THE ROLE OF COST EFFICIENCY OF FINANCIAL INSTITUTIONS IN CAPITAL MARKET DEVELOPMENT: AN EVIDENCE FROM DUAL BANKING SYSTEM COUNTRIES

By

Muhammad Hassan

PIDE2018FMPHILEAF22

Supervisor

Dr. Atiya Yasmin Javed

Co-Supervisor

Dr. Ahmad Fraz

Department of Business Studies

Pakistan Institute of Development Economics

Islamabad

Year 2020

PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS, ISLAMABAD

CERTIFICATE

This is to certify that this thesis entitled **"The role of cost efficiency of financial institutions in capital market development: An evidence from dual banking system countries."** submitted by **Mr. Muhammad Hassan** is accepted in its present form by the Department of Business Studies, Pakistan Institute of Development Economics (PIDE) Islamabad as satisfying the requirements for partial fulfillment of the Degree of Master of Philosophy in Economics and Finance.

Supervisor:

Dr. Attiya Yasmin Javid
Professor,
PIDE, Islamabad

Co-supervisor:

Dr. Ahmed Fraz
Assistant Professor,
PIDE, Islamabad

External Examiner:

Dr. Syeda Faiza Urooj,
Assistant Professor,
Federal Urdu University of Arts,
Science & Technology, Islamabad

Head, Department of Business Studies:

Dr. Nadeem Ahmed Khan
Assistant Professor,
PIDE, Islamabad.

Date of Examination: December 10, 2020.

Author's Declaration

I **Muhammad Hassan** hereby state that my MPhil thesis titled **The role of cost efficiency of financial institutions in capital market development: An evidence from dual banking system countries** is my own work and has not been submitted previously by me for taking any degree from this University **Pakistan Institute of Development Economics** or anywhere else in the country/world.

At any time if my statement is found to be incorrect even after my Graduation the university has the right to withdraw my MPhil degree.

Date: 30-08-2020 Signature of Student

Name of Student

Muhammad Hassan

Dedication

Dedicated from the core of my heart to my beloved family

ACKNOWLEDGEMENTS

In the name of Almighty Allah, most gracious, the most merciful. First of all, I thank Almighty Allah who blessed me to overcome difficulties throughout my life, and without His immense blessings, I would have never been able to complete this project.

I sincerely wish to express my profound gratitude and appreciation to my supervisor **Dr. Attiya Yasmin Javid** and co-supervisor **Dr. Ahmad Fraz** who have provided invaluable instructions, mentorship, and encouragement throughout my thesis journey.

Also, I would like to thanks all my friends for their advice during my MS studies especially **Abdul Subhan, Sajjad Khan, Muhammad Yasir**, and **Komal Altaf.** Their persistent encouragement and support have made a difference in helping me persevere towards the completion of this journey. Last but not least, my deepest gratitude goes to my beloved family, and special thanks go to my elder brother **Malik Muhammad Hussain** for his financial support and encouragement throughout my degree.

Abstract

The purpose of this research is to study the relationship between the banking sector and stock market development. To analyze the relationship between the efficiency of banking sector and the development of stock market this study used the time-series cross-sectional data of 29 countries that have dual-banking systems the data span from 2006 to 2017. This study has investigated the two-way causal relationship between banking efficiency and capital market development by using a two-stage framework. The Output-oriented Data envelopment analysis (DEA) model has been employed in the first stage to estimate the efficiency scores of banking sector with the use of financial ratios. Thereafter, in the second stage, those estimated scores of efficiencies are linked with the level of development of stock markets with the help of the generalized method of moment (GMM) technique.

The results demonstrate that the banking efficiency is positively affecting the development level of stock market, in other words, the banking sector contributes to the development of stock markets by giving a positive signal to the outside investors and increasing the investors' participation in the stock market. The other side of the relationship shows that stock market development has a negative impact on banking sector. Furthermore, results show that investment and GDP positively affect both banking sector and stock market development.

Contents

List of Tables

List of Abbreviations

DEA	**Data Envelopment Analysis**
SFA	**Stochastic Frontier Approach**
VRS	**Variable Return to Scale**
CRS	**Constant Return to Scale**
DMU	**Decision Making Unit**
NIM	**Net Interest Margin**
GMM	**Generalized Method of Moments**
TES	**Technical Efficiency Score**
CAP	**Market Capitalization**
FA	**Fund Access**
BC	**Bank Concentration**
GDP	**Gross Domestic Product**
INF	**Inflation**
INV	**Investment**

Chapter 1

1.1: Introduction

Banking efficiency and Stock market development is broadly discussed in finance literature. Banks and stock markets are important sources of channeling funds from lenders to borrowers. Banks are crucial for any economy and are not only help savors to deposit their savings in a safer place and earn interest on it, but they also help firms and companies to go public and issue securities in the stock market. Banking efficiency measures the overall performance of banks. An improvement in bank performance affects the stock market in different ways. Notable literature has documented that there exists competition between banks and stock markets. In developing markets where information is not easily available, investors shift from the stock market toward financial intermediaries where only managers need to have information about firms under consideration (Allen & Gale, 1999). Investors also shift their investments from the stock market to banks because they know that in case of any negative shock in the market their investment will be safe, and the shock will be absorbed by intermediaries. Therefore, in the case of developing stock market, an improvement in the banking sector will reduce the investor's participation in the stock market.

Banks and stock markets can also be considered as a complement to each other. Banks have a comparative advantage over the stock market especially in the case of newly established firms due to their prior lending relationship with firms.

Fama (1985) examines the role of the banking sector as a producer of information. The study argues that when banks have firms' private information due to lending relationships, they have a comparative advantage in screening borrowers. Bank lending relationship provides firms' inside information to screen and monitor the borrower and lending record gives a positive signal to the market about firms' credibility and increases the investors in the market. Provision of loan to firms also reduce the information cost and thus increases investors participation in the stock market. The development of stock markets also affects banking efficiency. The presence of a large number of investors in stock markets increase its liquidity and reduce the cost of raising bank equity capital. That reduction in the cost of raising equity capital helps banks to raise more capital and issue relationship loans to risky firms that were denied earlier.

The development of Islamic banking system has changed the whole banking sector. Although Islamic banks and conventional banks operate on different philosophical foundations. They operate in the same macroeconomic environment therefore they interact with each other and make a difference in the whole banking system. The financial structure of dual banking system countries is different from other countries due to their dual nature of banking system. Islamic banking system enhances the financial services and increases public participation in banks. This in return reduces the financial exclusion and increases the efficiency of banking sector (Rajan, 2006). The co-existence of Islamic and conventional banks increases banking sector efficiency, reduces financial exclusion, and increases financial deepening (Gheeraert, 2014; Gheeraert, Weill, 2014). Therefore, countries having dual banking system are different in their financial structure from other countries.

Due to the rapid increase in technology and innovation, our financial system is becoming more and more interconnected and complex. Any single institute hit by adverse shock can cause severe damage to the whole economy. This damage does not remain within a country, but it also affects other countries as well due to globalization and financial liberalization across countries. To overcome spillover damage, we need to understand how these institutes are interlinked with each other. Several studies are examining the relationship between banking efficiency and their stock return (Liadaki and Gaganis, 2010; Beccalli, Casu and Girardone, 2006; Beck, Demirguc-Kunt and Levine, 2000; Bossone, 2010; Demirguc-Kunt and Levine, 1996). But few studies examine the relationship between banking sector and stock market (Ngo and Le, 2019). This study aims to examine the relationship between banking efficiency of dual banking system and stock market development after controlling differences in the economic environment of selected countries.

1.2: Problem statement

Recent studies show that there is a co-evolution between banks and stock markets (Song and Thakor 2010). Ngo and Le, (2019) empirically estimated the relationship between banking efficiency and stock market development and found that an increase in banking efficiency boosts the development of stock markets but an increase in the size of stock markets hinders the efficiency of banking sector. The problem with these studies is that national differences in institutions, legal systems, regulations, competitive conditions, and payment systems affect the performance of financial institutions (Berger, 2007). During the last three decades, the banking sector in the world transformed largely. The emergence of Islamic banking system is gaining ground in the financial landscape of economies. The existence of Islamic banks

increases competition in the banking sector and hence increases efficiency. Due to the rapid increase in the Islamic banking system and the importance of its salient features, it will be interesting to find the relationship between the banking sector and stock markets of those countries where dual banking system exist.

1.3: Research question

1. How banking efficiency in Dual banking system affects the stock market development?
2. How the stock market development affects the efficiency of Dual banking system?

1.4: Objective

The study has the following research objectives:

1. To analyze the role of dual banking system in stock market development.
2. To analyze the role of stock markets in banking efficiency of dual banking system.

