Impact of Corporate Governance on Firm Efficiency: A Study of Thai Banking Companies

¹Keertiman Sharma, Duangjai Ow-jariyapithak, Piyada Dasri, David Van Brecht and Danuch Sahakijpicharn

Faculty of Business & Technology, Stamford International University, Thailand Email: ¹keertiman.sharma@stamford.edu

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Abstract

Corporate governance refers to the system by which organizations are directed and controlled. The need for and the relative importance of corporate governance arose in the 1980s due to poor corporate governance, which led to a loss in the value of firms, a downturn in economies, trust deficit in businesses, and corporate responsibility scandals. Good corporate governance will help in reassuring the stakeholders that an organization's Board of directors (BOD) and top management are acting as worthy agents of their principal (the shareholders). Firm efficiency is the effective utilization of a firm's resources to generate more revenues. The present paper addresses whether a positive relationship exists between corporate governance and firm efficiency in Thai Banking companies. It analyzes whether good corporate governance leads to better firm efficiency and helps users' decision-making. For this purpose, the corporate governance scores (CG scores) of eleven (11) Thai banking companies (Public Companies Limited) have been compared and evaluated with their firm efficiency for each of the five years from 2015 to 2019. Data Envelopment Analysis (DEA) has been performed on essential financial items to determine firm efficiency. These financial items relate to the ones used in DuPont analysis. They have been obtained from the banks' financial statements. The findings report the change in CG scores and DEA firm efficiency of Thai banking companies and the impact of corporate governance on the efficiency of these firms. There is a clear and positive relationship between corporate governance and firm efficiency for most Thai banking companies but not for all of them.

Keywords: Corporate governance; firm efficiency; DEA; CG scores; Thai banking companies

Introduction

Corporate governance refers to how an organization is directed and controlled by its Board of directors (BOD) and senior management. The Stock Exchange of Thailand (SET) defines corporate governance as a relationship between the Board of directors, its management team, shareholders, and other stakeholders in controlling its direction and monitoring its operations and administration. Claessens and Yurtoglu (2006) suggest that corporate governance considers matters like how the Board of directors operates, the roles of shareholders and stakeholders, executive compensation in determining the performance of a firm, and the relationship between labor policies and firm performance. Mekong Capital (2003) mentioned the benefits of good governance, which are as follows:

- Higher valuation: The study indicated a high correlation between corporate governance and a company's performance.
- Capital efficiency: Companies with good governance are more likely to make better decisions and generate higher returns on their spending towards growing the revenue.
- Higher returns for shareholders: Good governance offers higher returns to the shareholders
- Mitigation of risks: Good governance, including transparency, transparent procedures, and responsibility for important decisions, could empower the company's Board to have better control and sound risk management that aids in mitigating the risks.
- Improved vision: Corporate governance helps improve an organization's vision through effective leadership by its Board and top managers.
- Transparency and social accountability: It enhances transparency and accountability in an organization, bolsters public confidence.

One of the causes of the financial crisis in Thailand in 1997 was poor corporate governance. Poor governance was responsible for frivolous lending by financial institutions, overusing short-term foreign currency-denominated loans to finance long-term investments, expropriation of company funds by managers and owners, risky business deals, and poor audits. The main factors contributing to weak corporate governance in Thailand were: ineffectiveness of regulatory framework, lack of transparency and adequate disclosure, and family-based corporate ownership structure (Limpaphayom, 2001). Weak corporate governance may cause various risk factors to stakeholders of the company such as loans to related parties, loans from related parties, asset sales to shareholders, share purchases from shareholders, fraudulent asset transfers, poor transparency, and unclear procedures. Each of these risk factors would harm shareholders and stakeholders. It may lead to poor transparency, and the investors would not make sound decisions (Mekong Capital, 2003).

Firm efficiency refers to how well the company utilizes its resources to generate revenues. Although the scope of firm efficiency can differ, depending on the type of research conducted and the economic situation in which a firm operates, its underlying import lies in the effective utilization of scarce resources that an organization has. Koh and Nawalkha (2020) define firm efficiency as an organization or a manager's ability to use its resources to maximize output based on a selection of input variables. Processes used in production, manufacturing, and service industries have become more efficient due to the increasing use of technology. Examples include data analytics, robotics, and enhanced processing power.

For this research, corporate governance (CG) scores are used to determine the quality of corporate governance in Thai banking companies. CG scores were obtained from the Thai Institute of Directors (IOD) website for the sample of banking companies. These scores will assist in knowing how well the corporate governance performance for the sample of these companies has been. Data envelopment analysis (DEA) is effective in measuring firm efficiency comparison. It is a non-parametric linear programming technique that converts input and output variables to an aggregate score relative to the best-in-class observations. Sherman and Zhu (2013) mentioned that DEA helps companies benchmark and identify best practices that are not easy to achieve using management techniques. DEA can be used to determine service organizations' efficiency and performance evaluation.

Lin et al. (2009) suggested that the corporate governance indicators like the proportion of outside directors and number of board meetings are positively associated with the firm efficiency in Chinese manufacturing firms. They provide credible signals to minority



investors of firms with an insider-dominated or small board. The authors also mentioned that firm efficiency was positively related to public and employee share ownership while negatively related to state ownership. In a sample of manufacturing firms from sixteen countries, Nanka-Bruce (2011) mentioned that corporate governance could contribute towards better technical efficiency of firms by increasing the large external shareholders. The author also suggested that a firm should increase the size of non-executive directors when the firm has widely dispersed directors or the executive directors are underperforming.

Nguyen and Vo (2020) examined the impact of corporate governance on the efficiency of ASEAN banks. They suggested that government-owned banks were more costefficient, but private and foreign banks were more efficient. They also mentioned that CEO duality, board independence, and foreign ownership showed no significant effect on bank efficiency levels. Another paper by Hsu and Petchsakulwong (2010) also studied the effect of corporate governance on efficiency, but it was done for Thai non-life insurance industry. There is still a lack of studies about the impact of corporate governance on the efficiency of Thai banking companies. There has also been a lack of studies on determining the efficiency of the firms by using the DEA technique on the Thai banks. Thus, more study and evidence are required to expand knowledge in this area and assist the managers, investors, and other users in better decision-making.

As an attempt to fill this research gap, the objective of this study is to address whether corporate governance in an organization is positively related to its efficiency or not. The point here is to analyze if good corporate governance will lead to better firm efficiency for a sample of Thai Banking companies and therefore help users' decision-making by analyzing the relationship between CG and firm efficiency. Results from this study will provide a further contribution to existing literature that still needs more evidence regarding the effect of corporate governance on firm efficiency in Thai banks. In addition, the results will also provide implications to the stakeholders like managers about which companies demonstrate a positive relationship between good corporate governance and efficiency and which ones do not. This may help the managers of banks, for instance, identify and analyze the causes or factors responsible for lower firm efficiency despite having good corporate governance.

