# THE IMPACT ON BANK PROFITABILITY: TESTING FOR CAPITAL ADEQUACY RATIO, COST-INCOME RATIO AND NON-PERFORMING LOANS IN EMERGING MARKETS

Adel A. Al-Sharkas *, Tamara A. Al-Sharkas **

* *Corresponding author*, Institute of Banking Studies, Amman, Jordan
Contact details: Central Bank of Jordan, P. O. Box 37, Amman 11118, Jordan
** Institute of Banking Studies, Amman, Jordan

OPEN ACCESS

**How to cite this paper:** Al-Sharkas, A. A., & Al-Sharkas, T. A. (2022). The impact on bank profitability: Testing for capital adequacy ratio, cost-income ratio and non-performing loans in emerging markets [Special issue]. *Journal of Governance & Regulation, 11*(1), 231–243.
https://doi.org/10.22495/jgrv11i1siart4



**ISSN Print:** 2220-9352
**ISSN Online:** 2306-6784

**Received:** 13.09.2021
**Accepted:** 14.02.2022

**JEL Classification:** G2, G21, G28, E51
**DOI:** 10.22495/jgrv11i1siart4

## Abstract

Following the methodology applied by Nguyen (2020), this paper tests for the potential impact of capital adequacy ratios on bank profitability in a Jordanian context by using static panel data for a sample of 24 banks covering the period 2008–2018. Furthermore, the study examines the viability of various potential determinants of profitability led by primary bank-specific variables: cost-income ratio, bank size, debt ratio, and non-performing loans. The main objective is to assess if and how capital adequacy ratios have had any measurable effects along with other bank-specific variables on bank profitability that is determined by the return on assets (ROA) and return on equity (ROE). The study's main takeaway is that ROA is negatively correlated with the four capital adequacy ratios. However, mixed results are observed when ROE is used as a proxy for bank profitability. ROE is positively affected by both core capital to risk-weighted assets ratio and total capital to risk-weighted assets ratio. On the contrary, ROE is negatively affected by the core capital to total assets ratio and total equity capital to total assets ratio. It can be argued that the most significant finding in this paper is that the impact on bank profitability differs according to the proxy used for capital adequacy. Furthermore, the cost-income ratio is inversely related to both bank profitability measures and both bank profitability measures are inversely affected by the non-performing loan ratio.

**Keywords:** Bank Capital Adequacy, Bank Profitability, Basel II

**Authors' individual contribution:** Conceptualization — A.A.A.-S.; Methodology — A.A.A.-S.; Investigation — A.A.A.-S.; Resources — A.A.A.-S. and T.A.A.-S.; Writing — Review & Editing — A.A.A.-S. and T.A.A.-S.; Supervision — A.A.A.-S.

**Declaration of conflicting interests:** The Authors declare that there is no conflict of interest.

## 1. INTRODUCTION

Bank regulation is a debatable topic since its underlying assumptions violate the laissez-faire principles of free-market economics. Banks play a crucial role as they carry out financial intermediation in economies by closing the gap between borrowers and savers. Deposits are the tools to finance credit which fuels investments that stimulate economic growth and development (Efayena, 2014). Therefore, threats to the functioning of banks or financial institutions can have a devastating impact on countries and unsettle their economies. As a result, central banks normally stand ready to take organized steps to monitor and regulate financial institutions. In some cases, their

role could be extended as they become lenders of last resort to work towards systemic stability (Huertas, 2018).

The Basel Committee (hereinafter Committee) was founded in 1974 at the Bank of International Settlements in Switzerland to enhance financial stability by promoting the quality, adequacy, and inclusiveness of banking supervision across countries. The Committee continued to gradually expand its membership base internationally as the base reached 45 institutions from 28 jurisdictions in 2014[1].

The Committee established a number of principles, standards, and reports, which were the main tools to enhance banking supervision among its member countries. The Committee also developed a series of accords focusing on risks that impact banks such as liquidity and credit risks. Following the outbreak of the Latin American debt crisis in the 1980s, a capital measurement system (Basel I: the Basel Capital Accord) was declared in 1988 to banks asking for capital buffers to be allocated to strengthen banks and allow them to counter financial crises[2].

By 2004, the Basel Capital Accord became Basel II, which provided more dynamic and risk-sensitive measures while also expanding rules for capital threshold requirements that were originally introduced by Basel I. Ever since Basel II was introduced, the issues that surfaced have been pointing to its impact on banks' stability and profitability. Also, questions emphasized the extent of banks' ability to maintain capital adequacy without jeopardizing their profitability and efficiency. Many studies have questioned the impact of Basel II on banks' performance. For example, Kretzschmar, McNeil, and Kirchner (2010) argue that the approach to integrate risks reflected several weaknesses and the models failed to incorporate the overall exposure to the different types of risks in a single measure. As a result, banks were sustaining a level of capital that could not guarantee their robustness or safety. In addition, the concern of financial institutions was whether complying with a more stringent capital adequacy framework would compromise their profitability, as it is often argued that capital and profitability are negatively correlated (Navapan & Tripe, 2003).

In Jordan, the Central Bank of Jordan (CBJ) shifted from Basel I to Basel II between 2007 and 2008. Accordingly, the CBJ now requires all financial institutes, irrespective of their individual risk exposures, to maintain a capital base that covers 12% of risk-weighted assets. This requirement is 1.5% higher than the previous requirement of 10.5%.

Banks in Jordan play a pivotal role in the economy as banks' assets had a 113.97% share of GDP in 2017. To put this percentage into context, Jordan ranked 22nd out of 162 countries, where the average of that share was no less than 64.48% of GDP (globaleconomy.com). Moreover, total credit facilities represent 85.6% of GDP by the end of 2018, reflecting almost a middle rank among some countries in the region (Central Bank of Jordan [CBJ], 2018).