1.5: Research gap

The available literature on banking efficiency mostly focused on the one-way link between banks and stock markets. They either find the effect of banks on stock return or the other way around. But as discussed before that there exists a two-way relationship between banks and stock markets (Bosson, 2010). Another aspect that is considered in many studies is that they focus on the relationship between banking

efficiency and stock performance of banks only. Ngo and le, (2019) examine the two-way nexus between banking sector efficiency and stock market development using an input-oriented DEA model. The underlying assumption in the input-oriented model is that it assumes that DMU has more control over the cost side. This study is different from Ngo and le, (2019) and other studies in many aspects. As investors are more concerned with the profit of the firm so this study uses an output-oriented DEA model to estimate efficiency score. Output oriented efficiency model assumes that DMUs have more control over their output such that they can increase their output to increase their profit. Ngo and le, (2019) examine the relationship from 2006 to 2011 but this study expands the time span up to 2017 and examines the relationship in a more controlled environment by increasing controlled variables (Bank concentration, Investment to GDP ratio).

As the banking system transformed due to the introduction of Islamic banking system. Islamic banking system follows shariah standards that make them different from the conventional banking system. Islamic banks operate under the governing authority of a country in which operates and also take guidance from shariah rules that make them more competent and more efficient than conventional banks. The induction of Islamic banking system into a banking system of a country makes them different from other countries. This different structure of banking system in dual banking system countries need to explore the effect of banking efficiency on stock market development and the effect of stock market development on banking efficiency. According to my best knowledge, there is no such research that examines the relationship between banks and stock markets in countries that have dual banking systems (i.e. Islamic and conventional banking). This study aims to find the

relationship between banking efficiency and stock market development in dual-banking system countries.

1.6: Significance of the study

Banks and stock markets are two major contributors to the financial sector. Both work in the same direction as they channel savings from lenders to investors. Any shock in one sector can cause the whole economy to collapse. Therefore, it is necessary to study the linkages between them. This study contributes to the literature by examining the two-way nexus between banking efficiency and stock market development in 29 countries that have dual banking system. It will help to understand the difference in the financial system of those countries which practice dual banking system. Nowadays, when banks and financial markets are more and more interconnecting with each other, this study will help to understand the way they affect each other. This study will help firms in dual banking system countries to better understand the financial structure of their country. A better understanding of fund providers (banks and stock markets) helps firms to make a good decision about their financial needs.

This study will help firms' financial managers to make a good decision about their financial needs and their investment plans to which sector they should go, the banking sector, or stock markets for financing. Individual investors can also be benefitted from this study. This study will provide sound knowledge about the relationship between banks and stock markets that will help investors to make decisions on whether to invest directly in the stock market or to put their money in

banks. This study will also help the policymakers in making policies regarding stock markets and banks.

1.7: Organization of study

In Chapter 2 we discuss the brief literature on banking efficiency and stock market development. In Chapter 3 we discuss the methodology of estimating efficiency scores, GMM model estimation, model building, data description, and variables distribution. Chapter 4 discusses the empirical results and discussion, and chapter 5 includes the conclusion of the thesis.

Chapter 2

2.1: Literature review

There are strong shreds of evidence that a good financial system effectively mobilizes funds from savors to investors to utilize it in the most efficient way, provide risk management facilities (diversification of portfolio) and reduce asymmetric information between entrepreneurs, investors, and savors (Rousseau & Sylla, 2005). There are two major contributors to financial development namely capital markets and the banking sector. Stock markets contribute toward economic development through various channels, an increase in the size of stock market decreases the cost of saving mobilization and thus facilitates investment in production. According to Levine, (1991), stock market facilitates economic growth by providing a platform where firms can buy and sell their securities without disturbing their production process and allow investors to reduce risk by diversifying the portfolio, on the other hand, he also found that an increase in banking sector increases the services provided to borrowers and lenders that expand the real sector of the economy. Beck and Levine, (2004) also find that there is a positive and significant impact of the capital market and banks on economic development independently and jointly.

Stock markets and the banking sector both contribute toward economic development they both provide services to their customers and facilitate borrowers and lenders to fulfill their needs. Both are part of the financial system, is there a relationship between banks and markets? To answer this question researchers and policymakers are different in their views. Some researchers argue that both are

competitors and others say they are complemented to each other and co-evolution exists. Banks have a comparative advantage over the stock market especially in the case of newly established firms due to their prior lending relationship with firms. Bank's lending relationship provides firms' inside information to screen and monitor the borrower. That lending record gives a positive signal to the market about firms' credibility and increases the investors in the market. Fama (1985) examines the role of banking sector as a producer of information. He argued that when banks have firms' private information due to lending relationships, they have a comparative advantage in screening borrowers. Banks first screen and monitor borrowers and then provide loans to firms. That provision of loans gives a positive signal to outside investors about firms' credibility.

A narrative that banks and the stock market grow at the expense of others emerged from two incidents. First, when Oil prices shock occur in 1970 it affects many economies adversely and the investors who invest in markets bear losses but for those who placed their savings with intermediaries like banks the effect was different. Second, after the 1980s when US mutual funds emerged, the size of depository institutions was observed to shrink (Allen & Gale, 1997). In the underdeveloped stock market where information is not easily available, the cost of market participation is high that shifts investors, especially small investors, from the market toward intermediaries because investors know that if any surprise shock occurs the intermediary will share its loss (Allen & Gale, 1999). Investment in the stock market need every individual to have information about his portfolio but in the case of financial intermediaries only manager need to have knowledge so if there are significant amount of people having different opinions then the stock market will flourish and vice versa (Allen & Gale, 1999).

Another narrative about the relationship between banks and stock markets is that stock markets and financial intermediaries develop together. When a stock market develops the quality of information increases this information aggregation affects the large firms whose stocks are frequently sold in the market by decreasing the cost of traders' information acquisition. When firms increase debt financing it promotes the banking sector. But in developed markets, any further increase in development reduces debt financing in long term instruments for large firms (Demirgüç-Kunt & Maksimovic, 1996). Demirgüç-Kunt and Levine, (1996) describe the correlation between stock markets and financial markets using data from 44 countries and find that there is a positive relationship between different indicators of financial intermediaries and stock markets. Countries that have well-functioning stock markets also have developed financial intermediaries.

Stock market development increases information dissemination that helps banks in screening borrowers and reduces the cost of screening that increases bank capital that creates a flow of benefit from the stock market to the banking sector. Banking sector development increases the quality of screening the borrower that in return increases the authenticity of the borrower going to the stock market for securitization this gives a positive signal to the investors about the borrower and increases investor's participation in the stock market (Song & Thakor, 2010). Demirgüç-Kunt and Huizinga (2000) first examine the overall impact of financial development on banking profit and margin and then after controlling the level of financial development it is examined that whether a financial structure has an independent effect on the banking sector or not. The data set covers all OECD as well as developing countries from 1990 to 1997. The study employs simple regression analysis to check the relationship between financial development and bank profit and

margin, and also between financial structure and banks. The variables used in this process are of three kinds Bank specific, Country specific, and Financial development indicators. The results provide evidence that in underdeveloped countries financial market development improves banking efficiency and profit margin, potentially increase economic growth, but under a high level of financial development, such relation does not exist. However financial structure does not have a significant impact on bank efficiency and profit.

Maudos, et al, (2002) aim to estimate and compare profit and cost efficiency in the banks of 10-European Union countries from 1993 to 1996. Methods used to estimate profit and cost efficiency are DFA (Distribution Free Approach), FEM (Fixed Effect Model), and REM (Random Effect Model). To estimate efficiency loans, Other earning assets and deposits are used as input whereas the cost of loanable funds, cost of labor, and cost of physical capital is used as output variables. After estimating efficiency regression analysis is used to find out different factors affecting efficiency in different countries for this purpose profit and cost efficiency is regressed on bank size, specialization, concentration, demand for banking services (GDP GROWTH), network density (BRANCH), and loan to asset ratio. It is found that there is a wide range of variations in baking efficiency, medium-size banks are more efficient, bank specialization has no significant impact on efficiency, concentration has a positive impact on profit efficiency and negative impact on cost efficiency, risk-prone banks are more likely to have higher profit efficiency.

Ioannidis, Molyneux, and Pasiouras, (2008) examine the impact of bank efficiency on stock returns of 19 Asian and Latin American countries. The study has used Battese and Coelli, (1995) Stochastic Frontier Production Function to estimate the efficiency of 260 banks of these 19 markets from 2000 to 2006. The cost of

borrowed funds and the cost of non-financial inputs are used as input variables and Loans, Other earning assets, and Non-interest income are used as output variables to calculate efficiency scores. The results of the study indicate that profit efficiency has a significant and positive impact on stock returns whereas the coefficients of cost efficiency and ROE are insignificant. These results show that information about profit efficiency is incorporated in stock return which is not captured by cost efficiency and ROE. This is because profit efficiency is an indicator of quality and persistence of profit relative to other competitors which makes it a more reliable source of information for shareholders as compare to traditional ROE. Delis and Papanikolaou, (2009) tried to find determinants of productive efficiency. DEA is used to estimate efficiency scores. After the estimation of efficiency scores, a bootstrap technique was applied to analyze macroeconomics, bank-specific, and industry-specific determinants. The study indicates that the efficiency score increases over time. The second stage analysis shows that public ownership, the concentration of the banking sector, and industry has a negative impact on banking efficiency. Furthermore, investment to GDP ratio, EBRD index, short term interest rate, and foreign ownership positively affect efficiency. These results gave us an indicator that by increasing structure performance we can increase banking efficiency. Hadad, et al, (2011) study the profit efficiency by monthly data of Indonesian banks. Two-stage methodology "DEA" is used to estimate efficiency. Results show that Domestically owned banks are more efficient than foreign-owned banks. Banking efficiency has a positive effect on its stock price.

