiency gains are a critical driver of M&As in the banking sector. According to Fraisse et al. (2018), M&A activities are often motivated by the potential for cost savings and increased operational efficiency. However, the literature suggests that not all M&A transactions result in efficiency improvements. For instance, Bernad et al. (2010) found that only half of the banks in their study sample experienced productivity gains post-M&A, highlighting the importance of the integration process in determining the success of M&A activities. Similarly, Amel et al. (2004) noted that, while small banks benefit from scale efficiencies, large banks often experience diminishing returns to scale following a merger or acquisition.

The consolidation of the banking sector through M&As has led to increased market concentration, particularly in developing markets. Alexakis and Samantas (2020) found that well-capitalized banks tend to enjoy large monopolies in developing markets, primarily due to the cost-cutting strategies employed after M&A. This trend has raised concerns about the potential negative impact of increased market power on competition and financial stability. The literature suggests that, while M&As can lead to efficiency gains, they can also result in reduced competition, which may undermine the stability of the banking sector (Maghyereh and Awartani, 2016).

2.2. Data Envelopment Analysis (DEA) of Banking Efficiency

The data envelopment analysis (DEA) is a non-parametric method used to measure the efficiency of decision-making units (DMUs), such as banks, by comparing their inputs and outputs. The DEA has been widely applied in the banking sector to assess efficiency, productivity, and the impact of M&As on bank performance (Chortareas et al., 2013). The method allows for the identification of best-practice frontiers and the measurement of efficiency relative to them.

Several studies have employed the DEA to measure bank efficiency in various contexts. Chortareas et al. (2013) explored the link between financial freedom and bank efficiency in a sample of 2000 banks from 27 Eurozone countries. Their findings indicated that greater financial freedom is associated with higher cost savings and overall efficiency. Similarly, Dell'Atti et al. (2015) investigated the efficiency of European banking groups and found that larger banks tend to be more efficient than smaller banks. However, Bautista Mesa et al. (2014) noted that the efficiency ratio stops increasing beyond a certain level of total assets, suggesting that there are limits to the efficiency gains achievable through scale.

Both Islamic and conventional banks in the GCC region have had their efficiency evaluated using the DEA. Jreisat and Al-Mohamad (2022) examined 63 banks across six GCC countries from 2008 to 2016, finding that their efficiency scores ranged between 72% and 78%. The study highlighted that external shocks, such as the global financial crisis (GFC) and oil price volatility, negatively impacted bank efficiency, with domestic macroeconomic conditions having a more substantial effect than bank-specific variables. Similarly, Alsharif (2020) used the Malmquist productivity index to assess the productivity of 73 GCC banks from 2005 to 2015, finding that Islamic banks were less productive than conventional banks, with Basel III regulations further impeding efficiency.

2.3. Empirical Findings on M&As and Bank Efficiency

M&A activities in the GCC banking sector have been relatively understudied, with limited research focusing on their impact on bank performance. Darayseh and Alsharari (2023) conducted an empirical study on M&As in the UAE banking sector from 2000 to 2017, identifying key determinants of successful M&As, including income, growth, costs, and legal factors. The study found that larger banks with more assets and revenues were more likely to initiate mergers, driven by the desire to improve financial positions and respond to macroeconomic pressures. However, the

study did not provide specific findings on the impact of M&As on bank efficiency or performance.

The short- and long-term impacts of M&As on bank performance have been a subject of debate in the literature. Alsharif (2023) examined the short- and long-term impacts of M&As on bank performance in Saudi Arabia, focusing on the mergers of Saudi British Bank and Alawwal Bank, as well as National Commercial Bank and Saudi American Bank. This study found that merging banks (bidders) experienced higher positive cumulative abnormal returns than merged banks (targets), indicating that investors expected bidding banks to benefit more from the mergers. However, the efficiency measures of the combined banks varied: Saudi British Bank and Alawwal Bank experienced a deterioration in efficiency, while National Commercial Bank and Saudi American Bank saw improvements. This evidence suggests that the success of M&As in achieving cost synergies and efficiency gains depends on effective integration and restructuring strategies.

Despite the potential benefits of M&As, there are significant barriers to consolidation in the GCC banking sector. Alshamali et al. (2008) identified several social and business barriers to M&As in Kuwait, including inappropriate market regulations, poor internal decision-making and governance, a high concentration in equity ownership, and inexperienced management. These barriers have hindered the consolidation of the banking sector, despite the global trend toward M&As in it. The study suggests that addressing these barriers through regulatory reforms and improved governance could facilitate more effective M&A activities in the region.

2.4. Impact of Cross-Border M&As on the GCC Banking Sector

Cross-border M&A activity in the GCC banking sector has the potential to impact competition in several ways. Al-Hassan et al. (2010) indicated that cross-border M&A transactions can enhance financial stability by creating larger, more resilient banks that are better able to withstand economic shocks. Cross-border M&A transactions can also pose risks to financial stability, particularly if they lead to increased concentration in the banking sector or if they are not properly regulated. Al-Khouri (2012) emphasised the difficulties of corporate governance, especially when they result in conflicts of interest or inadequate management.

Conversely, an IMF report (2022) highlighted that cross-border M&A transactions can lead to increased concentration in the banking sector, which could reduce competition and lead to higher prices for consumers. We expect this move to enhance competition by creating larger, more efficient banks that can better compete with international players. We also anticipate that it will improve corporate governance by fostering the growth of larger, more transparent banks that are more appealing to institutional investors. Unlike domestic mergers, which are very common, mergers across borders are not that frequent. This gap exists due to a complex mix of regulatory, cultural, and operational hurdles. The laws or regulations that govern cross-border bank mergers and acquisitions in the GCC are primarily regulated by each GCC member state's central banks, securities authorities, and commerce

ministries. Such frameworks are subject to prudential regulation, financial stability measures, corporate governance standards, and consumer protection laws. Still, the significant regulatory diversity in GCC countries creates friction for cross-border transactions.