With a view to maintaining a profitable and safe banking sector, the CBJ applied the first and the third pillars of Basel II in 2008 and further expanded its precautionary measures in 2010 by issuing instructions for the second pillar, which calls for banks to prepare an Internal Capital Adequacy Assessment Process (ICAAP) to strengthen their capacity to counter multiple risks and increase employee awareness of international best practices for risk management and evaluation (CBJ, 2017).

This paper evaluates the main drivers of profitability for Jordanian banks during the period of the study by conducting ordinary linear regression analysis based on data collected from their annual reports. The financial performance was measured as return on assets (ROA), which represents annual net income divided by total assets and return on equity (ROE), which represents net income divided by average total equity. These two ratios are widely considered to be the most popular measure of performance (ECB, 2011). The paper also investigates bank-specific factors that shape profitability, such as non-performing loans (Nguyen, 2020). Equity ratio, leverage, operating efficiency, and firm size are included in the analysis to test the relevant hypotheses. The paper performs multiple regression with ROA or ROE as the dependent variable(s) and capital adequacy ratio, non-performance loan, equity ratio, leverage, operating efficiency, and firm size as independent variables. The objective is to evaluate if and how the capital adequacy ratio had any measurable effect (along with bank-specific variables) on ROA and ROE. The study aims to contribute to the available research in this area by evaluating a country within the Middle East and North Africa (MENA) region.

The remainder of this document is organised as follows. Section 2 reviews related literature. Section 3 describes the data and methodology. Section 4 presents the empirical results. Section 5 concludes the paper.

## 2. LITERATURE REVIEW

### 2.1. Role of bank regulation

When discussing regulatory standards, it is important to emphasize why banks are regulated and why there is a need for a regulatory framework. Banks face a wide variety of risks that could have a major impact on the banking sector and other key sectors in the economy. According to Goodhart, Hartmann, Llewellyn, Rojas-Suarez, and Weisbrod (1998), the need for financial regulation of banks stems from two factors: the likelihood for banks to cause a systemic crisis that can have country-wide repercussions, such was the case with the Global Financial Crisis (GFC) of 2008. The second factor is depositors' inability to carry out any supervision over banks, which calls for a global authority to assure depositors that the financial entities are safe and sound.

The literature also offers an important factor underlining authorities' role to regulate banks, which is known as the moral hazard. This is essentially an entity's tendency to be subject to additional risks on the assumption that it does not take full responsibility for the costs associated with these extra risks. Within the context of the GFC, this came to be known as the "too big to fail", which was first suggested by Merton (1977), and later confirmed by the outcomes of papers such as

[1] https://www.bis.org/bcbs/membership.htm
[2] https://www.bis.org/bcbs/history.htm?m=3/7C14/7C573/7C76

Pennacchi (2005), who claims that it was a moral hazard that led financial institutions to invest in portfolios that entailed needless risk.

This inclination of banks to practice risk-taking behaviour is directly influenced by the banks' management and owners. Demsetz and Lehn (1985) argue that banks with private managers, who have more to lose, will acquire investments with less risky behavioural patterns. Laeven and Levine (2009) also reflect similar findings, proving that banks' risk-taking decisions are directly correlated with the corporate governance of their institutions. Such behaviour should not be allowed as banks are subjecting depositors' money to risk in such cases, which calls for a central authority to enforce rules and regulations on banks.

The primary goal of banking regulations is to ensure the safety and stability of the global banking system. Since troubled banks have historically resulted in severe adverse shocks on interconnected economies, they are generally considered more important than failures in other sectors (Summer, 2003). Risk-taking is an integral part of the banking industry, hence calling for enforcement of financial regulations to ensure a sound, prudent risk management mechanism that sets the path for a stable financial system. The regulatory framework has been evolving over the last two decades as the approach to measure risk has changed and the capital requirements have been reflective of the appropriate defence mechanism against losses in a manner that echoes the type and magnitude of risks in Basel I. Banking supervision has also been shaped around the assessment of supervisory capital against risk-weighted assets (RWA) through the solvency ratio.

The financial system in Jordan comprises banks, insurance companies, financial intermediation, and services companies, exchange companies, financial leasing companies, and multi-finance companies, including microfinance houses. The CBJ is responsible for the supervision of banking operations and the foreign exchange sector operations and functions. Since 2015, microfinance companies have been under the CBJ's supervisory umbrella. Banks constitute the largest part of the financial sector in Jordan with assets having a 93.4% share of total sector assets, amounting to JD 52.0 billion by end of 2018. There are 24 licensed operating banks, 16 of which are Jordanian banks including 3 Islamic banks. The remaining banks are branches of foreign banks (one of them is a branch of a foreign Islamic bank). In 2018, the 24 banks performed their operations through a network of 844 branches and 83 representative offices. During that period, that number of branches yielded a ratio of 12.2 thousand citizens per branch. The number of branches of Jordanian banks operating abroad reached 188 branches, 6 representative offices, 21 offices, and 2 offshore units.

## 2.2. Determinants of bank profitability

The literature review begins by examining the determinants of bank profitability, which are divided into internal and external factors. Swandewi and Purnawati (2021) study the effect of non-performing loans (NPL) on ROA with the capital adequacy ratio (CAR) for 24 banks listed on the Indonesia Stock Exchange, as compared to Brastama and Yadnya (2020), who focus on just four companies listed on the Indonesia Stock Exchange during the period 2011–2018. Anggriani and Muniarty (2020) work on a similar set of variables for the period 2010–2018. Swandewi and Purnawati (2021) and Brastama and Yadnya (2020) conclude that the CAR has a positive effect on both the ROA and stock prices, whereas the NPL has a negative effect on ROA and stock prices. On the contrary, Anggriani and Muniarty (2020) claim that non-performing loans do not affect the ROA.