Literature Review

History of Corporate Governance

Corporate governance has been referred to as creating an environment that stimulates trust within an organization. In the capital markets, the word trust has been associated as an essential factor for buying shares. It is so because without trust, investors will not buy shares, and without access to adequate funding sources, companies cannot prosper quickly. Corporate governance has also been a significant consideration among foreign investors looking at Thai capital markets. However, corporate governance was not deliberated upon in the professional or academic literature before 1980.

Corporate governance was primarily brought to focus in 1987 by the Treadway Commission in the United States, which issued a report on fraudulent financial reporting and asserted the role and status of audit committees. Afterward, in May 1991 in the UK, the Cadbury Committee was set up by Financial Reporting Council (FRC), the London Stock Exchange, and the accountancy profession to look into the low level of confidence of stakeholders in financial reporting and inadequacy in the work of auditors who audit the financial reports. In addition, the responsibilities of the Committee were to report on the financial aspects of corporate governance, consider the responsibilities of executive and nonexecutive directors, the case for the audit committee, the principal responsibilities of auditors, the extent and value of the audit, and the links between shareholders, boards, and auditors. This Committee recommended three principles of the Code of Best Practice to be the guidelines for the companies, which are:

- Openness: subject to corporate confidentiality
- Integrity: honest, balanced, and complete financial reporting
- Accountability: requirement for directors to provide quality information and for shareholders to exercise their powers as owners' responsibility

Significance of corporate governance in modern times

Jo and Harjato (2011) suggested that corporate governance manages the interest of shareholders and non-investing stakeholders and helps resolve the conflict between the two. Accelerated corporate governance in the last decade has also led to the growth of Corporate Social Responsibility (CSR), ensuring the firm's sustainability through transparency and accountability (Jo and Harjato, 2011). In other words, CSR is an extension of an organization's efforts to provide better corporate governance and enhance its sustainability. Good corporate governance promotes investor confidence. Therefore, it is crucial to raise capital from potential investors. The companies should focus on a holistic and informative explanation of their corporate governance framework to their stakeholders.

The role of the Board of Directors (or Board) is crucial to good corporate governance. Denis and McConnell (2003) mentioned that the Board exists mainly to recruit, disengage a senior employee from service, monitor and compensate management with the significant objective of maximizing the shareholders' value. In theory, it is an effective mechanism but may not be so in practice. In the US, the Board of Directors includes some of the very insiders to be monitored (Denis & McConnell, 2003). There is also a possibility that the Chief Executive Officer (CEO) is the chairperson of the Board. In other words, it raises some questions on whether good corporate governance is possible in such situations or not.

Corporate Governance in Thailand

Initial interest and concern concerning corporate governance in Thailand started in the 1980s by Siam Cement Plc., Thailand's most significant conglomerate in building and construction materials. This company adopted a code of best practice by following the governance model of IBM. Despite this, there was generally a lack of development and interest towards corporate governance until the financial crisis in 1997. At that time, The Stock Exchange of Thailand (SET) realized the significance of corporate governance in developing the capital markets after the banks and many other financial institutions collapsed. Since then, corporate governance practices have been studied and taken seriously.

The SET has continuously supported listed firms to establish their CG systems. In 2002, the SET supported listed firms' good CG by proposing the 15 Principles of Good Corporate Governance as preliminary guidelines to implement. In 2006, the principles were revised to be comprehensive and comparable to the Principles of Corporate Governance of the Organization for Economic Co-operation and Development (OECD). Also, it includes recommendations made by the World Bank in its Report on the Observance of Standards and Codes related to Thai CG (CG-ROSC).

The Stock Exchange of Thailand (SET) and the Securities and Exchange Commission (SEC), Thailand have cited four factors to promote good corporate governance. These factors are:



- Fairness: To treat shareholders and creditors fairly and protect them against fraud and misconduct
- Transparency: To disclose accurate and timely information of both financial and non-financial aspects of a company
- Accountability: To set up a structure of accountability for the Board of directors and executives and make them accountable towards the interest of shareholders and creditors
- Responsibility: Management should take responsibility regarding the interests of the organizations' shareholders and stakeholders.

Prommin et al. (2014) studied the effect of corporate governance on stock liquidity in Thailand. The authors suggested that effective corporate governance provided better operational and financial transparency in firms and that this led to a significant improvement in the stock liquidity. They have claimed that a rise in governance quality by one standard deviation improves the stock liquidity ratio by 26.19%.

Hoontrakul and Karnchanasai (2010) suggested that the majority of the privately owned banks in Thailand are efficient and have better corporate governance. The authors mentioned that the Bank of Thailand (BoT) has continuously updated its bank functioning and corporate governance regulations. The Thai banks can do better with a clear strategic direction.

According to the Institute of Directors (IOD) in Thailand, the Thai banking sector has consistently been the best performing in corporate governance over the years compared to other sectors. The Thai SEC requires Thai companies to disclose their CG practices in the 56-1 business report and the annual Report. For instance, Thai banks scored highest on the IOD 2019 and 2018 CG ratings. All the banks scored an excellent or very good CG rating in both years. In general, the companies with high market capitalization from different sectors have exhibited a better corporate governance performance in Thailand.

Corporate Governance parameters

Iftikhar et al. (2017) studied the relationship between corporate governance and Pakistani listed commercial banks' technical efficiency from 2005 to 2014. The study found a statistically significant positive relationship between a corporate governance index and the technical efficiency observed in the banks. The corporate governance index used in the study was subdivided into the following five areas: Board of directors, audit committee, disclosure and transparency, remuneration committee, and shareholder's rights.

Like the CG scores in Thailand, corporate governance benchmarking benefits the shareholders, creditors, management, employees, directors, policymakers, academics, analysts, customers, and regulators. CG score for a firm may help in investment screening, pricing the new capital issues, and guiding regulation and policy. It helps the various stakeholders evaluate a firm's corporate governance practice and compare the firms. It also supports comparing corporate governance practices from one country to another.

The Thai Institute of Directors (Thai IOD) compiles annual corporate governance scores for nearly all listed Thai companies. The IOD evaluates corporate governance using five categories, namely: Rights of Shareholders (15%), Equitable Treatment of Shareholders (10%), Role of Stakeholders (20%), Disclosure, and Transparency (20%), Board Responsibilities (35%). Each category's weightings to the firm's corporate governance score have been included in parentheses. The Thai IOD calculates a weighted average score by checking a list of criteria related to each corporate governance category. The individual scores of each company are not made publicly available, but the Thai IOD reports company performance by categorizing performance; the following categories are used: Excellent

(****) for CG scores greater than 90, Very Good (****) for scores between 80 and 89, Good (***) for scores between 70 and 79. If a listed firm is not included in one of the above categories, it can be assumed to achieve a score of lower than 70.