According to Vaddepalli and Vishwanath (2024), opportunities in smaller domestic markets are limited by saturation, which propels banks toward cross-border M&As. The relatively moderate market size in the GCC, however, may also inhibit large-scale cross-border activity. Hussain et al. (2023) stated that cross-border synergies could help address these challenges. There are several barriers to cross-border bank mergers and acquisitions in the GCC. The diversity of regulations across GCC countries creates an obstacle. UAE banks offer extensive services, contributing significantly with USD 233 billion in gross written premiums from life insurance; however, ultimately, these banks adapt to foreign requirements. Differences in the corporate cultures of partner institutions add further complications to cultural and operational integration, as Emirates NBD experienced in its expansion into Egypt and Saudi Arabia (Lootah et al., 2024).

2.5. The Legal Framework Governing Cross-Border M&As in the GCC Banking Sector

The regulatory environment for cross-border M&As in the GCC banking sector is shaped by a combination of domestic laws, including company laws, banking laws and securities regulations, regional regulations, and international standards. Each GCC country has its own legal framework governing cross-border M&A transactions, which is typically enforced by central banks and other regulatory bodies. Domestic laws set out the legal requirements for cross-border M&A transactions, including the approval process, disclosure requirements, and shareholder rights. For example, in the UAE, the Companies Law (Federal Law No. 2 of 2015) and the Central Bank Law (Federal Law No. 14 of 2018) provide the legal basis for cross-border M&A transactions in the banking sector (UAE Ministry of Justice, 2015; UAE Central Bank, 2018).

A GCC Secretary-General document (2020) highlighted the establishment of several regional regulations, aiming to promote cross-border M&A activity and harmonise regulatory standards. For example, the GCC Common Market, which was established in 2008, aims to facilitate the free movement of goods, services, and capital within the region. In addition, the GCC Monetary Council, which was established in 2010, is working toward the establishment of a single GCC currency, which could further facilitate cross-border M&A activity.

International standards, particularly those set by the Basel Committee on Banking Supervision (BCBS), also influence the GCC banking sector. The BCBS has issued several guidelines on cross-border M&A activity in the banking sector, including the Principles for Effective Consolidation and Diversification (Basel Committee on Banking Supervision [BCBS], 2012). These guidelines emphasise the importance of maintaining financial stability, protecting depositors, and ensuring that cross-border M&A transactions are conducted transparently and fairly.

2.6. The Process of GCC Cross-Border M&A Transactions

The processes involved in cross-border M&A transactions in the GCC banking sector are complex and multifaceted. These processes typically include due diligence, negotiation of terms, regulatory approval, and post-merger integration. Due diligence is a critical component of the cross-border M&A process, as it allows the parties involved to assess the financial, legal, and operational risks associated with the transaction. In the GCC banking sector, due diligence typically involves a detailed review of the target bank's financial statements, legal contracts, regulatory compliance, and corporate governance practices. Due diligence is particularly important in cross-border M&A transactions, where the parties may be subject to different legal and regulatory requirements. The negotiation of terms is another key component of the cross-border M&A process. This phase typically involves the negotiation of the purchase price, the structure of the transaction, and the terms of the merger agreement. The negotiation process may be complicated by the need to comply with domestic laws and regulations, as well as the need to obtain regulatory approvals.

Post-merger integration is the final stage of the cross-border M&A process, and it involves the integration of the operations, systems, and cultures of the merging entities. Al-Khouri (2012) indicated that post-merger integration may be particularly challenging due to the need to comply with domestic laws and regulations, as well as the need to achieve operational efficiencies and synergies. Effective post-merger integration is critical to the success of cross-border M&A transactions and requires careful planning and execution.

2.7. Comparative Analysis of Banking Systems in GCC, Europe, Asia, and the United States

The banking sector plays a pivotal role in economic development by providing financial intermediation, ensuring financial stability, and supporting economic growth. The Gulf Cooperation Council (GCC) banking sector, influenced mainly by oil-driven economies, has distinct characteristics from the more mature banking systems of Europe, Asia, and the United States. In this part of the literature review, the aim is to analyse the similarities and differences between these global banking systems, focusing on regulatory frameworks, government involvement, risk management strategies, and operational models. This will indicate which GCC banking systems are comparable in both operational and risk models.

Al-Hassan et al. (2010) looked into how GCC banks work and discovered that these banks follow rules similar to European banks, especially by using Basel III standards for capital and liquidity. These regulatory measures emphasise financial stability and resilience against economic shocks. Conversely, European banks have a long-standing tradition of stringent regulatory oversight under the European Central Bank (ECB) and other supervisory authorities. Cetorelli and Strahan (2022) mentioned that American banks, in contrast to GCC banks, follow a more market-driven regulatory model, with institutions such as the Federal Reserve and the Securities and Exchange Commission (SEC) playing

crucial roles. The U.S. banking system is characterised by a greater tolerance for risk-taking and innovation, which leads to the proliferation of complex financial products and services. Wang et al. (2021) indicated that Asian banking systems exhibit a hybrid regulatory structure, with strong government oversight in countries such as China and India and more liberal regulatory policies in financial hubs such as Singapore and Hong Kong.

A defining characteristic of GCC banks is their significant government ownership and influence, with state-related entities holding substantial stakes in major banks. This model is similar to some European economies, particularly in countries such as France and Germany, where public sector banks play an essential role in economic development (Arouri et al., 2021). Government involvement ensures financial stability but may also lead to inefficiencies and a lack of competition.

According to Barth et al. (2021), European banks tend to focus on universal banking models, offering a full range of financial services, including retail banking, investment banking, and asset management. According to Shome et al. (2023), GCC banks are more focused on traditional banking activities, such as corporate lending, retail banking, and trade finance, with a growing emphasis on Islamic finance.

GCC banks share several similarities with European banks in terms of regulatory frameworks, conservative risk management, and government involvement. However, the prevalence of Islamic finance in the GCC creates a unique distinction. In contrast, American banks are characterised by a market-driven approach with a strong focus on financial innovation and competition, whereas Asian banks display a mix of government influences and market-oriented practices.