Liadaki and Gaganis (2010) study the cost and profit efficiency relation with stock return providing evidence from 171 listed banks in 15 EU countries from 2002 to 2006. The stochastic Frontier Approach is used to estimate profit and cost-

efficiency. Three input prices are the Price of labor, Price of Capital, and Cost of deposits. Output variables include Non-interest income, Total customer loans, and Other earnings assets. To control for different operating environments in different countries five country-specific variables, real GDP growth, inflation, size of the market and bank claims to the private sector and one bank-specific variable, equity to total asset, are used as the control variable. After estimation of profit and cost efficiency scores, a fixed-effect model is applied to find whether profit and cost efficiency is reflected in stock returns or not. Empirical results show that profit efficiency has a significant and positive impact on stock return. However, it found that cost efficiency does not significantly affect stock returns. It is also observed that changes in profit efficiency have more explanatory power as compare to cost efficiency.

Ayadi, et al, (2015) study the effect of financial development and banking development with other variables like institutional, legal, and a variety of macroeconomic variables on economic growth spanning from 1984 to 2010 in 11 Mediterranean countries. The study finds that private sector credit negatively affects economic growth. Bank deposits, market capitalization, and meta-efficiency do not have any effect on growth. In countries that have low-quality institutes, any improvement in the stock market improves growth. Ngo and Le (2019) investigate the two-way nexus between capital market development and bank efficiency in 86 countries from 2006 to 2011. The study used a two-step DEA technique to estimate efficiency scores. At the first stage, two input variables (percentage of bank deposits to GDP and bank overhead cost to total asset) and two output variables (private credit to GDP and net interest margin) are selected through the intermediation approach and input-oriented technical efficiency scores are obtained. Because the banking sector

and capital market are complemented to each other there exists two-way causality between them, to tackle this problem GMM is used to find the relationship between capital market development and banking efficiency while controlling for GDP (economic growth) and inflation. The results show that a high level of inefficiency exists but with the passage of time it decreases. Banking efficiency has a positive and significant impact on the capital market since the capital market has a negative impact on banking efficiency.

Chapter 3

Data description and methodology

3.1: Data

This study uses the data of 29 Islamic and non-Islamic countries that have dual banking system. These 29 countries are selected from Islamic Finance Country Index (IFCI, 2019) that have sufficient data available for analysis. Cooper, Seiford, and Tone, (2007) suggest that the number of DMUs must be three times higher than the sum of input-output variables. Data for all 29 countries are taken from 2006 to 2017, as aggregate level data is available only up to 2017. The model used in the second stage of our analysis is run on panel data. The selected countries are:

Table 3. 1: List of Countries

#	Countries	#	Countries
1	AUSTRALIA	16	OMAN
2	BAHRAIN	17	PAKISTAN
3	BANGLADESH	18	PHILIPPINES
4	CHINA	19	QATAR
5	EGYPT	20	RUSSIAN FEDERATION
6	INDIA	21	SAUDI ARABIA
7	INDONESIA	22	SINGAPORE
8	JORDAN	23	SOUTH AFRICA
9	KAZAKHSTAN	24	SPAIN
10	KUWAIT	25	SRI LANKA
11	LEBANON	26	THAILAND
12	MALAYSIA	27	TUNISIA
13	MAURITIUS	28	TURKEY
14	MOROCCO	29	UNITED STATES
15	NIGERIA		

Input and output variables selected for DEA model and CAP (Stock Market Capitalization) is taken from WDI data on financial structure and development (Beck, Demirgüç-Kunt, and Levine, 2000). The data on Fund Access FA is extracted from Global Competitiveness Index (WEF, 2016). Control variables GDP, INF, and investment to GDP ratio are taken from World Development Indicator WDI dataset.

3.2: Variable description

3.2.1: Banking efficiency

There are several ways to evaluate the performance of a firm or an institute. Efficiency is the ability to convert inputs into outputs in an efficient way. Koopman (1951). A firm is considered technically efficient when it produces a maximum level of output from the given level of inputs. It measures productivity as a ratio of input to output. There are different ways to estimate efficiency. It can be estimated by ratios like overhead cost to total asset or by different efficiency models like DEA or SFA using different input-output variables. In this study, we use DEA model to estimate the efficiency of banking sector. To estimate DEA model, we need input-output variables. Input-output variables are selected for this study from Financial Development and Structure Database (Beccalli, Demirguc-Kunt, and Levine 2000). Due to the limitation of aggregate-level data, Input and output variables are selected following the research of Ngo and Le, (2019), these variables are:

Table 3. 2: Input-Output Variables

Input Variables	Output Variables
The overhead cost of banks to total asset	Private credit by commercial banks to GDP
Bank deposits as a percentage of GDP	Net interest margin (NIM)

3.2.1.1: Input variables

3.2.1.1.1: Overhead cost of banks to total asset:

Overhead cost is those expenses that do not directly relate to any output generating unit, but they are still vital to any business because they provide support to businesses in generating output. These expenses include employee salaries, office equipment, and supplies, external legal and audit fee and travel and entertainment cost, etc. According to the intermediation approach, labor cost is used as an input variable. To capture the labor cost "Overhead cost to total asset" is used as a proxy variable that is the accounting value of the overhead cost of commercial banks as a share of total assets.

$$\textbf{Overhead cost of bank to total asset} = \frac{Overhead\ cost}{Total\ asset} \times 100 \qquad (3.1)$$

Studies that analyze individual bank efficiency, use the ratio of personnel expense to total asset (Beccalli, Casu, and Girardone, 2006; Liadaki, and Gaganis, 2010; Maudos, et al, 2002). To estimate the efficiency of the whole banking sector overhead cost is used as a proxy for labor cost (Ngo and Le, 2019).

3.2.1.1.2: Bank deposits as a percentage of GDP:

The core function of banking sector is to channel savings from savors to investors. Banks take deposits from individuals/firms and transfer them to investors or borrowers to generate revenue thus deposits of banks are treated as an input for banks. This variable measures saving, time, and demand deposits of commercial banks as a percentage of GDP.

$$\textbf{Bank deposits as a percentage of GDP} = \frac{\boldsymbol{Bank\ deposits}}{\boldsymbol{GDP}} \times \mathbf{100} \qquad \textbf{(3.2)}$$

This variable is used to measure the aggregate value of deposit as an input of banking sector (Ngo and Le, 2019).

3.2.1.2: Output variables

3.2.1.2.1: Private credit by commercial banks to GDP:

Private credit refers to the direct loan issued to the private sector by deposit money banks (commercial banks) loan issued to the government sector is not included. Private credit does not include loans issued by the government sector. As the main function of the banking sector is to channel funds from lender to borrower, private credit captures the activity of banking sector and is used for a total loan of banking sector. Its value will be high in those countries where banks are too much involved in credit generating activities. Private credit to GDP equals the commercial bank's credit to the private sector as a ratio of GDP.

$$\textbf{Private credit by commercial banks to GDP} = \frac{\boldsymbol{Private\ credit}}{\boldsymbol{GDP}} \times \mathbf{100} \qquad \textbf{(3.3)}$$

It measures the overall activity of financial intermediaries as their main function is to channel the savings to investors (Levine and Zervos 1998). This study used this variable as a proxy for total loans as loans are considered as output of banks in intermediation approach (Ngo and Le, 2019).

3.2.1.2.2: Net interest margin (NIM):

This variable measures the difference between interest received on loans and interest paid on deposits as a ratio of total assets. Banks operating in a competitive market tends to reduce their interest margin. A higher value of NIM represents low competition and a low level of NIM represents a high level of competition in banking sector. It captures the profitability of a firm.

$$\textbf{NIM} = \frac{\textit{Investment returns} - \textit{Interest expenses}}{\textit{Total assets}} \times \mathbf{100} \qquad \textbf{(3.4)}$$

It is the difference between interest earned from borrowers and interest paid to depositors relative to the interest-earning assets. It captures the manager's investment decisions and profitability of banking sector and is used as an output variable (Ngo and Le, 2019, Hadad, et al, 2011).