Firm Efficiency

Different scholars have also used different techniques to determine firm efficiency. One such technique is known as the modified form of the technique for order preference by similarity to ideal solution (TOPSIS). Deng et al. (2000) pioneered the new method to analyze and rank the firms based on their overall performance on multiple financial ratios. It can also be considered as a multiple-criteria analysis for inter-firm comparison using financial ratios. Scholars have also used Tobin's Q ratio to measure firm performance.

Another technique that industry practitioners and research scholars use to value a firm is the Data Envelopment Analysis (DEA). Sharma (2018) has defined DEA as a usual nonparametric method that uses linear programming to measure the relative performance of similar units of a firm or between the firms. This technique uses multiple input and output variables to generate an overall score. Anadol et al. (2014) mentioned that DEA could play an important role in firm valuation as it is a relatively advanced technique. Anadol et al. (2014) used this method to determine the efficient and inefficient American companies.

DEA has not been used in financial analysis, although its use has grown since 2000 and onwards. One of the significant advantages of using this technique is that multiple input and output factors can be used to generate the relative efficiency of the firms. The use of DEA contrasts to ratio analysis which typically compares one financial item with another to derive information. For instance, the Return on Assets ratio expresses the relationship between net profit and the average total assets of a firm to throw light on the asset efficiency. Since DEA can use multiple inputs and outputs simultaneously, it provides a holistic view and a pragmatic relative efficiency and performance of a firm. Another advantage of using DEA is that it provides a relative measure of a firm's efficiency. So, it becomes easier and straightforward to analyze and compare the firms and helps investors in their decisionmaking process.

Zhu et al. (2021) conducted an efficiency and productivity analysis of Pakistan's banking industry using the DEA approach. They used interest and non-interest expense as input variables and interest income and non-interest income as the output variables. They selected these variables based on past studies done by Zhu and Shah (2019) and Avkiran (1999). Rodríguez-Pérez et al. (2011) researched 85 Spanish insurance companies and considered total expenses, financial investments in associated and group companies, other financial investments, land and buildings, and other assets as input variables while considering total revenues as output variable. These variables were used to determine firm efficiency by using DEA analysis. They considered these input variables because they form a significant chunk of a financial (insurance) company and will therefore affect the generation of revenue (the output variable). They also considered the changes in the historical cost basis to fair value basis. They advocated that some of these input variables will show significant differences between the two valuation bases and, therefore, help determine and compare the firm efficiency by using each valuation basis. Different authors and scholars have used different variables based on the nature and scope of their studies and the variables used in the past studies for related research.



Research Hypothesis

H1: High corporate governance score leads to the high efficiency of the Thai banking companies.

H2: Ranking of Thai banking companies based on their corporate governance scores will concur with the ranking based on their efficiency.

Research Methodology

Sample and data collection

The annual reports of a sample of eleven (11) Thai banking public companies limited (PCL) were obtained. All the financial information related to the variables chosen, like total expenses, available for sale securities, annual revenue, etc., were obtained from the financial statements or notes to the financial statements. This was done in order to test the hypothesis and analyze the findings. The present research is based on secondary data, which is the annual reports/financial statements of the Thai banking PCL. The main reason for selecting banking companies is that they are critical to developing the Thai economy and contribute a substantial portion to Thailand's Gross Domestic Product (GDP). Finance (including banking) and the insurance industry contributed Thai Baht 1.27 trillion towards the country's GDP in 2019.

The annual reports and related financial information were obtained from these companies' websites, the settrade.com website, and the Stock Exchange of Thailand (SET) website. The information on available-for-sale securities, securities-held-to-maturity and land & buildings was collected from the balance sheet of the sample of companies. The information for revenues and expenses was taken from the income statement of these companies. Expenses, available-for-sale securities, securities-held-to-maturity, and land & buildings have been taken as input variables. In contrast, the revenue is considered as an output variable for this research.

The first word in capital letters of these banking companies mentioned below refer to their stock symbol or ticker, and these symbols will be used more often in this research. The list of these companies is as follows:

KBANK – Kasikorn Bank Public Company Limited; TTB - TMBThanachart Bank Public Company Limited; BBL - Bangkok Bank Public Company Limited; KTB - Krung Thai Bank Public Company Limited; BAY - Bank of Ayudhya Public Company Limited; KKP - Kiatnakin Phatra Bank Public Company Limited; CIMBT - CIMB Thai Bank Public Company Limited; SCB - The Siam Commercial Bank Public Company Limited; TCAP -Thanachart Capital Public Company Limited; TISCO - Tisco Financial Group Public Company Limited; LHFG - LH Financial Group Public Company Limited

The information regarding the corporate governance scores (CG score) of the sample of companies has been taken from the Thai Institute of Directors (IOD) website. The Institute of Directors is a leading organization for improving corporate governance and director professionalism in Thailand. The organization's guidelines on corporate governance are considered reliable and effective, nationally and globally.

The assessment of the corporate governance practices of Thai listed companies is done by the IOD in collaboration with the Stock Exchange of Thailand (SET). The assessment criteria are developed based on the Thai Corporate Governance Code for Listed Companies and the Organization for Economic Cooperation and Development (OECD). It is then published in a comprehensive report, "Corporate Governance Report of Thai Listed Companies (GCR)".

Measures

a. Focus was placed on the financial items likely to affect banking companies' efficiency. They included the annual revenues as the output and expenses, available-for-sale securities, securities-held-to-maturity, and land & buildings as the inputs. In other words, these variables relate to the ones used in DuPont analysis.

b. Standard deviation was used to study all the variables under consideration, like companies' expenses for different years. This was done to know the dispersion of the variables from the mean.

c. The CG scores of Thai banking companies were compared with their efficiency scores for each of the five years from 2015 to 2019 to test hypothesis H1.

Table 1. CG scores description categorized by the Institute of Directors

Score	90-100	80-89	70-79	60-69	50-59	<50
Description	Excellent	Very Good	Good	Satisfactory	Pass	N/A

The significant categories of assessment of corporate governance by IOD and SET include the role of stakeholders (20%), disclosure and transparency (20%), board responsibilities (35%), rights of shareholders (15%), and equitable treatment of shareholders (10%). A steering committee comprising industry leaders reviews and comments on the CG score evaluation process.

d. Relative efficiency for each year of Thai banking companies was determined using DEA analysis and evaluated with the ranking of these companies based on their corporate governance scores. This was done to test hypothesis H2. DEA analysis is a proven method to determine firm efficiency and is especially relevant when the data is not normally distributed as it is a non-parametric method. A non-parametric method does not make any assumption about the characteristics of the sample or its parameters and usually means that the data does not have a normal distribution.

One sample Kolmogorov- Smirnov (K-S) test is also used to determine if a variable is normally distributed or not. e. The skewness & kurtosis and one-sample Kolmogorov-Smirnov (K-S) test were performed to determine if the data is normally distributed or not. Skewness can be quantified as representing the degree to which a given distribution varies from a normal distribution, while kurtosis measures whether the data are lightly tailed or heavily tailed relative to the spread or normal distribution.