The literature review highlighted several key findings and implications regarding mergers and acquisitions (M&As) in the GCC banking sector. M&A activities mainly aim to improve efficiency, achieve larger scale operations, and diversify, but their success depends on how well the companies integrate, work together, and follow regulations. Studies using data envelopment analysis (DEA) have shown that GCC banks have average efficiency scores between 72% and 78%, with Islamic banks usually performing worse than conventional banks. Notably, only half of M&A transactions result in productivity gains, underscoring the critical importance of post-merger integration and robust governance structures. Cross-border M&As face significant challenges, including fragmented national regulations, complex approval processes, foreign ownership restrictions, and cultural differences, despite regional initiatives such as the GCC Common Market and the Monetary Council's aim to harmonise standards. Comparatively, GCC banks also share similarities with European models in terms of regulatory adherence (e.g., Basel III) and government ownership. In contrast, the U.S. and Asian banking systems emphasise market-driven innovation and hybrid governance, respectively. External shocks, such as the COVID-19 pandemic, have exacerbated systemic risks and interconnectedness within the GCC banking sector, highlighting the need for income diversification and strategic fintech adoption.

For regulators and policymakers, streamlining cross-border M&A processes, enhancing governance frameworks, and promoting macroeconomic stability are essential. The banks, however, must prioritise post-merger integration, asset-based diversification, and fintech investments to boost resilience and competitiveness. Future research should explore the long-term impacts of M&As on GCC bank efficiency, particularly in the post-pandemic context, and examine the role of Islamic finance in cross-border M&As within the global regulatory landscape. In general, the growth of the GCC banking sector through M&As offers great chances for expansion, as long as the challenges of regulations, governance, and economic risks are managed well.

In summary, the study using a Bayesian DEA approach shows how GCC bank mergers could improve efficiency and highlights the complicated issues and difficulties involved in cross-border mergers and acquisitions in the area. The GCC's unique regulatory, cultural, and economic landscapes present both opportunities and obstacles in aligning with global banking systems. Looking at the GCC banking sector alongside those in Europe, Asia, and America shows clear differences in how they operate and are regulated, which are made even more complex by political issues and Islamic finance rules. The adoption of mergers and acquisitions as strategic tools for achieving scale efficiencies and enhancing competitiveness underscores the need for robust regulatory frameworks and effective integration strategies. This study adds to the conversation about banking mergers in the GCC by offering insights into the rules, market conditions, and possible policy effects that are important for making M&A successful. As the sector navigates a rapidly evolving financial landscape, ongoing research and adaptive regulatory measures will be crucial in harnessing the full potential of mergers and acquisitions to enhance efficiency and global competitiveness.

2.8. Research Questions

The above literature review provides a comprehensive background on mergers and acquisitions (M&As) in the Gulf Cooperation Council (GCC) banking sector, highlighting the drivers, challenges, and outcomes of M&A activities. It also discusses the regulatory frameworks, and efficiency gains and provides a comparative analysis of GCC banks with global banking systems, providing support for the following research hypotheses addressed in this study:

H_1: Potential mergers and acquisitions between banks within GCC member states in comparison to existing global and regional efficiency frontiers can produce favorable results.

H_2: A GCC-based megabank can compete on a global level.

3. METHODOLOGY AND DATA

The methodology used in this study draws on a generalized directional distance function (GDDF) data envelopment analysis (DEA) model introduced into a Bayesian framework. The latter ensures the correction of the bias of the efficiency scores, which is expected to be present due to the limited number of sample banks and the overall dimensionality of the production set. Banker (1993), Kneip et al. (2008), and Zervopoulos et al. (2019) demonstrated the overestimation of efficiencies due to

sampling variations, specification errors, and other irregularities. The Bayesian approach applied to this work, put forth by Zervopoulos et al. (2023), yields consistent efficiency estimates, with significantly lower mean square errors (MSEs) and mean absolute errors (MAEs) than alternative bias correction techniques, including the smoothed bootstrap (Kneip et al., 2008; 2011; Simar et al., 2012), the chance-constrained DEA (Olesen and Petersen, 1995; Mitropoulos et al., 2020), and other computational Bayesian methods (Tsionas, 2020). Regarding the GDDF or the conventional directional distance function approaches, they are regarded as the most appropriate for measuring efficiency when undesirable outputs, e.g., non-performing loans, are incorporated into the analysis (Podinovski and Kuosmanen, 2011; Cheng and Zervopoulos, 2014; Alshehhi and Zervopoulos, 2023; Vlachos et al., 2024).

An estimation of valid efficiency is essential for evaluating consolidation scenarios between sample banks and estimating the performance of hypothetical M&As via the degree of operating efficiency (DOEG). The process for estimating the DOEG from M&As between banks is as follows:

Stage 1:	Efficiency measurement using the GDDF DEA model [Section 3.1].
Stage 2:	Consolidation between efficient (bidders) and inefficient (targets) banks. Note: (a) efficient banks are assigned scores equal to unity, while inefficient banks' scores are lower than unity, and (b) the corresponding inputs and outputs of the bidder and target banks are merged to create hypothetically consolidated institutions.
Stage 3:	Efficiency estimates for actual and hypothetically consolidated banks are obtained from the Bayesian approach [Section 3.2].
Stage 4:	Using the efficiency estimates from Stage 3, the degree of operating efficiency gains (DOEG) is calculated from hypothetically consolidated banks [Section 3.3].

3.1. Efficiency Measurement: The Generalized Directional Distance Function DEA

To measure efficiency, inputs $x = (x_1,\ldots,x_m) \in \mathbb{R}_+^m$ are utilized to produce desirable outputs $y = (y_1,\ldots,y_s) \in \mathbb{R}^s$ and undesirable outputs $b = (b_1,\ldots,b_p) \in \mathbb{R}_+^l$. The production possibility set is expressed as follows:

$$T = \left\{ (x,y,b) \in \mathbb{R}^{m+s+l}; x \text{ can produce} (y,b) \right\} \quad (1)$$

For a given technology T, the directional distance function (DDF) is

$$\vec{D}_T \left(x,y,b;g_x,g_y,g_b \right) = \sup$$

$$\left\{ \beta : (x + \beta g_x, y - \beta g_y, b - \beta g_b) \in T(x,y,b) \right\} \quad (2)$$

where β expresses inefficiency, and the non-zero direction vector $\vec{g} = \left(g_x = g_y = 1, g_b = -1 \right)$ of the inputs (x), desirable outputs (y), and undesirable outputs (b), respectively.