3.2.2: Dependent and independent variables

3.2.2.1: Market Capitalization to GDP ratio:

To estimate stock market development different proxies have been used in the literature. Market capitalization to GDP ratio captures the size of the stock market. It is the total value of shares traded in the market as a ratio of GDP.

$$\textbf{Market Capitalization} = \frac{\textit{Total value of shares traded}}{\textit{GDP}} \times \mathbf{100} \qquad \textbf{(3.5)}$$

It captures the total value of the stock market. A large number of shares traded in the market depict more liquidity and more development. This variable measures the development level of the stock market as it captures the overall activity of the market (Jayakumar, 2004).

3.2.2.2: Banking efficiency score:

The efficiency of an institute indicates their overall performance of DMU. Efficiency scores are estimated by DEA model. Banking efficiency score measures the overall performance of banking sector, ranging from 0 to 1. Efficiency scores used as a proxy for banking sector development (e.g. Liadaki and Gaganis, 2010) To find the impact of stock market development on bank performance, technical efficiency score is treated as a dependent variable and to estimate the effect of banking sector development on stock market, efficiency score is treated as an independent variable.

3.2.3: Control variables

3.2.3.1: Gross domestic product (GDP):

GDP is presented as a log form of GDP. It represents the income and development level of a country. High GDP countries have a high demand for banking services (Maudos, et al, 2002) and have more savings rates and more funds to invest in the stock market (Neely and Wheelock, 1997).

3.2.3.2: Inflation (INF):

It represents the inflation rate that has a negative impact on the stock market and banking sector. High inflation reduces savings and thus funds to invest in stock market and deposit in banks. An increase in the inflation rate increase the cost of funds thus reduces bank efficiency (Sufian and Habibullah, 2012).

3.2.3.3: Fund Access:

Fund access is a measure of the ease of access to funds from the stock market. Stock markets overall are going through significant changes and are relied upon the assumption that they should play a significant and important job in financing business by providing easy access to funds. Stock market changes are frequently upheld by more competitive regulations for corporate administration, including securities regulations and organization law. This variable measures the accessibility of funds through the stock market and is based on a survey question that in your country how easy it is to get funds from stock market scaled from 1 to 7, where 1 means not at all and 7 means to a greater extent.

3.2.3.4: Bank concentration:

The concentration of banking sector is measured by summing the assets of the three largest banks and comparing it with the total assets of banking sector. It captures the structure of banking sector of any economy. The structure of banking sector plays an important role in the activities of financial intermediaries. High concentration in banks increases the profit efficiency of banking sector (Maudos, Pastor, Perez and

Quesada, 2002). A highly concentrated banking sector depicts the lack of competition in banks that may reduce efficiency.

3.2.3.5: Investment to GDP ratio:

This variable is used to control the fluctuation in macroeconomic economic activity and variability in the market. Stock market development and banking efficiency are sensitive to the economic conditions of a country. Investment to GDP ratio has a positive impact on banking efficiency an increase in investment ratio increases the economic activity and enhances banking efficiency (Pasiouras, Delis and Papanikolaou, 2009).

3.3: Methodology

3.3.1: Data envelopment analysis (DEA)

There are two commonly used methods Stochastic Frontier Approach (SFA) and Data Envelopment Analysis (DEA) to estimate banking efficiency. SFA is a parametric approach that assigns a functional form to the cost or profit relationship between input, output variables and also has an error term. The non-parametric approach does not specify any functional form to input, output variables, and assumes that there are no measurement errors in the model. The problem with SFA is that it assigns a specific functional form to efficiency estimates that presuppose a specific efficient frontier for that institute that can not be the case in estimating efficiency score for multiple institutes or cross-country comparison. Therefore, a two-stage DEA model is selected to estimate banking efficiency for cross-country comparison.

Technical efficiency is referred to as the conversion of input into output (Sathye, 2001). There are two commonly used orientations in DEA model: input-oriented model and output-oriented model. Input oriented model estimates efficiency score by decreasing inputs with a given level of output. Output oriented model estimates efficiency by increasing output with a given level of input. Ngo and Le, (2019) estimated banking efficiency using an input-oriented DEA model and assumed that managers have more control over the cost incurred by DMU. Shareholders are mostly concern with the level of output and profit of a firm so an output-oriented efficiency model will be used. In the output-oriented model, we assume that managers have more control over profit generating process so an inefficient decision-making unit (DMU) needs to increase their production of output to reach the efficient frontier.

In the first stage, DEA model has employed that measures efficiency score by finding an optimal level of output with a given level of inputs. To estimate DEA model we have "n" number of DMUs (j = 1,…,n) each DMU utilize "m" number of inputs x_i (i = 1,…,m) to produce "s" number of output y_r (r = 1,…,s). DEA model finds the efficiency score for j_o-th DMU as:

$$\min w_o(v, v_o) = \sum_{i=1}^{m} v_i x_{io} + v_o \qquad (3.6)$$

Subject to:

$$\sum_{r=1}^{s} \mu_r y_{ro} = 1$$

$$\sum_{i=1}^{m} v_I x_{ij} - \sum_{r=1}^{s} \mu_r y_{rj} + v_o \geq 0$$

$$\mu_r , v_i = \varepsilon$$

v_o free in sign

where v and μ are weights of input and output respectively.

Most of the literature on banking efficiency is based on the bank level or branch level data. This study uses the aggregate level or country level data to estimate banking efficiency. The whole banking sector of a country is treated as one DMU where input and output variables are aggregated on the country level (Ngo and Le, 2019).

3.3.2: Selection of input and output variables

The selection of input and output variables is very important in DEA model. The choice of input and output variables affect the estimated efficiency score for a given sample. There are two main approaches to identify inputs and outputs of the banking sector namely the production approach and intermediation approach. The production approach assumes financial institutions as the producer of services for account holders whereas the intermediation approach considers financial institutions as an intermediary, they transfer funds from savors to investors. This study uses the intermediation approach because it is more appropriate to analyze the whole banking sector (Berger and Humphrey, 1997). According to the intermediation approach deposits, labor and capital are considered as input variables whereas loan and investment are treated as output variables. As our goal is to estimate banking efficiency of different countries, two input and two output variables are taken at the country level. The first input used in our model is the overhead cost of banks to total asset, that is the accounting value of the overhead cost of commercial banks as a share of total asset. This variable accounts for labor costs. The second variable used as input is bank deposits as a percentage of GDP. That measures saving, time, and demand

deposits of commercial banks as a percentage of GDP. Two output variables are net interest margin (NIM) and private credit to GDP. NIM is the ratio of net interest revenue and total earning assets that represent the profitability of banks. Financial intermediaries (banks) receive savings from savers and convert them into loans (output). Net interest margin is used as a proxy for total loan generated from the savings received by financial intermediaries as it captures the net revenue received from interest payments. Private credit by commercial banks to GDP is the credit of money banks that goes to the private sector and is used instead of loans. As banking sector being an intermediary of channeling funds from savers to the investor, private credit to GDP captures the total amount of output (investment) generated from the input (deposits). Therefore, private credit to GDP is used as an output variable.

3.3.3: Generalized method of moment (GMM)

Generalized method of moment (GMM) estimation method was formalized by Hansen (1982), and from that time it becomes one of the most broadly utilized methods for the estimation of endogenous covariate models in finance and economics. Unlike maximum likelihood estimation (MLE), Generalized method of moment (GMM) has fewer restrictions and fewer assumptions about the distribution of the data. Just specified moment conditions need to be derived from the model to estimate GMM model. Generalized method of moment (GMM) is used in case of an endogeneity problem in the model. The endogeneity problem exists when our independent variable is correlated with the error term. In the case of the existence of endogeneity, OLS estimates are not valid. Therefore, we need to go to GMM model. General form of GMM is:

$$Y_{it} = \beta X_{it} + \varepsilon_{it} \quad (3.7)$$

Where

$$E(\varepsilon_{it}, X_{it}) \neq 0$$

So, we have instrument variable Z that is significantly correlated with X but not correlated with an error term and

$$E(\varepsilon_{it}, Z_{it}) = 0$$

After incorporating instrumental variable, we have

$$Y_{it} = \beta X_{it} + \Upsilon Z_{it} + \varepsilon_{it} \quad (3.8)$$

Where X_{it} is endogenous independent variables that are correlated with ε_{it} error term and Z_{it} is instrumental variables that are significantly correlated with X_{it} but no correlation with the error term.

In the second stage, we analyze the relationship between capital market development and estimated banking sector efficiency scores of countries having dual banking system. The second stage of DEA model is used to examine the determinants of efficiency scores. Consequently, this process examines the one-way direction of effect, that goes from determinants to efficiency scores. Previous studies in contrast find that there exist bidirectional linkages between banking efficiency and stock market development. Due to this endogeneity problem, we use the GMM method to examine the relationship between stock market development and banking efficiency. To check endogeneity in our model Durban-Wu-Hausman test is used and for the validity of instruments, a weak instrument diagnostic Cragg-Donal F-statistics is used.

Fama (1985) suggests that stock market and banking sector both help each other to grow simultaneously. To check this positive effect of stock market on banking sector we hypothesize it as follow:

H1: As stock market development increases it will lead to an increase in the efficiency of banking sector.