The use of CG scores and DEA efficiency methods will help to achieve the objective of this study which is to address whether corporate governance in a bank is positively related to its efficiency or not. CG scores are provided by IOD, which is a reliable organization in Thailand. These scores are derived for companies through the use of scientific assessment methods. DEA is an effective and reliable non-parametric method used to determine an organization's efficiency.

DEA and statistical analysis

DEA software DEAP and SPSS software were used to perform this research. DEAP software was used to determine companies' efficiency scores, while SPSS software was used to determine Standard deviation, mean and perform Kolmogorov-Smirnov (K-S) test.

DEA can effectively determine an overall score for the efficiency of a firm based on the input and output variables. It is a powerful tool in analyzing the efficiency of a firm. In financial statement analysis, input and output variables are the primary financial items or accounts that can significantly affect firms' efficiency. In the DEA model used in this study, total expenses, Available-for- sales-securities, Securities-held-to-maturity, Land & Buildings have been taken as input variables. At the same time, annual revenue is considered an output variable. These input variables are a firm's significant resources that help it generate its total revenues. Therefore, these variables have been taken as the inputs which affect the output, i.e., total revenues. Contrasting outputs to inputs helps to determine the efficiency of a firm.

Table 2. Input and Output Variables used in DEA model

Input variablesOutput variableTotal expensesTotal revenuesAvailable-for- sales-securitiesTotal revenuesSecurities-held- to-maturityLand & Buildings

A simple DEA model of one input variable and one output variable is explained below:



Fig. 1. Simple DEA model - one input variable and one output variable

The decision-making units (DMUs) or firms A, C, and D are considered the most efficient as they are on the efficiency frontier among a set of observations. The curve from 0 and passing through A, C, and F is the efficiency frontier because it shows the best input and

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output variables combinations. Firm B is inefficient as it is not on the efficiency frontier. To be efficient, it can do one of two things; one way is to reduce its input from X_C to X_A while keeping the output Y the same. Labeled YB. Another method is increasing its output variable from Y_B to Y_C while keeping the same (X_C) input. It can be expressed as follows:

1. Firm B should increase its output by δ_0

$$\gamma = \frac{Y_C/X_C}{Y_B/X_C} > 1$$

Here γ represents the factor by which Firm B's output should be improved to become fully efficient. This approach is called the output-oriented approach as it focuses on improving the output variable.

2. Firm B should decrease its input by δ_1

$$\theta = \frac{Y_D / X_G}{Y_D / X_E} > 1$$

Here θ represents the factor by which Firm B's input should be decreased to become fully efficient. This approach is called the input-oriented approach because it aims at decreasing the input and maximizing efficiency.

For this research, an output-oriented approach and constant returns-to-scale have been assumed. Technical efficiency of 1 is considered the best and means that the decision-making unit (DMU) is the most efficient, whereas a score of 0 means the DMU is least efficient among its peers. In other words, the technical efficiency of DMUs can have a score between 0 and 1, with 0 representing the least efficient firm, while the more the score, the better is the efficiency of a firm with the maximum at 1. DMUs refer to the firms under consideration for their firm efficiency.

Results

Financial year (FY) 2015

The following information has been taken from the financial statements and annual reports from 2015-2019. This data pertains to the input and output variables chosen for DEA analysis of eleven (11) banking companies (Public Company Limited) in Thailand. PCL means Public Company Limited. All units are in Thai Baht (THB) million.

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			Available-for-	Securities-		
Bank Name	Annual revenue	Total expenses	sales- securities	held- to- maturity	Land & Buildings	Corporate governance Score
KBANK	147,515	66,656	215,365	248,272	45,284	excellent (5 stars)
TTB	33,450	16,467	40,814	39,557	10,292	excellent (5 stars)
BBL	102,728	45,045	441,497	16,213	46,108	very good (4 stars)
KTB	116,607	50,920	93,740	124,706	26,355	excellent (5 stars)
BAY	82,773	38,947	107,756	1,006	20,993	very good (4 stars)
ККР	15,057	7,822	12,940	1,005	1,892	excellent (5 stars)
CIMBT	12,234	7,127	26,518	22,399	2,770	very good (4 stars)
SCB	137,258	48,797	382,200	133,064	39,988	excellent (5 stars)
TCAP	39,895	20,009	160,527	11,053	8,047	very good (4 stars)
TISCO	16,489	5,527	7,886	191	2,633	excellent (5 stars)
LHFG	5,543	2,400	2,353	44,824	499	excellent (5 stars)

Table 3. Financial information of Thai banking companies for FY 2015



Available-for-Securities-Bank Annual Total salesheld- to-Land & **Corporate** governance Name securities maturity Buildings Score revenue expenses 153,403 298,065 KBANK 63,854 336,234 49,728 excellent (5 stars) TTB 35,223 16,589 24,355 25,309 12,383 excellent (5 stars) BBL 105,858 50,505 462,742 18,121 45,231 very good (4 stars) KTB 124,668 103,088 27,313 excellent (5 stars) 50,631 106,241 43,080 BAY 91,487 114,497 16,700 25,221 excellent (5 stars) KKP 16,156 7,352 12,914 1,093,949 2,092 excellent (5 stars) CIMBT 12,928 7,424 17,511 very good (4 stars) 30,433 3,671 SCB 133,334 51,644 438,473 122,166 40,888 excellent (5 stars) TCAP 40,747 21,073 165,736 2,917 9,605 excellent (5 stars) TISCO 16,757 6,541 6,753 16 2,653 excellent (5 stars) LHFG 6,967 404 2,602 6,859 45,803 excellent (5 stars)

Financial year 2016

Table 4. Financial information of Thai banking companies for FY 2016

Financial year 2017 Table 5. Financial information of Thai banking companies for FY 2017

Bank Name	Annual revenue	Total expenses	Available-for- sales- securities	Securities- held- to- maturity	Land & Buildings	Corporate governance Score
KBANK	156,856	66,372	171,397	338,003	50,137	excellent (5 stars)
TTB	37,439	17,792	36,865	23,851	12,071	excellent (5 stars)
BBL	112,468	48,948	533,651	11,233	30,763	very good (4 stars)
KTB	123,224	49,483	158,497	41,837	26,019	excellent (5 stars)
BAY	100,480	48,210	66,797	16,438	26,401	excellent (5 stars)
ККР	16,298	8,578	16,737	1,218	2,744	excellent (5 stars)
CIMBT	13,155	7,613	20,811	13,600	3,588	very good (4 stars)
SCB	182,579	57,650	432,064	120,671	44,164	excellent (5 stars)
TCAP	47,323	20,836	155,454	2,024	8,678	excellent (5 stars)
TISCO	18,394	7,671	7,127	0	2,653	excellent (5 stars)
LHFG	6,493	2,721	1,246	47,146	343	excellent (5 stars)