Ozili (2021) compared the determinants of bank profitability among the USA, Nigeria, and South Africa, and indicate that in South Africa and Nigeria, the cost to total asset ratio is a significant determinant of the banking sector profitability, while the NPL is a significant determinant of banking sector profitability in South Africa and the USA. The study also concludes that the CAR is a significant determinant of banking sector profitability in the USA and Nigeria. Towhid, Havidz, and Alnawah (2019) examined the main determinants of NPL in 16 commercial banks in Bangladesh for the period 2011–2016 and found out that the NLP has a negative effect on ROA. Alshatti (2016) reviewed the determinants of profitability for Jordanian banks using a balanced panel data set of 13 banks during the period 2005–2014, by singling out ROA and ROE as measures of profitability. Alshatti (2016) concluded that the variables of capital adequacy, capital, and leverage positively affected bank profitability, while profitability is negatively correlated with asset quality. The paper also indicates that higher bank profitability in Jordan is linked with well-capitalized banks.

Other studies, such as Saona (2016) find meaningful relationships between bank profitability and a host of other factors in Argentina, Brazil, Chile, Mexico, and 3 other Latin American countries for the period 1995–2012. The paper finds an inverse, U-shaped relationship between capital ratios and profitability, a negative relationship with revenue diversification and improvements in the legal and regulatory system, and a positive relationship with asset diversification and market concentration. Petria, Capraru, and Ihnatov (2015) assess the main determinants of bank profitability in EU27 over the period 2004–2011. They concluded that other factors influence profitability. These include credit and liquidity risk, management efficiency, business diversification, market concentration/competition and economic growth. It was also noted that profitability is positively affected by higher competition. Căpraru and Ihnatov (2014) evaluated the main determinants of profitability in five selected Central and Eastern European countries over the period 2004–2011, by using return on assets, return on equity, and net interest margin as proxies for bank profitability. Key takeaways from their work reveal that management efficiency and capital adequacy growth influence bank profitability for all performance indicators, while credit risk and inflation impact only return on assets and return on equity. Research shows that banks tend to be more profitable if higher capital adequacy is enforced, as evident from Ozili (2015), which examines the effects of capital adequacy on

the profitability of deposits in Nigeria. The paper analyzes foreign and domestic banks and conducts primary research through distributing surveys to 518 bank staff. The findings conclude that capital adequacy plays a vital role in determining profitability. Also, research conducted in Ethiopia by Alemu (2015) concurs that there is a positive relationship between capital adequacy and profitability by sampling 8 banks between 2000 and 2013. The study uses a generalized least squares regression model by using return on assets as an independent variable.

In terms of the impact of credit risk on profitability, a study on commercial banks in Sweden by Ara, Bakaeva, and Sun (2009) observes that credit risk has a positive effect on return on equity. The risk in question is default risk and is defined as the risk of incurring a financial loss if a borrower does not fulfil their financial obligations in a timely manner. The computing of the risk has three components, namely, the value of the position exposed to default, the proportion of the value that would be recovered in the event of a default, and the probability of default (www.risk.net). The analysis is based on annual reports of four commercial banks during the period 2000–2008 using return on assets as a profitability indicator. Similarly, Mei, Nsiah, Barfi, and Bonsu (2019) analyze the relationship between credit risk and bank profitability in Ghana. The sample covers 6 banks based on their 2005–2009 annual reports. The findings confirm a positive relationship between credit risk and profitability. Lastly, the paper supports previous empirical pointing out that bank size, growth, and debt positively influence bank profitability. Abiola and Olausi (2014) analyse the impact of credit risk management on commercial banks' performance in Nigeria using financial reports of 7 commercial banking firms during the period 2005–2011. A panel regression model is used, in which performance indicators are identified as ROE and ROA, while credit risk management indicators are represented by NPL and CAR. The study concludes that there is a significant impact of credit risk management on commercial banks' profitability in Nigeria. Finally, Saeed and Zahid (2016) reveal that credit risk indicators have a positive relationship with bank profitability in 5 large UK commercial banks.

## 2.3. Impact of Basel II on profitability

The other focal area of the literature is looking into the implementation of Basel II and how it impacts profitability. Ahmed, Ahmed, Islam, and Ullah (2015) review the impact of Basel II accords in Bangladesh, using a sample of 25 out of 30 commercial banks. The study analyzes annual reports for a five-year period by using the ordinary least squares regression model and realizes that capital adequacy requirements positively impact bank profitability. Hossain and Islam (2017) study the impact of implementing Basel II and Basel III accords. Their research is focused on analyzing the capital adequacy framework by testing whether it can shelter banks in Bangladesh from shocks resulting from financial distress. An ordinary least squares regression model is used to further investigate the relationship between capital adequacy and profitability. The result shows a significant positive relationship between capital adequacy and the return on assets.

Nguyen (2020) investigates the effect of capital (CA) on bank profitability following the implementation of Basel II accords in Vietnam for 22 commercial banks for the period 2010–2018. The study employs ROA and ROE ratios to measure bank profitability, while also keeping in check the determinants of profitability including bank-specific variables and macroeconomic indicators. Nguyen (2020) observes that the bank CA, net interest margin, and non-interest income have positive effects on profitability indicators, while the NPL indicator and state ownership have a negative impact on bank profitability. The study also concludes that bank CA has a positive influence on ROA for small-sized banks, whereas it has a minor impact on the profitability of large banks.

Podpiera (2006) examines if compliance with the Basel Core Principles has any positive effect on bank performance by reviewing the quality of regulation collected from the Basel Committee's assessment reports of 65 countries (13 advanced, 19 emerging, and 33 developed countries) for the years 1998–2002. The paper establishes a simple index of overall compliance with the Basel principles, ranging from compliant to non-compliant, and a four-grade rating system to assess the compliance of the accords against the 65 countries. The paper analyses the data of non-performing loans[3] and the net interest margin while accounting for economic progress and the macroeconomic environment. The key finding is that higher compliance with Basel Committee principles is linked to lower levels of non-performing loans and net interest margin, thus having a positive impact on bank performance.