To find the effect of stock market development on the efficiency of banking sector in countries having dual banking system we follow the GMM model as:

$$TES_{it} = \beta_1 + \beta_2 CAP_{it} + \beta_3 BC_{it} + \beta_4 lngdp_{it} + \beta_5 INF_{it} + \beta_7 INV_{it} + \varepsilon_{it} \quad (3.9)$$

Where CAP_{it} is market capitalization to GDP ratio used for stock market development. TES_{it} is efficiency scores estimated in the first stage, ranges from 0 to 1. Where 0 means not efficient and 1 means highly efficient. These two variables are endogenous both depend upon each other. BC is bank concentration and used as an instrumental variable that is significantly correlated with bank efficiency (TES) but not correlated with ε (error term). lngdp, INF (inflation), INV(Total investment to GDP ratio), and are macroeconomic control variables.

The second effect that we examined is the effect of banking efficiency on stock market development. The existing literature suggests that banks and stock markets can be alternatively used for financing (Allen & Gale, 1999). For this purpose, we hypothesize our model as:

H2: As banking sector efficiency increases it will lead to a decrease in the development of stock market.

To check the validity of this relationship we form the GMM model as:

$$CAP_{it} = \alpha_1 + \alpha_2\, TES_{it} + \alpha_3\, FA_{it} + \alpha_4\, lngdp_{it} + \alpha_5\, INF_{it} + \alpha_6\ \ INV_{it} + \varepsilon_{it} \quad (3.10)$$

Where TES, CAP, GDP, INF, INV are the same as discussed before. FA_{it} is fund access (ease of access to stock market) and used as an instrumental variable that is significantly correlated with CAP_{it} score but not correlated with ε (error term).

Chapter 4

4.1: Descriptive Statistics

Descriptive statistics provide basic features of data used in a study. These statistics summarize and describe data in a meaningful way so that it becomes easy to understand the nature of data. Statistics that commonly used are central tendency (mean and median) range (maximum and minimum) and standard deviation. Mean is the average value of the variable and median is the value situated in the middle of observations. Closer values of mean and median depict symmetry distribution. The maximum and minimum values show the range of data and the standard deviation gives the estimated value of dispersion. Table 4.1 shows the descriptive statistics of our data.

Table 4. 1: Descriptive Statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.
TES	0.734354	0.71715	1	0.3261	0.187148
CAP	72.94017	61.9012	328.361	4.81303	58.53469
FA	4.398717	4.391019	6.312292	2.174717	0.785521
BC	57.24698	54.85636	100	20.8464	18.42905
Lngdp	26.2749	26.19645	30.60069	22.67328	1.653164
INF	5.104735	4.042189	29.50661	-4.86328	4.244258

INV	26.27634	26.1365	48.86901	12.835	7.095323

Note: Descriptive statistics are calculated for 29 countries from 2006 to 2017 all values are in percentage form except Lngdp, GDP values are in billion. TES is technical efficiency scores for each country estimated using an output-oriented DEA model ranges between 0 and 1. CAP is market capitalization as a share of GDP. FA is the ease of access to the financial market. BC is bank concentration. GD is gross domestic product. INF is the inflation rate and INV is total investment to GDP.

The mean value of TES is 0.734354 and the median of TES is 0.71715 both values are very close to each other that the distribution is symmetrical. The values of TES lies between 1 and 0 where 1 shows highly efficient and 0 value means not efficient, the maximum and minimum values of our sample are 1 and 0.3261 respectively. The standard deviation of TES is 0.187148. Market capitalization CAP has mean and median values of 72.94017 and 61.9012 respectively. FA is accessibility to funds from stock market where 1 mean very difficult to access funds and 7 mean very easy to access funds from the stock market. The average score of FA is 4.398717, the maximum score that any country got is 6.312292 and the minimum score is 2.174717. The standard deviation of FA is 0.785521. The mean value of BC is 57.24698 that shows that on average 57% concentration in the banking sector exists high concentration value that any country has is 100% and the lowest concentration value is 20.85%. The average value of Lngdp is 26.2749 whereas the maximum and minimum values are 30.60069 and 22.67328 respectively and the standard deviation is 1.653164. The average rate of inflation in our sample from 2006 to 2017 is 5.10% and the maximum and minimum inflation rate observed in our model is 29.50% and -4.86% respectively. On average the total share of investment in our GDP is 26.27%, the maximum and minimum value of the investment to GDP ratio is 48.86%, and 12.83% respectively and the standard deviation from mean value is 7.095323. We

have divided our countries into 6 regions and the region-wise description statistics are given in Appendix A.

4.2: Correlation analysis

The correlation matrix shows the correlation coefficient of variables. Table 4.2 shows the correlation between different variables. Negative signs show that variables are negatively correlated with each other. The maximum value of the correlation coefficient in our data is 0.46 that shows no sign of multicollinearity in our data. The correlation coefficient of TES and CAP is -0.1212 and P-value is 0.0256 that is significant at 5% and shows a negative correlation between TES and CAP. FA is positively correlated with CAP and has a correlation coefficient value of 0.4659 and P-value is 0.000 significant at 1% level of significance that indicate that FA can be a good instrument for CAP. BC and TES have a correlation value 0.14956 with P-value of 0.0022 which shows a positive and significant correlation between BC and TES that means BC can be a good instrumental variable for TES. The strong correlation of FA and BC with CAP and TES shows that FA and BC can be good instruments for CAP and BC respectively. Lngdp is positively correlated with CAP and INF and INV are negatively correlated with CAP. TES is positively correlated with Lngdp, INF, and INV having correlation coefficients of 0.22383, 0.03817, and 0.20556 respectively. Regional correlation matrixes are in Appendix B.

Table 4. 2: Correlation Matrix

Variables	TES	CAP	FA	BC	lngdp	INF	INV
TES	1						
CAP	-0.1212	1					
	(0.0256)						
FA	-0.0042	0.4659	1				
	(0.9385)	(0.000)					
BC	0.1636	0.4396	0.3399	1			
	(0.0022)	(0.000)	(0.000)				
Lngdp	0.2279	0.1312	0.0358	-0.359	1		
	(0.000)	(0.0157)	(0.5087)	(0.000)			
INF	0.0348	-0.2722	-0.0146	-0.1535	-0.0409	1	
	(0.519)	(0.000)	(0.7877)	(0.0043)	(0.4484)		
INV	0.1971	-0.0155	0.1905	0.0332	0.1324	-0.0918	1
	(0.0002)	(0.7757)	(0.0004)	(0.5376)	(0.0134)	(0.0885)	

Note: The correlation matrix is estimated on cross-sectional time-series data from 2006 to 2017. Negative values mean a negative correlation between variables. P-values are in parenthesis.

4.3: Banking Efficiency of countries having dual banking system (Islamic and conventional)

The first stage of our analysis consists of an estimation of efficiency score. Output oriented technical efficiency scores are measured through DEA model. Data comprises of 29 countries that exercise Islamic banking along with their conventional counterparts. Efficiency scores range from 0 to 1 where 0 efficiency score means that DMU is not efficient and an efficiency score equal to 1 means that the DMU is highly efficient in the utilization of their inputs in a way that produces maximum output. Efficiency Scores estimated through technical efficiencies are listed in Table 4.3. The overall average value of efficiency is 0.73 it shows that there exists a high level of technical inefficiency i.e. 0.27.

The overall trend of technical efficiency score is increasing and equal to 1.3% despite a huge dip in 2007 and 2008 due to financial crises. This increasing trend in efficiency suggests a highly competitive environment in the banking sector. It is obvious from these results that all banks are performing very well, and their managers are experts in their field. However, there is still space for improvement in the banking sector.

Table 4. 3: Mean Values of Technical Efficiency

Year	Mean Technical Efficiency
2006	0.7121
2007	0.688766
2008	0.695124
2009	0.786048
2010	0.759038
2011	0.7366
2012	0.757845
2013	0.741541
2014	0.753014
2015	0.739769
2016	0.721
2017	0.721403
Overall Mean	0.734354
SD	0.1871475

Note: Efficiency scores are generated through DEA model that ranges from 0 to 1, where 0 means not efficient and 1 means highly efficient. Average values of efficiency scores are present on yearly basis.

4.4 Causality between banking efficiency and stock market development

4.4.1: Testing endogeneity of regressors

The second stage of our analysis is to examine the causality between banking efficiency and stock market development. stock market and banking sector are closely interconnected with each other as discussed before. To find the relationship between the development of the stock market and banking efficiency, we first need to check the endogeneity of relative variables. A variable is considered as an endogenous one when it is correlated with the error term. To check whether a variable in our model is correlated with the error term or not, we use Hausman test. Table 4.4 presents the F-statistics and P-values of Durbin – Wu - Hausman test for regressors endogeneity. Results of Durbin-Wu-Hausman test suggest that market capitalization is the only endogenous regressor for banking efficiency in equation (3.9) at 5% significant level and TES is the only variable that is endogenous in equation (3.10) and all other variables BA, FA, Lngdp, INF and INV are exogenous in both equations.