Similar to the DDF, the GDDF yields efficiency ex-post by using the objective function

$$\min \frac{1 - \frac{1}{m}\sum_{i=1}^{m} \beta g_i / x_{io}}{1 + \frac{1}{s+l}\left(\sum_{r=1}^{s} \beta g_r / y_{ro} + \sum_{\eta=1}^{l} \beta g_\eta / b_{\eta o} \right)} \quad \text{(Cheng and}$$

Zervopoulos, 2014). Hence, the GDDF program reads as follows:

$$\theta = \min \frac{1 - \frac{1}{m}\sum_{i=1}^{m} \beta g_{io} / x_{io}}{1 + \frac{1}{s+l}\left(\sum_{r=1}^{s} \beta g_{ro} / y_{ro} + \sum_{\eta=1}^{l} \beta g_{to} / b_{\eta o} \right)}$$

$$s.t. \sum_{j=1}^{n} \lambda_j x_{ij} + \beta g_{io} \le x_{io}\, i = 1,\ldots,m$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} - \beta g_{ro} \ge y_{ro}\, r = 1,\ldots,s$$

$$\sum_{j=1}^{n} \lambda_j b_{\eta j} - \beta g_{to} = b_{\eta o}\, \eta = 1,\ldots,l$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda \ge 0$$

$$g_{io} = g_{ro} = 1,\, g_{to} = -1 \quad (3)$$

Where θ expresses the sample units' efficiencies, and $\beta g_{io}/x_{io}$, $\beta g_{ro}/y_{ro}$ and $\beta g_{to}/b_{\eta o}$ denote the proportional inputs' and outputs' changes (i.e., the inputs' and undesirable outputs' decrease, and the desirable outputs' increase).

Details on the advantages of the GDDF over conventional DDF and the slacks-based measure (SBM) are available in Cheng and Zervopoulos (2014) and Kounetas and Zervopoulos (2019).

3.2. Efficiency Estimates: The Bayesian DEA

The Bayesian DEA approach is based on two distributional assumptions: a uniform likelihood and a beta prior. According to Poirier (1995), the combination of these two distributions yields reasonable estimates of the parameter.

Specifically, the maximum likelihood estimator for the parameter $\theta_L \in (0,1)$, where $\left\{ \theta_j \right\}_{j=1}^{k} \in [\theta_L,1)$, and k⊂n is a subset of the sample under review, excluding units assigned an efficiency of one, is used to identify the expected value (4) and the unbiased estimator (5) of the same parameter, which are as follows:

$$\hat{\theta}_L = \theta_L + \frac{1 - \theta_L}{k + 1} \quad (4)$$

$$\tilde{\theta}_L = \frac{\hat{\theta}_L (k+1) - 1}{k} \quad (5)$$

Based on the distributional assumptions above, the prior is expressed as follows:

$$f_{\theta_L}\left(\theta_L \mid \gamma, \delta\right) = \frac{1}{B\left(\gamma, \delta\right)}\left(\theta_L\right)^{\gamma-1}\left(1-\theta_L\right)^{\delta-1}, \theta_L \in (0,1) \quad (6)$$

Subsequently, the unbiased estimator $\tilde{\theta}_L$ (5) is set equal to the expected value of the prior, which is $E\{\theta_L\} = \dfrac{\gamma}{\gamma+\delta}$, to obtain the shape parameter δ (7):

$$\delta = \frac{\left(1-\tilde{\theta}_L\right)\gamma}{\tilde{\theta}_L} \quad (7)$$

The joint probability density function (PDF) of the vector $\Theta = \left\{\theta_j\right\}_{j=1}^{k}$ is as follows:

$$f_\Theta\left(\Theta\right) = \int_0^1 f\left(\Theta \mid \theta_L\right) f_{\theta_L}\left(\theta_L \mid \gamma, \delta\right) d\theta_L = \frac{B\left(\gamma, \delta-k\right)}{B\left(\gamma, \delta\right)}[\quad (8)$$

Where $\delta > k$ and $\gamma > k\dfrac{\tilde{\theta}_L}{1-\tilde{\theta}_L}$ (9)

The posterior beta distribution with shape parameters γ and $\delta-k$ is expressed as follows:

$$f\theta L(\Theta) = f\theta\theta L\Theta\theta Lf\theta L\theta L\gamma, \delta f\theta\Theta = 1B\gamma, \delta-k\theta L\gamma-11-\theta L-(\delta-k)-1 \quad (10)$$

The posterior beta distribution refers to the upward biased efficiencies, while the prior expresses the bias-corrected efficiencies. The relationship between the two distributions is as follows:

$$E_k\left\{\theta_L \mid \Theta\right\} > E_k\left\{\theta_L\right\} \text{ as } \frac{\gamma}{\gamma+\delta-k} > \frac{\gamma}{\gamma+\delta} \quad (11)$$

Where $\delta > k$ (9) should apply to prevent problems with the posterior distribution ($E_k\left\{\theta_L \mid \Theta\right\} \nrightarrow 0$).

For efficiency bias correction, we develop a ratio of distributions (12), which yields values below unity and is expressed as follows:

$$\varphi = \frac{\tilde{\theta}_L}{\hat{\theta}_L} < 1, \text{where MLE } \hat{\theta}_L = \min\Theta \quad (12)$$

From the analysis above, we obtain expressions (13) and (14):

$$\hat{\gamma} = k\tilde{\theta}_L / \left(1-\varphi\right) \quad (13)$$

and $\hat{\delta} = (1\tilde{\theta}_L)\hat{\gamma}/\tilde{\theta}_L$ (14)

The MATLAB function *betarnd* is used to estimate (13) and (14).

Subsequently, the MATLAB function *normfit* ($\hat{\mu}$, $\hat{\sigma}$) is applied to fit the beta distribution (prior/posterior) ratio and obtain bias-corrected efficiencies (θ_j^c)(15):

$$\theta_j^c = \rho^{-1}\sum_{\tau=1}^{\rho}\theta_{j\tau}^{\varnothing} \quad (15)$$

where ρ refers to Monte Carlo iterations ($\rho = 1000$). The MATLAB function *normrnd* ($\theta_j\hat{\mu}$, $\theta_j\hat{\sigma}$) yields the randomly generated efficiencies $\theta_{j\tau}^{\varnothing}$, where $\theta_j^{\varnothing}$ are obtained from the GDDF DEA program (1) for $j = 1,\dots,n$.