Bank Name	Annual revenue	Total expenses	Available-for- sales- securities	Securities- held- to- maturity	Land & Buildings	Corporate governance Score
KBANK	155,483	68,348	266,798	371,025	48,525	excellent (5 stars)
TTB	48,042	17,475	40,830	31,143	11,876	excellent (5 stars)
BBL	121,400	55,165	497,838	19,849	31,168	very good (4 stars)
KTB	117,221	53,088	196,800	2,392	26,501	excellent (5 stars)
BAY	109,579	51,741	117,098	16,297	26,239	excellent (5 stars)
ККР	18,103	9,470	18,715	1,227	2,773	excellent (5 stars)
CIMBT	13,537	8,346	48,874	20,105	3,536	very good (4 stars)
SCB	188,135	64,639	432,663	120,645	43,206	excellent (5 stars)
TCAP	49,168	20,979	147,676	2,231	8,043	excellent (5 stars)
TISCO	20,033	8,753	8,793	0	2,992	excellent (5 stars)
LHFG	7,060	2,768	2,408	43,241	292	excellent (5 stars)

Financial year 2018 Table 6. Financial information of Thai banking companies for FY 2018

Financial year 2019

Table 7. Financial information of Thai banking companies for FY 2019

Bank	Annual	Total	Available - for- sales-	Securities- held- to-	Land &	Corporate governance
Name	revenue	expenses	securities	maturity	Buildings	Score
KBANK	160,491	72,729	336,707	416,369	52,698	excellent (5 stars)
TTB	39,821	20,674	55,377	0	23,642	excellent (5 stars)
BBL	133,746	54,963	574,720	23,257	40,754	very good (4 stars)
KTB	125,658	62,474	344,198	1,737	24,201	excellent (5 stars)
BAY	121,608	52,169	102,724	13,437	29,029	excellent (5 stars)
ККР	19,168	10,194	20,701	1,221	3,038	excellent (5 stars)
CIMBT	14,155	9,640	34,446	19,555	3,429	very good (4 stars)
SCB	201,445	70,538	270,740	8,717	40,777	excellent (5 stars)
TCAP	14,177	3,153	33,197	3,046	301	excellent (5 stars)
TISCO	19,436	9,271	9,146	0	2,984	excellent (5 stars)
LHFG	7,904	3,005	1,648	42,075	280	excellent (5 stars)

Statistics

The standard deviation for all variables like annual revenue, total expenses, etc. is high, which means that dispersion or variation from the mean is high. The skewness coefficient is an indicator for measuring the extent of the latent variables' asymmetrical distribution compared to the normal distribution (Ho & Yu, 2015). When the value of the skewness coefficient is zero, it indicates normality; otherwise the data is not normally distributed. Ho and Yu (2015) suggested that the kurtosis coefficient is an indicator for estimating the extent of pointedness of the latent variables' distribution compared to the normal distribution. When the value of the Kurtosis coefficient is zero, it indicates normal distribution. The skewness and kurtosis of all the descriptive statistics like annual revenue, total expenses, available-for-sale securities etc., for years 2015 to 2019 are not near zero, so the data is not normally distributed. Some variables such as securities-held-to-maturity, the



skewness, and kurtosis in all the years are greater than 1, clearly indicating that the data is not normally distributed.

Kolmogorov-Smirnov (K-S) test is used to measure if the data is drawn from a specific distribution or not (Lall, 2015). Lall (2015) mentions that the K-S test is significant as it is non-parametric, which means that it does not assume that the data comes from some fixed type of distribution. For all variables overall years, the one-sample Kolmogorov-Smirnov (K-S) test is significantly less than one and at times close to zero. It implies that the data are not normally distributed.

DEA is a non-parametric technique that produces an efficient frontier from the data provided (Visbal-Cadavid, 2017). The author also mentioned that DEA enables a single efficient index for each unit evaluated and generates a reference set of efficient units as a benchmark. It can handle multiple input and output variables at the same time. Therefore, using a non-parametric technique like the DEA for further analysis based on these variables is justifiable.

Tabl	e 8. Descriptive	Statistics	for variables	of Thai banking	companies	for FY 2015
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Statistics					
	Annual		Available-for-	Securities-held-	Land &
	Revenue	Total expenses	sale-securities	to-maturity	Buildings
Mean	64,504.586	28,156.108	135,599.670	58389.983	18623.701
Median	39,894.660	20,008.940	93,740.480	22399.000	10291.850
Std. Deviation	54,057.8771	22,499.6418	152,934.7093	78648.5979	18123.908
Skewness	.415	.378	1.217	1.694	.605
Kurtosis	-1.649	-1.424	.367	2.511	-1.414
Minimum	5,543.42	2,399.65	2,352.96	191.00	499.00
Maximum	147,515.13	66,656.15	441,497.00	248272.00	46108.06
Kolmogorov-Smirnov	.139	.200	.197	.008	.134
(Sig.)					

Table 9. Descriptive Statistics for variables of Thai banking companies for FY 2016

	Annual		Available-for-	Securities-held-	Land &
	Revenue	Total expenses	sale-securities	to-maturity	Buildings
Mean	67,047.853	29,208.652	155,021.519	158513.211	19926.094
Median	40,746.700	21,073.140	106,240.860	25309.000	12383.370
Std. Deviation	55,350.6415	22,821.135	175,709.280	322240.420	18643.129
Skewness	.371	.218	.994	2.926	.535
Kurtosis	-1.729	-1.871	625	8.908	-1.411
Minimum	6,967.07	2,601.53	6,752.76	16.00	403.90
Maximum	153,402.68	63,854.38	462,742.00	1093949.00	49727.87
Kolmogorov- Smirnov	.114	.200	.116	.000	.200
(Sig.)					

Statistics	Statistics									
				Securities -						
	Annual		Available-for-	held- to-	Land &					
	Revenue	Total expenses	sale-securities	maturity	Buildings					
Mean	74,064.400	30,534.011	145,513.293	56001.906	18869.306					
Median	47,322.860	20,835.920	66,797.000	16438.000	12070.720					
Std. Deviation	63,235.807	23,643.945	179,943.860	99718.630	17653.872					
Skewness	.518	.235	1.479	2.704	.655					
Kurtosis	-1.280	-1.851	1.242	7.662	933					
Minimum	6,493.43	2,720.64	1,246.31	.00	343.22					
Maximum	182,578.75	66,371.95	533,651.00	338003.00	50136.65					
Kolmogorov- Smirnov	.194	.118	.035	.000	.200					
(Sig.)										