Table 4. 4: Hausman test for endogeneity

Regressors	F-Statistics	P-value
Ho: CAP is exogenous in equation (eq,3.9)	4.14009	0.0429
Ho: BA is exogenous in equation (eq,3.9)	1.4017	0.2374
Ho: Lngdp is exogenous in equation (eq,3.9)	1.37853	0.2413
Ho: INF is exogenous in equation (eq,3.9)	0.462117	0.4972
Ho: INV is exogenous in equation (eq,3.9)	0.973699	0.3246
Ho: TES is exogenous in equation (eq,3.10)	5.84724	0.0163
Ho: FA is exogenous in equation (eq,3.10)	0.193771	0.6601
Ho: Lngdp is exogenous in equation (eq,3.10)	0.580004	0.4469
Ho: INF is exogenous in equation (eq,3.10)	2.07609	0.1508
Ho: INV is exogenous in equation (eq,3.10)	1.70167	0.1931

Note: CAP is Market Capitalization, BA is Bank Access, Lngdp is a natural log of GDP, INF is Inflation, INV is Investment, TES is Technical Efficiency Score of decision-making units estimated through DEA model.

4.4.2: Testing the validity of Instrumental Variables

Our model for testing causality requires instrumental variables. Instrumental variables are those variables that are significantly correlated with the endogenous

variable but not correlated with the error term. Instrumental variables that we are using in our analysis are CAP and TES. Table 4.5 present the result of weak instrument test.

Table 4. 5: Weak Instrument Test

Instrumental Variables	Cragg-Donald Wald F statistic	P-Value
Ho: FA is IV of CAP	1242.26	0.0000
Ho: BC is IV of TES	222.138	0.0000

Note: CAP is Market Capitalization, TES is the Technical Efficiency Score.

Cragg-Donald Wald test has been used to check the validity of instruments. Table 4.5 shows that Cragg-Donald Wald F statistics of both Fund Access (FA) and Bank Concentration (BC) are 1242.26 and 222.138 respectively and significant at 1% significance level. These results show that FA is a valid instrument of CAP and BC is a valid instrument of TSE. There is a significant correlation between FA and CAP as if it is easy to access funds from the capital market then stock market capitalization will increase. We can Hypothesize this in equation (3.9) as both CAP and FA are endogenous. However, Durbin-Wu-Hausman test shows that we do not have enough evidence to reject the null that FA is exogenous in equation 3.9. These shreds of evidence show that our results are unbiased and consistent.

4.4.3: Finding the relationship between stock market development and banking efficiency

After evaluation of the variable's endogeneity and testing for the validity of instrumental variables Generalized Method of Moments is then estimated. Cross-sectional pool data has been used that has a total of 29 cross-sections and 12 annual periods that made a total of 348 observations. As discussed before GMM estimators are better in accounting for other missing factors that are not covered in other IV approaches.

Table 4. 6: GMM regression results

INDEPENDENT VARIABLES	COEFFICIENT	SE	T-STATS
EQUATION (3.9) DEPENDENT VARIABLE: TES			
CONSTANT	-0.842850	0.189418	-4.449688
CAP	-0.001257	0.000208	-6.040679
BC	0.004773	0.000674	7.077093
LNGDP	0.049287	0.006680	7.378142
INF	-0.001703	0.002266	-0.751657
INV	0.003534	0.001347	2.624367
EQUATION (3.10) DEPENDENT VARIABLE: CAP			
CONSTANT	-165.5410	43.60589	-3.796299
TES	35.64840	17.09604	2.085185
FA	10.50965	2.513916	4.180590
LNGDP	14.01035	4.988820	2.808350
INF	-0.363601	0.335821	-1.082723
INV	1.737858	0.317122	5.480086

Note: This table presents the results of GMM estimation for equation (1) and equation (2). CAP is Market Capitalization, BA is Bank Access, Lngdp is a natural log of GDP, INF is Inflation, INV is

Investment, TES is Technical Efficiency Score of decision-making units estimated through DEA model.

Table 4.6 present the results of GMM estimation. In equation (3.9) we regress the TES against CAP with other control variables (i.e. Lngdp, INF, and INV) to find the impact of market capitalization on technical efficiency. The coefficient of CAP is -0.001257 with a standard error of 0.000208 and t-statistics -6.040679 i.e. significant at a 1% level of significance. This indicates that an increase in CAP will reduce the efficiency of the banking sector. This result is consistent with the view that the stock market and banking sector are competent to each other one sector develops at the expense of the other sector (Allen and Gale, 1999). The development of stock market attracts funds toward stocks directly rather than depositing money in banks. The coefficient of BC is 0.004773 and its standard error and t-statistics are 0.000674 and 7.077093 respectively. The positive sign indicates that there is a positive relationship between BC and TES. Accordingly, as a concentration in the banking sector increases the large-scale banking that enables large banks to earns more profits and hence increases efficiency. In addition to this, the coefficients of our control variables Lngdp and INV are positively and significantly related to TES, and INF is negatively related to TES but its impact on efficiency is insignificant. GDP and total investment in the private sector i.e. gross capital formation captures the development level of a country. As the development level of a country increases banking sector and stock market also develops.

The second part of Table 4.6 presents the results of equation (3.10). In equation (3.10) we analyzed the impact of TES on CAP. The coefficient of TES is 35.6484 with standard error and t-statistics are 17.0960 and 2.0851 respectively. The

impact of TES on CAP is significant at a 5% significance level. This result confirms the views of Song and Thakor (2010) that the development in banking sector increases the quality of screening the borrowers that in return increases the authenticity of borrowers going to the stock market for securitization this gives a positive signal to the investors about the borrower and increase investor's participation in stock market. Fund access FA has a coefficient 10.50965 and the values of standard error and t-statistics are 17.09604 and 4.180590 respectively that is significant at a one percent level of significance. The positive and significant relationship of FA with CAP indicates that as ease of access to the stock market increases firms will go to stock market to finance their project. The coefficient of Lngdp is 14.01035 and standard error and t-statistics are 4.988820 and the value of t-statistics is 2.808350 that is significant at a 5% level. The positive relation of Lngdp with capitalization shows that if there is a 1% change in GDP it will change stock market by 14.01%. INV also has a positive relation with CAP. Its coefficient is 1.737858 and standard error and t-statistics are 0.317122 and 5.480086. That shows that if a 1-unit change occurs in INV (positive/negative) it will change CAP by 1.73 units. The inflation variable INF has a negative relation with CAP but insignificant in our model.

4.5: Results' Discussion

Overall, efficiency estimates show that the average efficiency score is high at 0.73 that is due to the co-existence of Islamic and conventional banks. This high efficiency shows that both conventional and Islamic bank managers are experts in their field but there remains always a gap for further improvements. These two parallel banking systems compete with each other and that competitive environment

leads to an increase in banking sector efficiency. Gheeraert, (2014) found that Islamic banks spur the development of the banking sector through bringing in new shariah-compliant instruments in the market. These new shariah-compliant instruments and innovation in the banking sector do not crowd out previously existing conventional banking instruments. He also found that the penetration of Islamic banking complements the conventional banking system and increases the efficiency of the overall banking sector.

The impact of stock market development on banking sector is analyzed in equation (3.9) through GMM estimation. In equation (3.9) TES (banking efficiency) is our dependent variable and CAP (stock market capitalization) is an independent variable. The negative and significant value of the coefficient of CAP shows that an increase in stock market development will lead to a decline in banking sector efficiency. This is due to the diversity of opinion in investors. If funds are supplied directly to the stock market then the banking sector suffers from lack of funds. From the firms' perspective if stock market is more developed and funds are easily available and accessible from the stock market then firms will prefer to acquire funds through the stock market and that will lead to less demand for the loanable funds so the banking sector efficiency will reduce (Allen and Gale, 1999; Rojas-Suarez and Weisbrod, 1995; Jacklin and Bhattacharya, 1988).

The other side of the relationship is analyzed in equation (3.10) where TES is found to have a positive impact on CAP. It indicates that an increase in banking sector development leads to an increase in the development of stock market. The reason behind this positive impact of TES on CAP is that those countries which have efficient banking system are good in managing risk that in return reduces financing friction and hence that banking efficiency contributes toward a well-developed capital

market. Therefore, banks and stock markets can be considered as a complement to each other. This result is consistent with the view that banks have a comparative advantage over the stock market especially in the case of newly established firms due to their prior lending relationship with firms. Fama (1985) examines the role of the banking sector as a producer of information. The study argues that when banks have firms' private information due to lending relationships, they have a comparative advantage in screening borrowers. Bank lending relationship provides firms' inside information to screen and monitor the borrower and lending record give a positive signal to the market about firms' credibility and increase the investors in the market. Provision of loan to firms also reduce the information cost and thus increases investors participation in the stock market.