3.3. Degree of Operating Efficiency Gains (DOEG)

To estimate the degree of operating efficiency gains (DOEG) from potential bank consolidations, we introduce the bias-corrected efficiencies (θ_j^c) obtained in Section 3.2 into the following ratio, developed by Halkos and Tzeremes (2013):

$$\text{DOEG}_{(B1,B2)} = 1 - \frac{\theta_{(B1)}^c + \theta_{(B2)}^c - \theta_{(B1,B2)}^c}{\theta_{(B1,B2)}^c} \quad (16)$$

Where $\theta_{(B1,B2)}^c$ is the bias-corrected efficiency estimator assigned to the potential M&A between banks B1 (bidder) and B2 (target). Similarly, $\theta_{(B1)}^c$ and $\theta_{(B2)}^c$ denote the bias-corrected efficiencies of the bidder and target banks, respectively.

If $\text{DOEG}_{(B1,B2)} > 0$, then the potential bank consolidation is likely to be successful because of the potential operating efficiency gains. If $\text{DOEG}_{(B1,B2)} < 0$, then the M&A is expected to be unfavorable, while a $\text{DOEG}_{(B1,B2)} = 0$ implies an indifferent M&A.

3.4. Sample and Data Description

The sample includes 42 of the largest GCC banks by asset size, alongside 55 EU and Turkish banks and 31 MENA-based banks. The analysis covers the period from 2018 to 2020.

The variables that we use to estimate efficiency, and meta-efficiency can be found in the works of Fujii et al. (2014) and Mamatzakis et al. (2016). Specifically, we incorporate three inputs (x_i), two desirable outputs (y_r), and one undesirable output (b_t) into the efficiency estimation models, namely, x_1, staff expenses; x_2, total customer deposits; x_3, fixed assets; y_1, loans; y_2, other earning assets; and b_1, non-performing loans.

4. EMPIRICAL RESULTS

4.1. Description of Empirical Results

The results shown give a detailed look at how well the Gulf Cooperation Council (GCC) banks are doing now and how they might perform if they merged or acquired other banks. The findings are derived from a generalised directional distance function (GDDF) data envelopment analysis and a Bayesian GDDF DEA, both of which are robust methodologies for assessing efficiency in the banking sector. The discussion is structured around the key tables and their implications for the GCC banking sector, particularly in the context of M&A activities and their potential to enhance efficiency and competitiveness.

Table 1 presents the efficiencies of the GCC banks, obtained from the generalised directional distance function (GDDF) data envelope analysis (DEA) and the Bayesian GDDF DEA

Table 1: Average efficiencies of GCC-based banks

Sample	Approach	Efficiency			
		2018	2019	2020	CAGR
Sample 1	GDDF	0.9314	0.9253	0.9226	−0.0032
	Bayesian GDDF	0.8752	0.8679	0.8645	−0.0041
	N	42	42	42	
Sample 2	GDDF	0.8985	0.9089	0.9241	0.0094
	Bayesian GDDF	0.8654	0.8777	0.8973	0.0121
	N	482	483	479	
Sample 3	GDDF	0.9243	0.9212	0.9212	−0.0011
	Bayesian GDDF	0.8653	0.8707	0.8810	0.0060
	N	42	42	42	
Sample 4	GDDF	0.8960	0.9077	0.9244	0.0105
	Bayesian GDDF	0.8654	0.8784	0.8988	0.0127
	N	440	441	437	

bias-corrected efficiency estimates. Given the limited sample size of the GCC banks, the Bayesian DEA efficiencies are regarded as valid estimates. The consistency of Bayesian DEA estimates was demonstrated by Zervopoulos et al. (2023).

In Table 1, Sample 1 is the real group of 42 GCC banks, while Sample 2 includes these 42 banks plus an additional 440 banks from 2018, 441 from 2019, and 437 from 2020 that are imagined to be merged. We should note that the hypothetical mergers are between efficient banks (acquirers) and inefficient banks (targets). The 440 hypothetically consolidated institutions included all possible combinations of acquirers and targets. Sample 3's efficiencies are calculated only for the actual GCC banks of the extended sample of 482 units. Finally, we only calculate the efficiencies for the hypothetically consolidated banks in Sample 4, which refers to the extended sample.

The efficiency scores for the actual GCC banks (Sample 1) show a slight decline over the 3-year period, with a compound annual growth rate (CAGR) of −0.0032 for GDDF and −0.0041 for Bayesian GDDF. The result suggests that, on average, GCC banks experienced a marginal decrease in efficiency during this period.

In contrast, the extended sample (Sample 2), which includes hypothetical M&A scenarios, shows an improvement in efficiency, with a CAGR of 0.0094 for GDDF and 0.0121 for Bayesian GDDF. This result indicates that M&A activities between efficient and inefficient banks could lead to efficiency gains.

The results for Sample 4, which focuses exclusively on hypothetically merged banks, show a significant improvement in efficiency, with a CAGR of 0.0105 for GDDF and 0.0127 for Bayesian GDDF. This outcome suggests that M&As between efficient acquirers and inefficient targets could enhance overall efficiency in the GCC banking sector.

The results suggest that, while GCC banks have experienced a slight decline in efficiency recently, M&A activities could reverse this trend. The hypothetical M&A scenarios demonstrate that consolidations between efficient and inefficient banks could lead to significant efficiency gains, particularly if the integration process is managed effectively.

Table 2 displays the expected degree of operating efficiency (DOEG) from the hypothetical mergers and acquisitions (M&As) between efficient and inefficient GCC banks. A positive DOEG indicates beneficial M&As, a negative DOEG demonstrates a negative impact of possible bank consolidations, and a zero DOEG shows that M&As are indifferent. According to the same table, the number of positive DOEGs from M&As increases gradually during the period of 2018-2020. Consequently, the inverse trend applies to the cases with a negative DOEG. Additionally, while the average DOEG of hypothetically merged GCC banks is negative in 2018, it becomes marginally positive in 2019 and significantly increases in 2020, the 1st year of the COVID-19 pandemic. In this regard, we can conclude that M&As are particularly worthwhile during crises.