Table 10. Descriptive Statistics for variables of Thai banking companies for FY 2017

Table	11. Descriptive	Statistics	for variables	of Thai banking	companies	for FY 2018

Statistics							
				Securities -			
	Annual	Total	Available-for-	held- to-	Land &		
	Revenue	expenses	sale-securities	maturity	Buildings		
Mean	77,069.149	32,797.406	161,681.221	57104.972	18650.057		
Median	49,167.740	20,979.370	117,098.000	19849.000	11876.260		
Std. Deviation	63,566.805	25,582.984	172,456.313	109662.965	17299.0415		
Skewness	.477	.219	1.079	2.809	.599		
Kurtosis	-1.226	-2.006	.035	8.222	-1.104		
Minimum	7,060.02	2,768.13	2,408.04	.00	291.71		
Maximum	188,134.64	68,347.67	497,838.00	371025.00	48525.13		
Kolmogorov-Smirnov	.165	.125	.200	.000	.200		
(Sig.)							

Table 12. Descriptive Statistics for variables of Thai banking companies for FY 2019

Statistics	Statistics								
				Securities-					
	Annual		Available-for-	held- to-	Land &				
	Revenue	Total expenses	sale-securities	maturity	Buildings				
Mean	77,964.324	33,528.143	162,145.801	48128.530	20103.004				
Median	39,821.260	20,674.370	55,377.000	8717.000	23642.380				
Std. Deviation	71,228.943	28,765.075	190,437.814	122819.841	19164.078				
Skewness	.503	.269	1.180	3.251	.398				
Kurtosis	-1.457	-2.028	.494	10.672	-1.372				
Minimum	7,903.86	3,005.24	1,647.80	.00	280.19				
Maximum	201,444.74	72,729.25	574,720.00	416369.00	52697.53				
Kolmogorov- Smirnov	.055	.062	.038	.000	.033				
(Sig.)									

DEA analysis

The eleven (11) banking companies are called Decision-making units (DMUs) in DEA analysis. On undertaking the DEA analysis using DEAP software, with revenue as the output and expenses, available-for-sale investments, securities held to maturity, and land



and buildings as inputs, the DEA efficiency of firms for the years under consideration was as follows:

	2015	2016	2017	2018	2019
K BANK	1.000	1.000	1.000	0.971	0.770
ТМВ	0.827	1.000	0.876	1.000	0.748
BBL	1.000	0.842	0.742	0.946	0.788
КТВ	1.000	1.000	1.000	1.000	1.000
BAY	0.872	1.000	1.000	1.000	1.000
KKP	1.000	0.976	0.777	0.724	0.809
CIMBT	0.690	0.648	0.718	0.545	0.543
SCB	1.000	1.000	1.000	1.000	1.000
ТОР	1.000	0.870	0.736	0.818	1.000
TESCO	1.000	1.000	1.000	1.000	1.000
LFG	1.000	1.000	1.000	1.000	1.000
Mean	0.944	0.940	0.895	0.909	0.851

Table 13. DEA efficiency scores of Thai Banking companies for Years 2015 to 2019

Discussion

Comparison of efficiency scores with the CG scores

Praptiningsih (2009) performed a study to measure corporate governance and performance in the banking sector. The author's banking sectors considered were Thailand, Indonesia, Malaysia, and the Philippines. The author found that only CEO duality, the board size, and board independence among all the internal control monitoring mechanisms like CEO duality showed a positive relationship with corporate performance. The study also suggested that the disclosure monitoring mechanism through the big four auditing firms was significantly related to corporate performance. According to Nguyen and Vo (2020), foreign ownership, board independence, and CEO duality showed no significant effect on the bank efficiency levels. Board size had a positive effect on banking efficiency. The authors had conducted this study to evaluate the effect of corporate governance on the efficiency of ASEAN banks from 2007 to 2014. Hsu and Petchsakulwong (2010) conducted research on the impact of corporate governance on the efficiency performance of the Thai non-life insurance industry. They used the DEA method to determine the efficiency of firms. His findings suggest that audit committee size & diligence, board tenure, board ownership, and separation between voting rights and cash flow rights negatively affected firm efficiency. However, firm size and board independence & diligence had a favorable effect on efficiency performance. This discussion highlights that corporate governance is related to the firm's efficiency but not always. It also suggests that some of the mechanisms or categories of corporate governance may be positively related to the firm efficiency but not all of them. There has been a lack of research in Thailand on the overall impact of corporate governance on firm efficiency, particularly for the banking industry. This study contributes to filling this research gap.

Efficiency scores obtained by using DEA are compared with the CG scores of these firms under consideration for each year which is one of the principal objectives of this study. CG score is like a cumulative score of a firm's governance based on significant categories of

corporate governance assessment like stakeholders' role, disclosure and transparency, board responsibilities, rights of shareholders, and equitable treatment of shareholders. As mentioned in the research methodology, the assessment of CG practices is done by IOD in collaboration with SET and is then published in GCR.

Firm symbol/ticker	CG score	Efficiency score
K BANK	excellent (5 stars)	1.000
TMB	excellent (5 stars)	0.827
KTB	excellent (5 stars)	1.000
ККР	excellent (5 stars)	1.000
SCB	excellent (5 stars)	1.000
TESCO	excellent (5 stars)	1.000
LFG	excellent (5 stars)	1.000
BBL	very good (4 stars)	1.000
BAY	very good (4 stars)	0.872
COMBAT	very good (4 stars)	0.690
TOP	very good (4 stars)	1.000

 Table 14. Comparison of CG scores and DEA efficiency scores - FY 2015

From the above comparison, the CG scores have a positive relationship to their firm efficiency for most companies. Hypothesis 1, H1 was that 'High corporate governance score leads to the higher efficiency of the Thai banking companies.' It holds for all the companies in 2015 except for CIMB Thai Bank (CIMBT) whose technical efficiency is relatively low at 0.690.

Hypothesis 2, H2 was that the 'Ranking of Thai banking companies based on their corporate governance scores will concur with the ranking based on their efficiency.' In the case of TMBThanachart Bank (TMB), the CG score was 'excellent', but its efficiency was relatively lower at 0.827. Furthermore, in the case of Bangkok Bank (BBL) and Thanachart Capital (TCAP), the CG score was comparatively lower. However, the efficiency was still maximum, i.e., 1. Therefore hypothesis 2 does not hold for all banking companies in 2015, but it is validated for most of them.

Firm symbol/ticker	CG Score	Efficiency score
K BANK	excellent (5 stars)	1.000
TMB	excellent (5 stars)	1.000
KTB	excellent (5 stars)	1.000
BAY	excellent (5 stars)	1.000
KKP	excellent (5 stars)	0.976
SCB	excellent (5 stars)	1.000
TOP	excellent (5 stars)	0.870
TESCO	excellent (5 stars)	1.000
LFG	excellent (5 stars)	1.000
BBL	very good (4 stars)	0.842
COMBAT	very good (4 stars)	0.648

Table 15. Comparison of CG scores and DEA efficiency scores - FY 2016

CIMB Thai Bank (CIMBT) has a 'very good' CG score but its efficiency is quite low at 0.648. Hypothesis H1 holds for all companies other than CIMB Thai Bank (CIMBT).