Sundararajan, Marston, and Basu (2001) also analyze the compliance with the 25 Basel Core Principles in 25 countries using a grading system for compliance assessment. The research investigates both direct and indirect impacts of noncompliance to the Basel Core Principles. The paper concludes that macroeconomic factors and select prudential banking indicators significantly affect credit risk and bank soundness. However, the paper also points out that noncompliance to Basel principles does not directly influence credit risk or bank soundness in the short term, and it also emphasizes that there is no direct impact of Basel compliance on nonperforming loans. Nonetheless, the paper does not exclude the possibility that noncompliance to Basel principles may indirectly influence credit risk and bank soundness through the interaction with other macroeconomic and banking factors.

Finally, Herring (2005) reveals that the costly implementation of Basel II is unlikely to crowd out the gains, concluding that it will be a costly measure for countries to embark on implementing the accord for domestic and international banking activities. Demirgüç-Kunt and Detragiache (2011) further analyse if bank soundness is related to compliance with the Basel Core Principles, by analyzing 3000 banks in 86 countries and indicate that there is no relationship between improved banking regulations and bank performance.

[3] A bank loan is considered bad debt or non-performing when more than 90 days pass without the borrower paying the agreed instalments or interest (ECB, 2017).

Other researchers have also been intrigued by the impact of Basel implementation on capital adequacy ratios. Andersson and Nordenhager (2013) study the effect of equity ratio, net loans over total assets, ROA, liquid assets over total deposits, and the NPL ratio as part of investigating whether the enhanced regulatory framework (implemented by the Basel Committee on Banking Supervision) actually affects banks' capital adequacy ratio. Twenty-four (24) European banks were analyzed to assess if any changes occurred before and after the implementation by means of employing a multiple regression analysis using ordinary least squares and fixed effects. The research proved that Basel II has a statistically significant effect that is also indifferent to the size and cost of the implementation process. Beltratti and Paladino (2016) also examined whether banks complying with Basel II experienced a decline in their regulatory capital. The study used a regression model to examine the impact of the internal model on risk-weighted assets by applying a sample of international banks while controlling bank and country characteristics for banks complying and not implementing Basel II. The paper's outcome reflected that banks that implemented Basel II had a higher cost of equity that is not correlated with risk-weighted assets and total assets.

## 2.4. Other impacts of Basel II implementation

Other research focused on testing the effect of implementing Basel II on exacerbating business cycles. Kim and Lee (2006) analyse the implications for Basel II implementation on bank capital regulation and procyclicality of bank lending by exploring the cyclical patterns of buffer capital using unbalanced panel data for the banks in 30 OECD countries and 7 non-OECD Asian countries. Specifically, the relationships were examined between buffer capital and business cycles to check if there are systematic differences across country groups controlling for other potential determinants of bank capital. The conclusion referred to a positive correlation in developed countries compared to a negative correlation in Asian developing countries. This suggested that Basel II implementation could result in a higher possibility for a rise in output volatility in developing countries.

Griffith-Jones and Persaud (2008) examine the volatility impact of Basel II on emerging markets and their political economy. The paper raises an alarmist regarding Basel II, including the overestimation of the risk of international bank lending to developing countries, creating a risk that international bank lending to developing countries could be sharply reduced and remaining lending could see its cost increased. Another concern is that it would accentuate the volatility of bank lending, damaging all economies in general, and particularly the developing ones. In conclusion, the paper suggests policy proposals to avoid these negative effects, including introducing diversification benefits into Basel II and encouraging forward-looking provisioning to counteract volatility effects.

Andersen (2009) investigates capital positions' cyclicality and the cyclicality of Basel II capital requirements in Norwegian banks. The research relies on the statistics of corporate enterprises, banks, and households to calculate capital requirements in line with the Basel II framework. The paper finds a considerable rise in the calculated Basel II capital requirements in a recession scenario for the Norwegian economy. It also shows a negative co-movement between capital positions and Basel II capital requirements. Accordingly, it shows that Basel II might impose an additional source of pro-cyclicality.

A report by the European Commission (EC, 2018) has analyzed the impact of Regulation (EU) 575/2013 and Directive 2013/36/EU governing the implementation of the Basel framework on the economic cycle. The examined data (2008–2015) covers the global financial crisis and its repercussions. The report uses aggregate statistics and survey data (incl. the ECB Bank Lending Survey). It also applies a sample of 144 banks (international and domestic, retail and commercial, large and small) operating in 13 European Union (EU) countries and representing around 95% of the EU banking sector's total assets. Time-series analyses are used on a sample of 41 banks from 8 Union Member States (Belgium, France, Germany, Ireland, Italy, Luxembourg, Spain, and the United Kingdom). The report finds no empirical evidence of a strong pro-cyclical bias of the current framework that would impact the non-financial sector in the EU economy. Furthermore, the report concludes that it is important to regularly monitor the impact of the EU's regulatory capital ratio requirements on the economic cycle and to also analyze the potential impact, effectiveness, and efficiency of counter-cyclical instruments.

## 3. DATA AND METHODOLOGY

The study uses secondary data from a sample of 24 banks in Jordan based on their audited financial reports for the period 2008–2018. Annual data are used, instead of quarterly or monthly, because most financial decisions taken by Jordanian banks are done on an annual basis. This is the case despite some decisions not being reflected during a calendar year due to time lags in implementation. Furthermore, it is challenging to find historical quarterly or monthly data in Jordan. Banks in Jordan use standardized accounting systems that are in line with the International Accounting Standards (IAS), and International Financial Reporting Standards (IFRS) for publicly listed companies.

Based on the literature, different proxies are used for the financial performance of firms. Al-Matari, Al-Swidi, and Fadzil (2014) state that the most widespread variables used to test the financial performance of companies include ROA and ROE. Gilbert and Wheelock (2007) use ROA and ROE as proxies for bank profitability. ROA is the first indicator that will be used in this study with regard to the accounting variables. ROA is an indicator that shows a bank's net income relative to its total assets. ROA gives both managers and investors an idea of how efficient and effective the bank's management is at utilizing the assets it has to generate substantial earnings (Brealey & Myers, 2003). Furthermore, ROA allows comparison among banks of different sizes (Eakins & Mishkin, 2012). ROE is the second indicator that is used in this research in relation to the accounting variables.