Table 3 presents the firm-level average DOEG. Qatar National Bank, Abu Dhabi Commercial Bank, and First Abu Dhabi Bank consistently report the highest DOEG among the GCC acquirers over the 3-year review period. It should be highlighted that the number of firms with a DOEG > 0.1 increases during the review period. Based on these results, as well as the positive compound annual growth rate (CAGR) for most banks in Table 3, we conclude that M&As between GCC banks are worthwhile.

4.2. Operating Efficiencies for GCC versus EU and Turkish Banks

Table 4 displays the average efficiencies of actual GCC and EU banks, including Turkish banks, as well as the average efficiencies of hypothetically merged GCC banks and actual EU banks, including Turkish banks. As shown in the table, hypothetically merged GCC banks did not manage to increase their efficiency so as to outperform the EU banks, including Turkish banks. The efficiency of the latter banks remained higher than that of the (actual or hypothetically merged) GCC banks during the review period.

A comparative efficiency analysis between GCC banks and their European and Turkish counterparts revealed that GCC banks lagged in absolute efficiency levels. Although hypothetical mergers led to slight efficiency improvements in GCC banks, they were not sufficient to surpass the efficiency levels of EU and Turkish banks. The average efficiency of EU and Turkish banks remained consistently higher, reflecting the greater operational sophistication and competitive landscape of the European banking sector. While GCC banks recorded a slightly higher CAGR in some cases, their efficiency levels remained lower, indicating that European banks had more stable and well-established operational structures. This finding suggests that, while M&As may enhance efficiency in the GCC region, there may not be enough to close the efficiency gap with European banks.

4.3. Operating Efficiencies for GCC versus MENA Banks

Similar to the table above, Table 5 presents the average efficiencies of actual GCC and MENA banks, as well as the average efficiencies of hypothetically merged GCC banks and actual MENA banks. As indicated in the table, the hypothetically merged GCC banks demonstrate marginal efficiency improvements compared to the actual scenario, where both GCC and MENA banks are included

Table 2: Degree of operating efficiency gains (DOEG) from potential M&As

Year	Average DOEG	Performance of potential M&As					
		# of DOEG>0	%	# of DOEG=0	%	# of DOEG<0	%
2018	−0.0336	227	51.6	0	0.0	213	48.4
2019	0.0059	282	63.9	0	0.0	159	36.1
2020	0.0512	324	74.1	0	0.0	113	25.9

Table 3: Degree of operating efficiency gains (DOEG) for potential acquirers

Bank name (acquirer)	Country	DOEG			
		2018	2019	2020	CAGR
THE COMMERCIAL BANK (PQSC)	Qatar	0.0804	0.1114	0.1623	0.264
DOHA BANK	Qatar	0.0498	0.1415	0.1451	0.429
QATAR NATIONAL BANK (Q.P.S.C.)	Qatar	0.1708	0.1934	0.2069	0.066
AHLI BANK QSC	Qatar	0.0607	0.0843	0.0883	0.133
NATIONAL BANK OF KUWAIT S.A.K.P.	Kuwait	0.1571	0.1769	0.1961	0.077
BANK OF BARODA–UAE BRANCH*	UAE (India)	−0.1049	−0.2099	−0.1996	−0.239
ALUBAF ARAB INTERNATIONAL BANK (BAHRAIN) B.S.C.	Bahrain	−0.1024	−0.0838	−0.0636	0.147
GULF BANK KSC (THE)	Kuwait	0.0715	0.1043	0.0519	−0.101
FIRST ABU DHABI BANK	UAE	0.1174	0.1744	0.1805	0.154
ABU DHABI COMMERCIAL BANK	UAE	0.1539	0.1591	0.1968	0.085
AHLI UNITED BANK BSC	Bahrain	−0.0288	0.0801	0.0925	2.476
GULF INTERNATIONAL BANK BSC	Bahrain	−0.1017	−0.0007	0.0749	1.903
BANQUE SAUDI FRANSI JSC	Saudi Arabia	−0.0669	0.0599	0.1513	2.313
HSBC BANK OMAN SAOG	Oman	−0.3260	−0.3153	−0.3340	−0.008
CITIBANK N.A., UNITED ARAB EMIRATES*	UAE (USA)	−0.4922	−0.4160	−0.2918	0.160

Table 4: Efficiency of GCC banks versus EU and Turkish banks

Banks	Average efficiencies			
	2018	2019	2020	CAGR
GCC (Actual)	0.5225	0.5102	0.5574	0.0218
EU and Turkey (Actual)	0.6297	0.6207	0.6431	0.0070
All	0.5833	0.5728	0.6060	0.0128
GCC (M&As)	0.5481	0.5640	0.5564	0.0050
EU and Turkey (Actual)	0.5920	0.5982	0.5967	0.0027
All	0.5569	0.5701	0.5631	0.0037

Table 5: Efficiency of GCC banks versus MENA banks

Banks	Average efficiencies			
	2018	2019	2020	CAGR
GCC (Actual)	0.8312	0.8279	0.8302	−0.0004
MENA (Actual)	0.7592	0.7364	0.7567	−0.0011
All	0.8007	0.7890	0.7990	−0.0007
GCC (M&As)	0.8872	0.9210	0.9189	0.0117
MENA (Actual)	0.8285	0.8238	0.8417	0.0053
All	0.8800	0.9103	0.9111	0.0116

in the same sample. Even though the compound annual growth rate (CAGR) of GCC banks is better than that of MENA banks, the difference in average efficiency scores between GCC and MENA banks is more noticeable for MENA-based firms when looking at the samples before and after the hypothetical mergers and acquisitions (M&As).

When compared with banks in the broader MENA region, GCC banks demonstrated relatively higher efficiency levels. Both actual and hypothetically merged GCC banks outperformed MENA banks in efficiency scores. However, the efficiency gains from M&As were more pronounced in MENA banks, indicating that banks in the MENA region have more room for improvement. The CAGR values further illustrate that, while GCC banks were already performing better, M&A strategies had a stronger impact on the efficiency of MENA banks. This data suggests that cross-border M&As between GCC and MENA banks could be a viable strategy for enhancing overall regional banking efficiency.