Hypothesis 2, H2 is not satisfied because Kiatnakin Phatra Bank (KKP) and Thanachart Capital (TCAP) have relatively lower efficiencies at 0.976 and 0.870, respectively, although they have 'excellent' CG scores. Therefore, the ranking of a few companies based on their CG scores is not in line with their efficiencies.

Firm symbol/ticker	CG Score	Efficiency score
K BANK	excellent (5 stars)	1.000
TMB	excellent (5 stars)	0.876
KTB	excellent (5 stars)	1.000
BAY	excellent (5 stars)	1.000
KKP	excellent (5 stars)	0.777
SCB	excellent (5 stars)	1.000
TOP	excellent (5 stars)	0.736
TESCO	excellent (5 stars)	1.000
LFG	excellent (5 stars)	1.000
BBL	very good (4 stars)	0.742
COMBAT	very good (4 stars)	0.718

 Table 16. Comparison of CG scores and DEA efficiency scores - FY 2017

Hypothesis H1 is not validated as Kiatnakin Phatra Bank (KKP) and Thanachart Capital (TCAP) CG scores are 'excellent', but their efficiency is relatively lower. For all other companies, though, the CG scores reflect a positive relationship with their corresponding efficiency.

Hypothesis H2 is also not validated as the ranking of banking companies based on their CG scores does not concur with the ranking based on their efficiency for two companies, Kiatnakin Phatra Bank (KKP) and Thanachart Capital (TCAP).

Firm symbol/ticker	CG Score	Efficiency score
K BANK	excellent (5 stars)	0.971
TMB	excellent (5 stars)	1.000
KTB	excellent (5 stars)	1.000
BAY	excellent (5 stars)	1.000
KKP	excellent (5 stars)	0.724
SCB	excellent (5 stars)	1.000
TOP	excellent (5 stars)	0.818
TESCO	excellent (5 stars)	1.000
LFG	excellent (5 stars)	1.000
BBL	very good (4 stars)	0.946
COMBAT	very good (4 stars)	0.545

Table 17. Comparison of CG scores and DEA efficiency scores - FY 2018

Like in 2017, in 2018 hypothesis 1, H1 does not hold as Kiatnakin Phatra Bank (KKP) and Thanachart Capital (TCAP) CG scores are 'excellent', but their efficiency is lower. Also, hypothesis H2 is not validated because both Kiatnakin Phatra Bank (KKP) and Thanachart Capital (TCAP) scores highest on CG scores but not on the efficiency criteria. Therefore, the relative CG scores of a few banking companies do not concur with that of their efficiencies.

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Firm symbol/ticker	CG Score	Efficiency score
K BANK	excellent (5 stars)	0.770
ТМВ	excellent (5 stars)	0.748
КТВ	excellent (5 stars)	0.703
BAY	excellent (5 stars)	1.000
KKP	excellent (5 stars)	0.809
SCB	excellent (5 stars)	1.000
TOP	excellent (5 stars)	1.000
TESCO	excellent (5 stars)	1.000
LFG	excellent (5 stars)	1.000
BBL	very good (4 stars)	0.788
COMBAT	very good (4 stars)	0.543

Table 18. Comparison of CG scores and DEA efficiency scores - FY 2019

The efficiency scores of banks like Kasikorn Bank (KBANK), TMB Thanachart Bank (TMB), and Krung Thai Bank are lower while their CG scores are highest, which is 'excellent. Hypothesis 1, H1 does not hold.

Ranking of efficiencies also does not concur with the efficiencies of several companies like CIMB Thai Bank (CIMBT), Kiatnakin Phatra Bank (KKP), Kasikorn Bank (KBANK), TMBThanachart Bank (TMB), and Krung Thai Bank. For CIMB Thai Bank (CIMBT), its relative efficiency is not as high as Bangkok bank's (BBL) efficiency, although its CG score is the same as the latter.

Conclusions and Recommendations

For all the years from 2015 to 2019, The Siam Commercial Bank (SCB), LH Financial Group (LFG), and TISCO Financial Group (TISCO) have been the best performing both in terms of corporate governance and firm efficiency. These companies secured an 'excellent' CG score and an efficiency of 1 for all five years. Their CG scores and efficiency are positively related. Although CIMB Thai Bank (CIMBT) secured a 'very good' rating for its CG scores for all years, its efficiency varied more from year to year. Overall, its efficiency was relatively lower than its corresponding CG scores, and it was relatively the least efficient and had the lowest CG scores overall.

In all the years from 2015 to 2019, most banking companies with a high CG score also had a high firm efficiency. The notable ones where this was not the case were Kiatnakin Phatra Bank (KKP) and Thanachart Capital (TCAP). Notably, in 2016, 2017, and 2018, a high CG score of these two companies did not lead to high efficiency. Further, in no year from 2015 to 2019 did the ranking of the banking companies concur with the ranking based on their efficiency.

Studies were done by Salim et al. (2016), Ongore and Owoko (2011), and Lin et al. (2009) suggest that some CG assessment parameters or criteria have a positive relationship to the firm efficiency but not all of them. The effect of corporate governance on the firm efficiency is also dependent on the nature of a firm like whether it is government-owned, private or a foreign enterprise. The results in this research paper reflect that although there is a clear and positive relationship between corporate governance and the firm efficiency of most Thai Banking companies, this positive relationship cannot be said for all of them. This finding adds to the debate for managers and academia whether sound corporate governance will always lead to higher firm efficiency. This finding implies that sound corporate governance helps achieve effective utilization of resources and enhances the efficiency of most firms. However, other factors are involved, which may lead to higher firm efficiency for



Thai Banking companies. Some of these factors could be employee morale, use of latest technology, etc., for which more study will need to be done. When skilled employees are retained and their morale is stable, it leads to decreased costs and better organizational efficiency (Pampurini & Quaranta, 2018). When employees are recognized for their performance and productivity, it increases their morale and job satisfaction, translating into better firm efficiency (Afsar et al., 2017). Gumbau-Albert and Maudos (2002) mentioned that using the latest technology like new machines improved the efficiency of firms in the Spanish industry. These studies confirm that other factors may also affect firm efficiency.

The present study will be helpful to the stakeholders like investors, managers, and the government to know more about the corporate governance and firm efficiency of banking firms and how far they are related in the different Thai Banking firms. The managers and analysts of the companies like Kiatnakin Phatra Bank (KKP) and Thanachart Capital (TCAP) can identify and analyze the reasons and factors responsible for lower firm efficiency based on all the years despite the 'excellent' CG scores that they have. The managers of Kasikorn Bank (KBANK), TMBThanachart Bank (TMB) and Krung Thai Bank can also analyze the reasons for lower efficiency in 2019 despite excellent CG score. Further study is needed to identify other factors that, along with corporate governance, can be used to analyze their effect on the firm efficiency in Thai Banking companies. Future research can also look at how some categories of assessment of corporate governance, like disclosure and transparency, affect the firm's efficiency.