Numerous studies have analysed the determinants of profitability. Teixeria, Narciso, Salomão, and Dias (2014) find more concrete connections between leverage, profitability, and bank capital. According to Christian, Moffitt, and Suberly (2008), changes in firm assets (size) portray a relationship with performance. Moreover, several studies (Hess & Francis, 2004; Mathura, 2009) highlight the importance of a bank's efficiency, measured by the cost-income ratio (CIR), while also looking at bank profitability. Therefore, following empirical studies, this paper considers various capital adequacy ratios, and bank-specific variables, namely, the CIR, non-performing loans, debt ratio, and bank size within our model to test our hypotheses. CAR is the ratio of a bank's capital in relation to its risk-weighted assets and current liabilities. It is set by central banks and/or bank regulators to prevent commercial banks from taking excess leverage, which can lead to insolvency. There are two factors that need closer examination for capital adequacy ratio calculations: 1) capital composition and 2) nature of assets.

According to risk-based capital adequacy standards, capital can be classified into two categories:

1. *Tier 1 (core) capital:* includes common stock, retained earnings, qualifying non-cumulative preference shares, minority interest in the equity accounts of consolidated subsidiaries, and selected identifiable intangible assets less goodwill and other intangible assets. This is the most important parameter gauging a bank's reserves against losses. It is also an important measure of a banks' ability to manage risk (BIS, 1988). The equity capital and retained earnings are defined as "core capital". The Basel Committee states that the most important part of a bank's capital, which is completely reported in the financial statement, is the core capital, distinct that it does not vary between accounting systems in different countries, and many assessments of a bank's performance and adequacy are conducted using the core capital.

2. *Tier 2 (supplement) capital:* includes the allowance (reserves) for loan and lease losses, subordinated debt capital instruments, mandatory convertible debt, inter-mediate term preferred stock, cumulative perpetual preferred stock with unpaid dividends, equity notes, and other long-term capital instruments that combine both debt and equity features. Tier 1 and Tier 2 capitals are given special consideration while measuring the capital adequacy ratio.

Basel Accord argues that total assets should not be considered while determining the capital requirement of a bank. According to Basel I and II, the risk-weighted assets ratio (RWA) is the more appropriate parameter to measure the required capital maintenance for a bank. Therefore, this study considers both non-risk-weighted assets and RWA in order to calculate capital adequacy ratios for banks in Jordan.

Regulatory capital is defined as Tier 1 and Tier 2 capital combined. According to Basel II, CAR is calculated by dividing the regulatory capital on the bank's risk-weighted assets which have three components: credit risk, market risk, and operational risk. These three risk components are weighted into different probabilities of default either by a standardized approach or an internal risk model (BCBS, 1988). The calculation that includes different types of risk-weights is considered by the Basel Committee to improve the bank's capital adequacy (BCBS 1988):

$$\frac{Tier1\ Capital + Teir2\ Capital}{Total\ Risk\text{-}Weighted\ Assets} * 100 \qquad (1)$$

For the purposes of our model, we will consider four separate measures for *CAR*:

1) Core capital (Tier 1) to Total assets (*CCTA*);

2) Total equity capital (Tier 1+2) to Total assets (*TCTA*);

3) Core capital (Tier 1) to Risk-weighted assets (*CCRWA*);

4) Total capital (Tier 1+2) to Risk-weighted assets (*TCRWA*).

*Other independent variables used in the study*

Another factor affecting bank profitability is its efficiency as measured by the cost-income ratio (CIR). The cost-income ratio is calculated by dividing the operating expenses on operating income, which can be used while the bank reviews its operational efficiency for benchmarking. Hess and Francis (2004) observe that there is an inverse relationship between the CIR and a bank's profitability. Ghosh, Nachane, Narain, and Sahoo (2003) also confirm the existence of a negative relationship between efficiency and CIR.

The size of a bank is also used as one of the independent variables since size creates economies of scale, hence lowering the average cost and resulting in a positive impact on bank profits. However, for banks that become extremely large, the effect of size could be negative due to bureaucratic and other reasons. Hence, the size–profitability relationship may be expected to be non-linear (Athanasoglou, Brissimis, & Delis, 2008). Gul, Irshad, and Zaman (2011) find a direct relationship between the size of a bank and its profitability. The ratio of non-performing loans (NPL) and debt ratio (DTA) are negatively related to bank profitability (Akhtar, Ali, & Sadaqat, 2011).

Table 1 presents the eleven variables used in this study, along with the respective formulae. The table also shows the sources in the literature in support of these variables.

**Table 1.** The variables selection

| *Variable* | *Formula* | *Source* |
|---|---|---|
| Return on assets (*ROA*) | $\frac{Net\ Income}{Total\ Assets}$ | Gilbert and Wheelock (2007) |
| Return on equity (*ROE*) | $\frac{Net\ Income}{Total\ Equity}$ | Damodaran (2007) |
| Core capital/Total assets (*CCTA*) | $\frac{Tier1\ Core\ Capital}{Total\ Assets}$ | Hutchison and Cox (2006) |
| Total equity capital/Total assets (*TCTA*) | $\frac{Total\ Risk-Based\ Capital}{Total\ Assets}$ | Hutchison and Cox (2006) |
| Core capital/Risk-weighted assets (*CCRWA*) | $\frac{Tier1\ Core\ Capitall}{Total\ Risk-Weighted\ Assets}$ | Hutchison and Cox (2006) |
| Total capital/Total risk-weighted assets (*TCRWA*) | $\frac{Total\ Risk-Based\ Capital}{Total\ Risk-Weighted\ Assets}$ | Hutchison and Cox (2006) |
| Equity ratio (*EQTA*) | $\frac{Equity}{Total\ Asset}$ | Hutchison and Cox (2006) |
| Cost income ratio (*CIR*) | $\frac{Operating\ Expenses}{Operating\ Income}$ | Christian et al. (2008) |
| Debt to equity ratio (*DTA*) | $\frac{Debt}{Total\ Equity}$ | Ghosh et al. (2003) |
| Bank size | Natural logarithm of total asset | Christian et al. (2008) |
| Non-performing loans ratio (*NPL*) | $\frac{Non\_performing\ Loans}{Total\ Loans}$ | Akhtar et al. (2011) |