4.4. Discussion of Results and Efficiency Comparisons

The banking sector in the Gulf Cooperation Council (GCC) is currently at a pivotal point, as recent trends in efficiency have illuminated the forthcoming challenges and opportunities. This study looked closely at how well GCC banks operated from 2018 to 2020, using specific methods called the generalised directional distance function (GDDF) and Bayesian GDDF to understand their performance. The analysis indicated a slight downturn in efficiency among actual GCC banks yet significant potential for improvement through strategic mergers and acquisitions (M&As). Notably, hypothetical mergers demonstrated promising efficiency growth, signalling M&As as a potentially effective mechanism for enhancing sectoral efficiency, particularly in times of economic instability, such as the COVID-19 pandemic. At the firm level, certain GCC banks emerged as strong potential acquirers, showcasing an exemplary degree of operational efficiency gain (DOEG) and thus highlighting the potential for the successful integration and optimisation of acquired entities. In contrast, comparative analyses revealed a persistent efficiency gap between GCC banks and their European counterparts, underscoring the sophistication and competitive edge of the European banking landscape. Conversely, GCC banks outperformed those in the broader MENA region, suggesting an opportunity for strategic cross-border M&As to enhance regional banking efficiency. This study aimed to provide a comprehensive understanding of efficiency trends and the role of M&As in the GCC banking sector,

offering valuable insights for policymakers and banks aiming to drive performance enhancements and competitive positioning in the global banking arena.

4.4.1. Efficiency trends in GCC banks

An efficiency analysis of GCC banks over the 2018-2020 period revealed varying trends across different samples. Using the generalised directional distance function (GDDF) and Bayesian GDDF approaches, it was found that the efficiency of actual GCC banks (Sample 1) experienced a slight decline, as indicated by the negative compound annual growth rates (CAGRs) for both the GDDF (−0.0032) and Bayesian GDDF (−0.0041). This result suggests that the overall banking performance of the GCC region faced slight deterioration in the given period. However, the larger group of GCC banks, which included both real banks and those that were hypothetically merged, showed improvements in efficiency, with growth rates of 0.0094 (GDDF) and 0.0121 (Bayesian GDDF), suggesting that mergers and acquisitions (M&As) might be a beneficial way to make the banking sector more efficient. Sample 2, which included real banks and some that were merged in theory, showed better efficiency, with growth rates of 0.0094 (GDDF) and 0.0121 (Bayesian GDDF). Similarly, Sample 4, which only looked at hypothetical mergers, had the best efficiency improvements, with growth rates of 0.0105 (GDDF) and 0.0127 (Bayesian GDDF). Similarly, Sample 4, which focused on hypothetical mergers only, recorded the highest efficiency improvements, with CAGRs of 0.0105 (GDDF) and 0.0127 (Bayesian GDDF). These findings suggest that M&As can contribute positively to efficiency, particularly when strong acquirers merge with inefficient banks.

Furthermore, the Bayesian GDDF efficiency estimates were consistently lower than the GDDF values, reflecting bias-corrected measures of efficiency. This finding confirms that efficiency scores calculated using the standard GDDF could be overestimated due to the limitations in accounting for bias. The analysis also indicated that the real banks in the larger group (Sample 3) had a mostly steady efficiency trend, with a small decrease in growth rate (−0.0011) for the GDDF and a slight increase in growth rate (0.0060) for the Bayesian GDDF. This evidence suggests that the efficiency of actual banks did not significantly improve, highlighting the need for external interventions such as M&As to drive performance enhancements. The findings collectively reinforce the argument that merging inefficient banks with more efficient institutions can result in overall sectoral improvements.

4.4.2. Operating efficiency gains from M&As

A degree of operating efficiency gains (DOEG) analysis provided further insights into the impact of hypothetical M&As on efficiency. In 2018, the average DOEG was negative (−0.0336), indicating that bank mergers would have had an adverse effect on efficiency. However, by 2019, the DOEG turned slightly positive (0.0059), and, in 2020, it increased significantly to 0.0512. This upward trend suggests that M&As became increasingly beneficial over time, particularly in the context of economic instability caused by the COVID-19 pandemic. The proportion of mergers with positive DOEG values also increased from 51.6% in 2018 to 74.1% in 2020, while the number of mergers with negative DOEG

values declined from 48.4% to 25.9% in the same period. These findings highlight that M&As are more successful at generating efficiency gains during periods of financial stress, possibly due to cost optimisation strategies and increased market consolidation.

4.4.3. Firm-level efficiency gains for potential acquirers

At the firm level, the analysis identified several banks as strong acquirers based on their DOEG performance. Qatar National Bank (QNB), First Abu Dhabi Bank, and Abu Dhabi Commercial Bank consistently reported the highest DOEG values, suggesting they could effectively integrate and optimise the operations of acquisition banks. For instance, QNB's DOEG increased from 0.1708 in 2018 to 0.2069 in 2020, demonstrating sustained efficiency growth. Similarly, Abu Dhabi Commercial Bank recorded a positive CAGR, reinforcing its ability to lead successful mergers. Conversely, some banks exhibited negative DOEG values, indicating that they would not benefit from M&As. Notably, HSBC Bank Oman and Citibank UAE had persistently negative efficiency trends, suggesting that their operational inefficiencies could limit the success of potential mergers. The performance of these banks underscores the importance of carefully selecting acquirers in any future M&A activities.

5. CONCLUSION, RECOMMENDATIONS, AND STUDY LIMITATIONS

5.1. Conclusion

Bank consolidation in the GCC has been propelled by efforts to diversify economies and the need to build institutions that can compete on a global scale. Governments in the region—most notably in the United Arab Emirates and Saudi Arabia—have actively encouraged the formation of mega-banks to fortify their financial sectors and boost international competitiveness. These proactive, state-led initiatives underscore the belief that larger, better-capitalised banks are better capable of supporting diversified growth and withstanding recurring global financial shocks. The merger would offer increased scale and operational capabilities, yet it also presents challenges associated with integrating two entities and navigating regulatory requirements. This study uses Bayes-DEA, a new analytical method that helps show the likelihood of efficiency estimates, which is usually done with standard measurements, to assess if mergers typically lead to the expected efficiency gains. DEA is a methodology comprehensively outlined in the subsequent chapters, illustrating various factors that will assist in making critical decisions within the banking sector of the GCC. This study aims to enhance academic literature and inform public policy discussions concerning the role of bank mergers in fostering a robust and competitive financial sector in the GCC.