Limitations

As noted above, corporate governance and other factors can be identified and studied to analyze their effect on the firm efficiency of Thai banking companies. This research includes the study of banking companies only. Future research can also include other sectors in the financial industry like insurance companies and other financial companies in Thailand. Further studies of different sectors will help determine if similarities exist with the Thai banking sector. This research considers the CG scores, an aggregate derived from different categories of assessment of corporate governance. Some of these categories, like the role of stakeholders or disclosure and transparency, should be considered individually to analyze their impact on firm efficiency.

References

- Afsar, B., Badir, Y. F., Saeed, B. B., & Hafeez, S. (2017). Transformational and transactional leadership and employee's entrepreneurial behavior in knowledge-intensive industries. *The International Journal of Human Resource Management*, 28(2), 307-332.
- Anadol, B., Joseph, P. C., Simak, P., & Yang, X. (2014). Valuing private companies: A DEA approach. *International Journal of Business and Management*, 9(12), 16.
- Avkiran, N. K. (1999). The evidence on efficiency gains: The role of mergers and the benefits to the public. *Journal of Banking & Finance*, 23(7), 991–1013.
- Claessens, S. & Yurtoglu, B. (2006). Corporate governance and development. *The World Bank Research Observer*, 21(1), 91-122.
- Deng, H., Yeh, C. H., & Willis, R. J. (2000). Inter-company comparison using modified TOPSIS with objective weights. *Computers & Operations Research*, 27(10), 963-973.

- Denis, D. K., & McConnell, J. J. (2003). International corporate governance. *Journal of Financial and Quantitative Analysis*, 38(1), 1-36.
- Gumbau-Albert, M., & Maudos, J. (2002). The determinants of efficiency: the case of the Spanish industry. *Applied Economics*, 34(15), 1941-1948.
- Ho, A. D., & Yu, C. C. (2015). Descriptive statistics for modern test score distributions: Skewness, kurtosis, discreteness, and ceiling effects. *Educational and Psychological Measurement*, 75(3), 365-388.
- Hoontrakul, P., & Karnchanasai, C. C. (2010). The evolution of corporate governance in the banking industry of Thailand from the 1997 Asian crisis to the 2008 global credit crisis. *SSRN Electronic Journal*.
- Hsu, W. Y., & Petchsakulwong, P. (2010). The impact of corporate governance on the efficiency performance of the Thai non-life insurance industry. *The Geneva Papers on Risk and Insurance-Issues and Practice*, 35(1), S28-S49.
- Iftikhar, U., Asghar, M. J. E. K. A., Khan, H., & Mirza, H. H. (2019). The corporate governance and efficiency of commercial banks in Pakistan: application of the non-parametric approach. *Argumenta Oeconomica*, 2(43), 169–189.
- Jo, H., & Harjoto, M. A. (2011). Corporate governance and firm value: The impact of corporate social responsibility. *Journal of business ethics*, 103(3), 351-383.
- Koh, K. (R., & Nawalkha, S. K. (2020). Firm efficiency and the investment anomalies. *Managerial Finance*, 46(12), 1589–1603.
- Lall, A. (2015, October). Data streaming algorithms for the Kolmogorov-Smirnov test. In 2015 IEEE International Conference on Big Data (Big Data) (pp. 95-104). IEEE.
- Limpaphayom, P. (2001). Corporate Governance and Finance in East Asia– A Study of Indonesia, Republic of Korea, Malaysia, the Philippines and Thailand, Vol. 2. Asian Development Bank.
- Lin, C., Ma, Y., & Su, D. (2009). Corporate governance and firm efficiency: evidence from China's publicly listed firms. *Managerial and Decision Economics*, *30*(3), 193-209.
- Mekong Capital (2003). *Recommendations on Good Corporate Governance Practice in Vietnam*. Mekong Capital. <u>https://www.mekongcapital.com</u>
- Nanka-Bruce, D. (2011). Corporate governance mechanisms and firm efficiency. *International Journal of Business and Management*, 6(5), 28.
- Nguyen, T. L. A., & Vo, X. V. (2020). Does corporate governance really matter for bank efficiency? Evidence from ASEAN countries. *Eurasian Economic Review*, *10*(4), 681-706.
- Ongore, V. O., & Owoko, P. (2011). Effects of selected corporate governance characteristics on firm performance: Empirical evidence from Kenya. *International Journal of Economics and Financial Issues*, 1(3), 99.
- Pampurini, F., & Quaranta, A. G. (2018). Sustainability and efficiency of the European banking market after the global crisis: The impact of some strategic choices. Sustainability, 10(7), 2237.
- Praptiningsih, M. (2009). Corporate governance and performance of banking firms: evidence from Indonesia, Thailand, Philippines, and Malaysia. *Jurnal Manajemen dan Kewirausahaan*, 11(1), 94-108.
- Prominin, P., Jumreornvong, S., & Jiraporn, P. (2014). The effect of corporate governance on stock liquidity: The case of Thailand. *International Review of Economics & Finance*, 32, 132-142.
- Rodríguez-Pérez, G., Slof, J., Solà, M., Torrent, M., & Vilardell, I. (2011). Assessing the Impact of Fair-Value Accounting on Financial Statement Analysis: A Data Envelopment Analysis Approach. *Abacus*, 47(1), 61-84.

- Salim, R., Arjomandi, A., & Seufert, J. H. (2016). Does corporate governance affect Australian banks' performance?. *Journal of International Financial Markets, Institutions and Money*, 43, 113-125.
- Sharma, K. (2018). Fair-Value Accounting and Financial Statement Analysis in Thai Insurance Companies. *AJMI-ASEAN Journal of Management and Innovation*, 5(2), 176-188.
- Sherman, H. D., & Zhu, J. (2013). Analyzing performance in service organizations. *MIT* Sloan Management Review, 54 (4), 37.
- Thai Institute of Directors. (2018). Corporate Governance Report of Thai Listed Companies 2018. Thai Institute of Directors Association. <u>http://www.thai_iod.com/imgUpload/</u>CGR%20Report%202018.pdf
- Visbal-Cadavid, D., Martínez-Gómez, M., & Guijarro, F. (2017). Assessing the efficiency of public universities through DEA. A case study. *Sustainability*, 9(8), 1416.
- Zhu, N. & Shah, W. U. H. (2019). A Cross-Country Comparison of Operational Efficiency between Chinese and Pakistani Commercial Banking Industries. *International Journal* of Operational Research, 8(1), 1–11.
- Zhu, N., Shah, W. U. H., Kamal, M. A., & Yasmeen, R. (2021). Efficiency and productivity analysis of Pakistan's banking industry: A DEA approach. *International Journal of Finance & Economics*, 26(4), 6362-6374.