Furthermore, FA has a strong positive relationship with stock market development. It suggests that if firms and individuals can easily access stock markets then it will lead to the growth of market, suggest that well-developed stock markets have better risk-sharing and resource allocation facilities that attract investors toward stock market (Laeven, 2014). Bank concentration is also positively affecting banking efficiency, indicate that the structure of the banking sector plays an important role in the activities of financial intermediaries. High concentration in banks increases the profit efficiency of the banking sector (Maudos, Pastor, Perez, and Quesada, 2002). Our macroeconomic variables include inflation rate, total investment to GDP ratio, and log of GDP. The inflation rate does not realize its impact on stock market and banking efficiency. Total investment to GDP ratio and total investment has a positive impact on stock market and banking efficiency. The efficiency of banking sector is sensitive to macroeconomic fluctuations. Different trends in industrial sectors diversification in investment sectors and innovations and technological changes affect

the investment decisions and hence affect the efficiency of banks and also the development of stock markets. An increasing trend in economic growth increases the demand for funding facilities and that leads to higher interest margins and hence increases banking efficiency (Delis, and Papanikolaou, (2009).

Chapter 5

Conclusion

This study is based on technical efficiency that assumes that DMUs can manage and reallocate their resources and can enhance their productivity by increasing their output or decreasing their cost. This assumption is more suitable while analyzing the relationship between stock markets and banking sector efficiency. Generalized method of moment technique is applied to find the dual relationship between banking efficiency and stock market.

To find the relationship we first regressed the efficiency scores on stock market capitalization while controlling for macroeconomics changes with GDP, inflation, and the total investment to GDP ratio. Results show that in those countries where Islamic and conventional banks are working, an increase in market capitalization reduces banking efficiency. GDP and investment are found to have a positive impact on banking efficiency. Furthermore, we find that any positive change in banking sector efficiency increases the development of stock market and an increase in GDP and investment also increases the development of stock market. These results implement that if funds are available for stock market then they are not available for banking sector and the banking sector efficiency increases investors' participation in stock market that results in the development of stock markets.

Overall, the results of this study show that a larger and more developed stock market attracts more funds toward the stock market and reduces the efficiency of the banking system, but if banking sector is more efficient it will improve risk

management and reduce financing friction that increases the development of stock market. All in all, an improvement in banking sector is not only beneficial for banking system itself but also beneficial for the development of stock market. Moreover, investment and GDP also benefit both stock market and banking system. Our results suggest that policymakers should give more attention towards banking sector as compare to stock market to improve financial system of a country. In addition, an increase in investment and GDP can be used as a supplement for the improvement of the financial sector.

There are some limitations to this study, due to the unavailability of aggregate level data, this study could not change the input-output variables in the measurement of banking efficiency. Further studies are suggested to extend data. Compare and contrast the impact of Islamic banking and conventional banking on stock market separately. Use different input-output variables and different assumptions for estimation of efficiency scores.

References

Ali, H. (2014). Impact of Interest Rate on Stock Market; Evidence from Pakistani Market. Journal of Business and Management, 16(1), 64-6.

Allen, F., & Gale, D. (1997). Financial markets, intermediaries, and intertemporal smoothing. *Journal of political Economy*, *105*(3), 523-546.

Allen, F., & Gale, D. (1999). Diversity of opinion and financing of new technologies. *Journal of financial intermediation*, *8*(1-2), 68-89.

Allen, F., & Gale, D. (1999). Innovations in financial services, relationships, and risk sharing. *Management Science*, *45*(9), 1239-1253.

Ayadi, R., Arbak, E., Naceur, S. B., & De Groen, W. P. (2015). Financial development, bank efficiency, and economic growth across the Mediterranean. In *Economic and social development of the Southern and Eastern Mediterranean countries* (pp. 219-233). Springer, Cham.

Ball R., Kothari S., Robin A., (2000), The effect of international institutional factors on properties of accounting earnings, Journal of Accounting and Economics, 29 (1-3), 1-51.

Battese, G. E., & Coelli, T. J. (1995). A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical economics*, *20*(2), 325-332.

Beccalli, E., Casu, B., & Girardone, C. (2006). Efficiency and stock performance in European banking. *Journal of Business Finance & Accounting*, *33*(1-2), 245-262.

Beck, T., & Levine, R. (2004). Stock markets, banks, and growth: Panel evidence. *Journal of Banking & Finance*, *28*(3), 423-442.

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2000). A new database on the structure and development of the financial sector. *The World Bank Economic Review*, *14*(3), 597-605.

Berger, A. N. (2007). International comparisons of banking efficiency. *Financial Markets, Institutions & Instruments*, *16*(3), 119-144.

Berger, A. N., & Humphrey, D. B. (1997). Efficiency of financial institutions: International survey and directions for future research. *European journal of operational research*, *98*(2), 175-212.

Bossone, B. (2010). Banks and capital markets: A two-way nexus. *VoxEU. org*, *18*.

Delis, M. D., & Papanikolaou, N. I. (2009). Determinants of bank efficiency: evidence from a semi-parametric methodology. *Managerial Finance*, *35*(3), 260-275.

Demirgüç-Kunt, A., & Huizinga, H. (2000). Financial structure and bank profitability. *World Bank Policy Research Working Paper*, (2430).

Demirgüç-Kunt, A., & Levine, R. (1996). Stock market development and financial intermediaries: stylized facts. *The World Bank Economic Review*, *10*(2), 291-321.

Drucker, S., & Puri, M. (2007). Banks in capital markets. In *Handbook of Empirical Corporate Finance* (pp. 189-232). Elsevier.

Fama, E. F. (1985). What's different about banks?. *Journal of monetary economics*, *15*(1), 29-39.

Gheeraert, L. (2014). Does Islamic finance spur banking sector development?. Journal of economic behavior & organization, 103, S4-S20.

Gheeraert, L., & Weill, L. (2015). Does Islamic banking development favor macroeconomic efficiency? Evidence on the Islamic finance-growth nexus. Economic modelling, 47, 32-39.

Greenwood, J., & Smith, B. D. (1997). Financial markets in development, and the development of financial markets. *Journal of Economic dynamics and control*, *21*(1), 145-181.

Hadad, M. D., Hall, M. J., Kenjegalieva, K. A., Santoso, W., & Simper, R. (2011). Banking efficiency and stock market performance: an analysis of listed Indonesian banks. *Review of Quantitative Finance and Accounting*, *37*(1), 1-20.

Ioannidis, C., Molyneux, P., & Pasiouras, F. (2008). The relationship between bank efficiency and stock returns: evidence from Asia and Latin America. *University of Bath, School of Management, Working Paper*, (2008.10).

Jacklin, C. J., & Bhattacharya, S. (1988). Distinguishing panics and information-based bank runs: Welfare and policy implications. Journal of Political Economy, 96(3), 568-592.

Jayakumar, V. (2004). *Essays on capital liberalization and stock market development in emerging market economies* (Doctoral dissertation, Purdue University).

Laeven, M. L. (2014). *The development of local capital markets: rationale and challenges* (No. 14-234). International Monetary Fund.

Levine, R. (1991). Stock markets, growth, and tax policy. *The Journal of Finance*, *46*(4), 1445-1465.

Levine, R., & Zervos, S. (1998). Stock markets, banks, and economic growth. *American economic review*, 537-558.

Liadaki, A., & Gaganis, C. (2010). Efficiency and stock performance of EU banks: Is there a relationship?. *Omega*, *38*(5), 254-259.

Maudos, J., Pastor, J. M., Perez, F., & Quesada, J. (2002). Cost and profit efficiency in European banks. *Journal of international financial markets, institutions and money*, *12*(1), 33-58.

Neely, M. C., & Wheelock, D. C. (1997). Why does bank performance vary across states?. *Federal Reserve Bank of St. Louis Review*, *79*(2), 27.

Ngo, T., & Le, T. (2019). Capital market development and bank efficiency: a cross-country analysis. *International Journal of Managerial Finance*.

Rajan, R. G. (2006). Has finance made the world riskier?. European financial management, 12(4), 499-533.

Rojfs-Suárez, L., Rojas-Suárez, L., & Weisbrod, S. R. (1995). *Financial fragilities in Latin America: the 1980s and 1990s* (Vol. 132). International monetary fund.

Rousseau, P. L., & Sylla, R. (2005). Emerging financial markets and early US growth. *Explorations in Economic History*, *42*(1), 1-26.

Sathye, M. (2001). X-efficiency in Australian banking: An empirical investigation. *Journal of Banking & Finance*, *25*(3), 613-630.

Song, F., & Thakor, A. V. (2010). Financial System Architecture and the Co-evolution of Banks and Capital Markets. The Economic Journal, 120(547), 1021-1055.