The objective of this study was to examine whether hypothetical mergers and acquisitions (M&As) among banks in the Gulf Cooperation Council (GCC) region can enhance their efficiency relative to that of banks in the European Union (EU), Turkey, and the Middle East and North Africa (MENA). We calculated bias-corrected efficiencies and the degree of operating efficiency gains (DOEG) for the proposed M&A scenarios using a Bayesian data envelopment analysis (DEA) approach. The sample included 42 of the largest GCC banks by asset size, alongside 55 EU and

Turkish banks and 31 MENA-based banks. The analysis covered the period from 2018 to 2020. The adoption of the novel Bayesian DEA method ensured robust and valid findings. This study also addressed an understudied topic: the potential impact of M&A activity in the GCC on the performance and competitiveness of consolidated banks compared to those of EU, Turkish, and MENA banks.

The findings of this study confirm that M&As can significantly improve the efficiency of GCC banks, particularly during economic crises. The rising positive DOEG values and efficiency improvements in larger samples show that when weaker banks merge with stronger ones, the whole banking sector gets better. The analysis also highlights that, while some banks, such as Qatar National Bank and Abu Dhabi Commercial Bank, are well positioned to drive successful M&As, others, such as HSBC Oman and Citibank UAE, may not benefit from such strategies. Furthermore, the comparison with European banks reveals that GCC banks still need to enhance their efficiency, while their efficiency advantage over MENA banks suggests potential opportunities for regional consolidations. Based on these insights, we can propose several policy recommendations to enhance M&A outcomes in the GCC banking sector.

Overall, the results support the hypothesis that M&A activities could produce favourable outcomes for GCC banks, but they also underscore the need for a comprehensive approach to address structural inefficiencies in the region's banking sector. Future research should focus on exploring the long-term impacts of M&As on GCC bank efficiency, particularly in the context of the post-pandemic economic environment and the increasing adoption of fintech solutions.

5.2. Recommendations
5.2.1. Policy and regulatory support for M&As
Regulatory authorities should actively encourage well-structured M&As by creating favourable conditions for banking consolidation. This could include providing financial incentives such as tax benefits, regulatory flexibility, and streamlined approval processes for mergers that align with sectoral efficiency goals. Policymakers should also introduce governance frameworks to ensure that M&A deals contribute to long-term financial stability rather than short-term profit maximisation.

5.2.2. Encouraging strong banks to lead M&As
Future M&A strategies should prioritise the acquisition of certain banks that consistently demonstrate high DOEG values. Institutions such as Qatar National Bank and First Abu Dhabi Bank should be encouraged to acquire weaker banks in order to create a more stable and competitive banking environment. Additionally, weaker banks with negative DOEG values should focus on internal efficiency improvements rather than pursuing mergers that may not yield benefits.

5.2.3. Addressing the efficiency gap with EU banks
To be able to bridge the efficiency gap with European banks, GCC banks should invest in technology-driven banking solutions, digital transformation, and improved risk management practices.

GCC banks could enhance their competitiveness in the global financial market by increasing automation, optimising operational processes, and adopting international best practices for banking management.

5.2.4. Promoting cross-border M&As with MENA banks
Given that efficiency gains from M&As were more substantial in MENA banks, regional financial integration should be pursued through cross-border mergers. Encouraging strategic alliances between GCC and MENA banks could strengthen the overall financial system and improve efficiency levels across the region.

By implementing these recommendations, GCC banks would be able to enhance their operational performance, improve their financial stability, and strengthen their competitive position in both regional and global banking markets. These strategies will ensure long-term sustainability and contribute to the overall economic growth and stability of the GCC financial sector.

5.3. Study Limitations
While this study provides valuable insights into the potential efficiency gains from mergers and acquisitions (M&As) in the Gulf Cooperation Council (GCC) banking sector, it is not without limitations. First, the study relied on hypothetical M&A scenarios, which may not fully capture the complexities and challenges of real-world mergers. The actual outcomes of M&A activities can be influenced by factors such as cultural integration, regulatory hurdles, and unforeseen market conditions, which are difficult to simulate in a hypothetical framework.

Second, the analysis only included the largest banks in the GCC, EU, Turkey, and MENA regions, despite the sample size being comprehensive. Smaller banks, which may have different operational dynamics and efficiency levels, were not included in the analysis. This could limit the generalisability of the findings to the entire banking sector, particularly in regions where smaller banks have a significant role.

Third, this study focused on a specific time period (2018-2020), which included the onset of the COVID-19 pandemic. While the pandemic provides a unique context for analysing M&A efficiency gains during crises, it may also introduce bias due to the extraordinary economic conditions of this period. The findings may not be fully representative of M&A outcomes in more stable economic environments.

Finally, this study employed a Bayesian data envelopment analysis (DEA) approach, which, while robust, is subject to the limitations inherent in DEA methodologies. These include the assumption of constant returns to scale and the potential for measurement errors in input and output variables. Additionally, this study did not account for qualitative factors such as management quality, corporate culture, and customer satisfaction, which can significantly impact the success of M&A activities.

5.4. Future Work
Future research is suggested to address the limitations identified in this study and explore additional dimensions of M&A efficiency

in the GCC banking sector. One potential area for future work is the inclusion of smaller banks in the analysis to provide a more comprehensive understanding of the sector. Such an effort could involve expanding the sample size to include a broader range of financial institutions, including regional and community banks.

Another important direction is the exploration of the long-term impacts of M&A activities. While this study focuses on the short-term efficiency gains from hypothetical mergers, future studies could track the performance of actual M&A deals over a longer period to assess their sustainability and impact on financial stability. Such studies would provide valuable insights into whether the efficiency gains observed in the short term translate into long-term benefits.

Additionally, future research could incorporate qualitative factors such as corporate culture, management practices, and customer satisfaction into the analysis. These factors play a crucial role in the success of M&A activities but are often overlooked in quantitative studies. A mixed-methods approach that combines DEA with qualitative case studies could provide a more holistic understanding of M&A outcomes.

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