## 3.1. Model specification

### *3.1.1. Regression analysis*

This study investigates the effect of capital adequacy ratios on the profitability of banks in Jordan after 2008, the date Jordan started implementing Basel II. To do so, individual data for 24 banks in Jordan during the period 2008–2018 are collected. The data cover ROA and ROE ratios as profitability measures and different measures of capital adequacy ratios (CARs) ratios as a proxy for Basel II regulations and requirements. As the dataset is comprised of multiple banks covering a period of years, a panel data approach is used, allowing for the two dimensions, specifically: cross-sectional analysis illustrating the differences between the banks in light of the variables identified above, and time series analysis illustrating changes through time for the period 2008–2018.

### *3.1.2. Fixed- and random-effects estimation*

The following are the three types of panel analytic models used:

1) pooled regression model;
2) fixed-effect model;
3) random-effects model.

The pooled regression model is one type of model that has constant coefficients, referring to both intercepts and slopes. It is used by pooling all of the data and running an ordinary least squares regression model. The fixed-effect model states that the differences across cross-sectional units that can be captured in differences in the constant term of the regression model vary across the cross-sectional units. In this model, the intercept term represents the fixed bank effect. On the other hand, in the random-effect model, the individual effects are randomly distributed across the cross-sectional units and in order to capture the individual effects, the regression model is specified with an intercept term representing an overall constant term (Seddighi & Theocharous, 2002).

To identify which one of the three panel analytic models is the best to fit the data. In this panel data study, only the cross-sectional data on 24 banks over the eleven-year period is collected. The cross-sectional sample is relatively small and the sample exhausts all cross-sectional units. Therefore, it is appropriate to use the fixed-effect model. However, the pooled regression model and the random-effect model will also be considered for the purpose of comparison. To determine which of these regressions should be used in this study, two tests can be performed, redundant fixed-effects and the Hausman test. The first test is the redundant fixed effects, which is provided by EViews and tests the significance of individual effects. The null hypothesis in this test is "the effects are redundant". If the null hypothesis is rejected, then the results indicate that the effects are statistically significant. Hausman (1978) proposes a testing mechanism that contrasts one of the estimators which is steady and consistent discarding the fact if the null hypothesis is correct or not, to any other estimators (Greene, 2007). The main idea of this test is to show that a person will choose the random-effects approach over the fixed-effects approach unless the Hausman test rejects the null hypothesis that errors are uncorrelated with the regressors. If the null hypothesis is rejected, random effects should not be used. All the results indicate that the fixed effects model is preferred.

### *3.1.3. The model*

The study examines how ROA and ROE ratios as profitability measures have been impacted during the period 2008–2018 by different measures of CAR ratios as a proxy for Basel II regulations and requirements, and other control variables. Four equations are used for ROA and the other four equations for ROE. The models can be summarized as follows:

$$ROA_{it} = \beta_0 + \beta_1 CCTA_{it} + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \beta_6 EQTA_{it} + \varepsilon_{it} \quad (2)$$

$$ROA_{it} = \beta_0 + \beta_1 TCTA_{it} + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \beta_6 EQTA_{it} + \varepsilon_{it} \quad (3)$$

$$ROA_{it} = \beta_0 + \beta_1 CCRWAit + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \beta_6 EQTA_{it} + \varepsilon_{it} \quad (4)$$

$$ROA_{it} = \beta_0 + \beta_1 TCRWAit + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \beta_6 EQTA_{it} + \varepsilon_{it} \quad (5)$$

$$ROE_{it} = \beta_0 + \beta_1 CCTA_{it} + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \beta_6 EQTA_{it} + \varepsilon_{it} \quad (6)$$

$$ROE_{it} = \beta_0 + \beta_1 TCTA_{it} + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \beta_6 EQTA_{it} + \varepsilon_{it} \quad (7)$$

$$ROE_{it} = \beta_0 + \beta_1 CCRWAit + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \beta_6 EQTA_{it} + \varepsilon_{it} \quad (8)$$

$$ROE_{it} = \beta_0 + \beta_1 TCRWAit + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \beta_6 EQTA_{it} + \varepsilon_{it} \quad (9)$$

The variables for bank *i* at time *t* are defined as follows:
$CCTA_{it}$ denotes banks core capital to the total asset;
$TCTA_{it}$ stands for total capital to the total asset;
$CCRWA_{it}$ represents core capital to the risk-weighted asset;
$TCRWA_{it}$ represents total risk-based capital to the risk-weighted asset;
$CIR_{it}$ is the cost-income ratio;
$SIZE_{it}$ is the natural logarithm of the total assets;
$EQTA_{it}$ is the equity ratio;
$DTA_{it}$ is debt ratio;
$NPL_{it}$ is the ratio of non-performing loans.

### *3.1.4. Hypotheses*

The proposed model of this study considers the following hypotheses:

*$H_0$ (null hypothesis): The independent variables have no statistically significant effect on a bank's profitability measured by ROA and ROE.*

*H1: At least one of the independent variables has a statistically significant effect on a bank's profitability.*

## 4. RESULTS AND DISCUSSION

This section begins by presenting the descriptive statistics of the selected variables. Secondly, the section covers the results of the correlation test and the multiple regression tests. Additionally, as part of the discussion, this section contains a discussion of the findings and of the impact of Basel II on the financial performance of banks in Jordan based on the empirical results.