Appendices

Appendix A

Region-wise summary statistics

Table A. 1: Asia and the pacific

VARIABLE	OBS	MEAN	S. D.	MIN	MAX
TES	72	0.759476	0.169377	0.4037	1
CAP	72	108.0333	62.54705	28.2156	259.026
FA	72	4.802658	0.605835	2.29332	6.312292
BC	72	59.77529	19.99105	38.40766	100
LNGDP	72	26.73024	0.670336	25.57258	28.08603
INF	72	3.212674	2.415413	-0.90043	13.10867
INV	72	25.94373	4.452712	16.01534	35.072

Table A. 2: Euresia

VARIABLE	OBS	MEAN	S. D.	MIN	MAX
TES	24	0.770271	0.181458	0.3669	1
CAP	24	35.58376	23.24884	10.3199	100.831
FA	23	3.250934	0.561746	2.736331	5.147622
BC	24	42.38549	14.86268	20.8464	67.92998
LNGDP	24	26.92119	1.224313	25.11776	28.46065
INF	24	8.682382	3.550769	3.683329	17.1399
INV	24	25.33768	3.722908	18.92638	35.5267

Table A. 3: Europe and North America

VARIABLE	OBS	MEAN	S. D.	MIN	MAX
TES	36	0.728117	0.210059	0.4056	1
CAP	36	76.83556	43.26223	19.8055	153.211
FA	36	4.302739	0.945181	2.421371	5.815181
BC	36	45.64106	11.85271	32.7963	73.1603
LNGDP	36	28.58465	1.336279	27.0377	30.60069
INF	36	4.027358	3.501204	-0.50046	11.14431
INV	36	23.77251	4.721281	17.2157	31.269

Table A. 4: Middle East and North Africa

VARIABLE	OBS	MEAN	S. D.	MIN	MAX
TES	120	0.721756	0.174626	0.3261	1
CAP	115	62.41027	39.37476	10.1291	230.826
FA	117	4.306026	0.722828	2.174717	5.889001
BC	120	65.79666	15.46005	35.38418	90.47438
LNGDP	120	25.15341	0.969897	23.44903	27.35177
INF	117	4.254614	4.509582	-4.86328	29.50661
INV	120	26.80745	7.108845	12.835	48.86901

Table A. 5: South Asia

VARIABLE	OBS	MEAN	S. D.	MIN	MAX
TES	60	0.7525	0.183414	0.4105	1
CAP	56	41.22587	25.21228	4.81303	111.877
FA	60	4.417716	0.585759	3.537022	5.78964
BC	60	49.29201	18.31338	26.44965	100
LNGDP	60	26.83516	1.816562	24.06541	30.14147
INF	60	7.011057	4.335197	-0.72817	22.5645
INV	60	31.10225	9.695872	14.121	46.66012

Table A. 6: Sub-Saharan Africa

VARIABLE	MEAN	S. D.	MIN	MAX	OBS
TES	0.678153	0.237298	0.3721	1	36
CAP	106.7333	101.1073	8.28088	328.361	36
FA	4.689702	0.757239	3.747419	6.288351	36
BC	58.46333	15.13508	38.5809	79.1769	36
LNGDP	25.42811	1.692293	22.67328	27.06627	36
INF	7.166827	3.90311	0.977675	16.52354	36
INV	20.25767	3.431666	14.90391	27.86559	36

Appendix B

Region-wise Correlation Matrix

Table B. 1: Correlation East Asia and the Pacific

	TES	CAP	FA	BC	LNGDP	INF	INV
TES	1.0000						
CAP	0.2271	1.0000					
	(0.0550)						
FA	0.1884	0.3143	1.0000				
	(0.1130)	(0.0072)					
BC	0.3724	0.7781	0.3732	1.0000			
	(0.0013)	(0.0000)	(0.0012)				
LNGDP	0.4672	-0.3084	0.0520	-0.1761	1.0000		
	(0.0000)	(0.0084)	(0.6643)	(0.1390)			
INF	0.0666	-0.3987	0.0252	-0.2982	0.0297	1.0000	
	(0.5783)	(0.0005)	(0.8333)	(0.0109)	(0.8041)		
INV	0.6618	-0.0555	0.0430	-0.0917	0.5939	0.3310	1.0000
	(0.0000)	(0.6436)	(0.7197)	(0.4435)	(0.0000)	(0.0045)	

Note: P-values are in parenthesis.

Table B. 2: Correlation Eurasia

	TES	CAP	FA	BC	LNGDP	INF	INV
TES	1						
CAP	-0.3676	1					
	(0.0772)						
FA	0.2495	0.4179	1				
	(0.2509)	(0.0472)					
BC	0.6487	-0.5563	0.2273	1			
	(0.0006)	(0.0048)	(0.297)				
LNGDP	-0.856	0.5346	-0.1784	-0.7332	1		
	(0.000)	(0.0071)	(0.4153)	(0.000)			
INF	-0.0536	0.1918	0.3288	0.0066	-0.0672	1	
	(0.8035)	(0.3693)	(0.1255)	(0.9756)	(0.7551)		
INV	0.6435	-0.2676	0.5854	0.6619	-0.7114	0.109	1
	(0.0007)	(0.2062)	(0.0033)	(0.0004)	(0.0001)	(0.612)	

Note: P-values are in parenthesis.

Table B. 3: Correlation Europe and North America

	TES	CAP	FA	BC	LNGDP	INF	INV
TES	1.0000						
CAP	-0.4717	1.0000					
	(0.0037)						
FA	-0.3689	0.3473	1.0000				
	(0.0268)	(0.0379)					
BC	0.5632	-0.1700	-0.2892	1.0000			
	(0.0003)	(0.3217)	(0.0871)				
LNGDP	-0.7135	0.8855	0.3671	-0.5261	1.0000		
	(0.0000)	(0.0000)	(0.0276)	(0.0010)			
INF	0.1995	-0.7253	0.0890	-0.2691	-0.5620	1.0000	
	(0.2435)	(0.0000)	(0.6056)	(0.1125)	(0.0004)		
INV	0.3486	-0.5656	0.2301	0.0001	-0.5658	0.8026	1.0000
	(0.0372)	(0.0003)	(0.1770)	(0.9997)	(0.0003)	(0.0000)	

Note: P-values are in parenthesis.

Table B. 4: Correlation Middle East and North Africa

	TES	CAP	FA	BC	LNGDP	INF	INV
TES	1.0000						
CAP	0.1968	1.0000					
	(0.0351)						
FA	0.3275	0.5382	1.0000				
	(0.0003)	(0.0000)					
BC	0.3215	0.6223	0.4859	1.0000			
	(0.0003)	(0.0000)	(0.0000)				
LNGDP	0.5996	-0.1023	0.1384	-0.0479	1.0000		
	(0.0000)	(0.2768)	(0.1366)	(0.6037)			
INF	0.0711	-0.0007	0.0854	-0.0600	0.1860	1.0000	
	(0.4461)	(0.9944)	(0.3622)	(0.5206)	(0.0447)		
INV	-0.0566	0.3459	0.4039	0.3403	-0.0511	-0.1812	1.0000
	(0.5394)	(0.0002)	(0.0000)	(0.0001)	(0.5795)	(0.0506)	

Note: P-values are in parenthesis.

Table B. 5: Correlation South Asia

	TES	CAP	FA	BC	LNGDP	INF	INV
TES	1.0000						
CAP	0.0263	1.0000					
	(0.8474)						
FA	-0.3613	0.1375	1.0000				
	(0.0046)	(0.3122)					
BC	-0.0125	-0.5558	0.1399	1.0000			
	(0.9244)	(0.0000)	(0.2863)				
LNGDP	0.4035	0.7335	-0.2761	-0.3569	1.0000		
	(0.0014)	(0.0000)	(0.0328)	(0.0051)			
INF	-0.5133	-0.2292	0.3032	0.2546	-0.4641	1.0000	
	(0.0000)	(0.0892)	(0.0185)	(0.0496)	(0.0002)		
INV	0.3826	0.6328	0.1798	-0.2922	0.6889	-0.3979	1.0000
	(0.0026)	(0.0000)	(0.1692)	(0.0235)	(0.0000)	(0.0016)	

Note: P-values are in parenthesis.

Table B. 6: Correlation Sub-Saharan Africa

	TES	CAP	FA	BC	LNGDP	INF	INV
TES	1.0000						
CAP	-0.6417	1.0000					
	(0.0000)						
FA	-0.2149	0.5766	1.0000				
	(0.2081)	(0.0002)					
BC	-0.4306	0.8570	0.8367	1.0000			
	(0.0088)	(0.0000)	(0.0000)				
LNGDP	0.5117	0.2543	0.3200	0.3613	1.0000		
	(0.0014)	(0.1345)	(0.0571)	(0.0304)			
INF	0.6800	-0.3982	-0.0731	-0.2676	0.4557	1.0000	
	(0.0000)	(0.0161)	(0.6718)	(0.1146)	(0.0052)		
INV	-0.5012	0.1357	0.3909	0.3048	-0.5021	-0.3109	1.0000
	(0.0018)	(0.4299)	(0.0184)	(0.0707)	(0.0018)	(0.0649)	

Note: P-values are in parenthesis.