### 4.1. Descriptive statistics

In previous similar studies, profitability is measured in the form of ratios that are normally reported by commercial banks in their annual reports. Bentum (2012) claims that the use of profitability ratios is not influenced by changes in price levels, hence making ratios the most appropriate way of measuring profitability in time series analysis. This is explained in relation to the real value of profits which cannot be affected by the changing inflation rates in order to measure a bank's performance. For the purposes of this study, profitability is measured using *ROA* and *ROE*. Table 2 presents a summary of the data of the 264 observations over the eleven-year period (2008–2018) with the mean, median, maximum, minimum, and standard deviation as measures for all independent, dependent, and control variables.

Descriptive statistics show that the average *ROE* is 9.2%, while the maximum rate is 23.0%, and the minimum was -21%. The average *ROA* was 1.2%, while the maximum rate was 2.5% and the minimum was -2.7%. Regarding the capital adequacy ratios that are considered in this study, they are higher than the minimum statutory limits set by both the CBJ and Basel Accords. Particularly, the *CCRWA* is 22.4% on average, and the *TCRWA* amounts to 22.6%. In addition, the *CCTA* and *TCTA* were on average 12.0% and 12.2%, respectively. Clearly, all the capital ratios indicate that banks in Jordan are well capitalized. With respect to the *DTA* ratio, it has a mean value of 13.4%, in which the highest one is 48.4% and the lowest is 13.4%. This reflects that banks in Jordan are not highly leveraged. Finally, the *NPL* mean value is at 6.5%, with the highest value of 26.6%, and the lowest at 0.0%.

**Table 2.** Summary of data statistics variable (%)

| | *ROA* | *ROE* | *CCRWA* | *CCTA* | *TCTA* | *TCRWA* | *CIR* | *DTA* | *NPL* | *SIZE* | *EQTA* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 1.2 | 9.2 | 22.4 | 12.0 | 12.2 | 22.6 | 58.7 | 13.4 | 6.5 | 7.1 | 14.2 |
| Median | 1.2 | 9.2 | 17.9 | 10.7 | 10.8 | 18.1 | 54.9 | 12.5 | 5.5 | 7.0 | 13.5 |
| Maximum | 2.5 | 23.0 | 127.7 | 35.9 | 36.2 | 128.6 | 174.3 | 48.4 | 26.6 | 9.2 | 48.4 |
| Minimum | -2.7 | -21 | 3.4 | 6.4 | 6.4 | 3.5 | 19.0 | 0.0 | 0.0 | 5.4 | 7.1 |
| Std. Dev. | 0.6 | 5.3 | 15.7 | 4.6 | 4.7 | 16.0 | 17.8 | 5.1 | 4.4 | 0.9 | 4.9 |
| Skewness | -1.7 | -1.2 | 4.0 | 2.0 | 2.0 | 3.9 | 2.2 | 2.1 | 1.2 | 0.3 | 2.1 |
| Kurtosis | 12.2 | 9.2 | 21.8 | 8.1 | 8.0 | 21.2 | 12.4 | 12.7 | 5.1 | 2.6 | 12.9 |

*Notes: All variables are ratios except the SIZE natural logarithm. ROA: return on assets; ROE: return on equity; CCTA: core capital/total assets; TCTA: total capital/total assets; CCRWA: total capital/total risk-weighted assets; TCRWA: total capital/total risk-weighted assets; EQTA: equity ratio; DTA: leverage; CIR: operating efficiency (cost-income ratio); NPL: non-performing loans; SIZE: natural logarithm of total asset.*

## 4.2. Regression analysis

In this section of the research, the results of the panel regression analyses are presented in order to test the hypotheses of the study. Collectively, as mentioned above, the results show that the fixed-effect model is the most appropriate model for this study. In addition, standard errors which are robust for heteroscedasticity and autocorrelation are used.

A panel data was constructed for the period 2008–2018 for 24 banks in Jordan. The objective of this analysis is to investigate the effect of capital adequacy ratios (CARs) on the profitability of banks in Jordan as measured by *ROA* and *ROE*. Proving that *CAR* ratios have an effect on bank profits is evidence that Basel II has an effect on banks' profitability. In addition, the regression also accounts for *CIR, SIZE, CCTA, DTA, NPL* as control variables. Finally, *CAR* ratios will not be included in a single regression analysis simultaneously as they provide very similar information with high correlation. Therefore, under the panel regression model, *ROA* and *ROE* are regressed against *CCRWA, TCRWA, CCTA,* and *TCTA* in 8 different models separately.

### *4.2.1. Statistical testing of the independent variables and ROA*

The study adopts the following empirical models with *ROA* as the dependent variable:

$$ROA_{it} = \beta_0 + \beta_1 CCTA_{it} + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \varepsilon_{it} \quad (10)$$

$$ROA_{it} = \beta_0 + \beta_1 TCTA_{it} + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \varepsilon_{it} \quad (11)$$

$$ROA_{it} = \beta_0 + \beta_1 CCRWAit + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \varepsilon_{it} \quad (12)$$

$$ROA_{it} = \beta_0 + \beta_1 TCRWAit + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \varepsilon_{it} \quad (13)$$

**Table 3.** The estimated results with fixed-effects model and dependent variables (*ROA*)

| *Explanatory variables* | *Dependent variable: ROA* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Model 1* | | *Model 2* | | *Model 3* | | *Model 4* | |
| | *Coefficient* | *T-statistic* | *Coefficient* | *T-statistic* | *Coefficient* | *T-statistic* | *Coefficient* | *T-statistic* |
| *CCTA* | -0.033 | -4.2*** | | | | | | |
| *TCTA* | | | -0.029 | -3.4*** | | | | |
| *CCRWA* | | | | | -0.008 | -4.6*** | | |
| *TCRWA* | | | | | | | -0.008 | -4.7*** |
| *CIR* | -0.024 | -28.8*** | -0.024 | -28.6*** | -0.024 | -28.4*** | -0.025 | -29.3*** |
| *SIZE* | 0.223 | 1.6* | 0.159 | 1.2 | 0.229 | 1.7* | 0.204 | 1.6* |
| *DTA* | 0.487 | 7.2*** | 0.046 | 7.1*** | 0.031 | 6.2*** | 0.032 | 6.3*** |
| *NPL* | -0.020 | -4.8*** | -0.022 | -4.8*** | -0.022 | -5.0*** | -0.024 | -5.3*** |
| Constant | 2.472 | 25.1*** | 2.496 | 22.5*** | 2.52 | 28.4*** | 2.540 | 28.1*** |
| $R^2$ | 0.79 | | 0.88 | | 0.88 | | 0.89 | |
| Adj. $R^2$ | 0.87 | | 0.87 | | 0.87 | | 0.88 | |
| F-statistic | 100.4*** | | 102.6*** | | 104.9*** | | 108.1*** | |
| DW | 1.99 | | 1.99 | | 1.99 | | 1.98 | |

*Note: *, **, and *** signify 10%, 5%, and 1%, respectively.*

Table 3 presents the outputs of all the four regressions with *ROA* as a dependent variable. The results in Table 3 show that all capital adequacy ratios (*CCTA, TCTA, CCRWA, TCRWA*) have a negative and significant (at 1% confidence) relationship with *ROA*, which means that the higher the core capital ratio, the lower the profitability of banks. This is inconsistent with prior research where a positive relationship was established between capital adequacy and profitability (Bourke, 1989; Berger, 1995). However, this finding is consistent with Goddard, Liu, Molyneux, and Wilson (2013) who find a negative relationship between the capital ratio and profitability. As for the control variables, as *CIR* affects *ROA* negatively, the higher the expenses to income ratio, the lower the bank profits. Moreover, a bank's size (*LN*) has positive effects on banks' profitability. All models significantly demonstrated a positive relationship between a bank's size and profitability (*ROA*). This indicates that large banks are more profitable than smaller banks. This upholds existing literature findings (Mathura, 2009; Dietrich & Wanzenried, 2011). It can be argued that large banks enjoy the advantage of experiencing loan diversification and comprehensive banking products in comparison with small-sized banks. Leverage ratio (*DTA*) is positively related to bank profitability, meaning that the higher the debt to total assets, the higher bank profits. The positive relationship between *DTA* and *ROA* is consistent with the findings of Almazari (2013) who suggests that *ROA* and *ROE* are positively correlated to debt to equity ratio (*DE*).

Finally, the results show that the non-performing loan ratio negatively affects bank profit (*ROA*), which increases a bank's costs and results in a lower return on assets. This finding is in line with the study conducted by Akhtar et al. (2011). Table 3 shows that the value of the coefficient of determination, adjusted R-squared, in the four models is 0.87. This means that 87% of the variability of the dependent variable, i.e., profitability, can be explained by the five variables in the regression line, i.e., *CAR, CIR, DTA, SIZE,* and *NPL,* while the remaining 13% is explained by other variables not included in the model. F-test values are above 100.4 and probability is 0.000 in the four models. Therefore, it can be said that there is a relationship between independent variables and *ROA*. Further, the Durbin-Watson test shows no serial correlation problem in the estimation with a value of around 2.

### *4.2.2. Statistical testing of the independent variables and ROE*

Similar equations are also used for *ROE*, another important measure of profitability. In these cases, the equations (14–17) are used.

Table 4 represents the outputs of all the four regressions with *ROE* as a dependent variable.

The empirical results (Models 5 and 6) show that *CCTA* and *TCTA* have a significant negative relationship with *ROE*. These results are consistent with previous studies, which find a negative relationship between bank capital and profitability (Navapan & Tripe, 2003). The higher the dividends from the bank retained earnings, the less retained earnings are available to the bank for growth purposes; hence, fewer funds will be available to increase profit later on. However, as reported in Models 7 and 8, both *CCRWA* and *TCRWA* have a significant positive relationship with *ROE*. Consistent with Bourke (1989) and Berger (1995), the results indicate that a significant positive relationship exists between profitability and capital adequacy ratio. This may suggest that Basel II has some positive effect on bank profitability measured by *ROE*. Both models have high adjusted R-squared values of 75% and 72%, respectively.

It is worth noting that the *NPL* ratio and *CIR* have a significant negative impact on *ROE* in all four regressions, which confirms the negative relationship as in the case with *ROA*. Bank size (*LN*) has a significant negative impact on bank *ROE*, which is inconsistent with the result found with ROA. Moreover, the results show that the leverage ratio (*DTA*) has a negative relationship with *ROE*. This implies that as the total debt of the bank increases, the bank performance also decreases. The negative relationship between *DTA* and *ROE* is in line with Mathura (2009) who confirms that that debt-equity has a negative effect on ROE. Finally, results show that the value of the coefficient of determination, adjusted R-squared, in Models 5 and 6 is 0.82, while it is 0.72 in Models 7 and 8. The F-test values are 69.9, 72.9, 19.4, and 18.6 with a probability of 0.000 in the four models respectively. Therefore, it can be said that there is a relationship between independent variables and *ROE*.

$$ROE_{it} = \beta_0 + \beta_1 CCTA_{it} + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \varepsilon_{it} \quad (14)$$

$$ROE_{it} = \beta_0 + \beta_1 TCTA_{it} + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \varepsilon_{it} \quad (15)$$

$$ROE_{it} = \beta_0 + \beta_1 CCRWA_{it} + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \varepsilon_{it} \quad (16)$$

$$ROE_{it} = \beta_0 + \beta_1 TCRWA_{it} + \beta_2 CIR_{it} + \beta_3 SIZE_{it} + \beta_4 DTA_{it} + \beta_5 NPL_{it} + \varepsilon_{it} \quad (17)$$

**Table 4.** The estimated results with fixed-effects model and dependent variables (*ROE*)

| *Explanatory variables* | *Dependent variable: ROE* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Model 5* | | *Model 6* | | *Model 7* | | *Model 8* | |
| | *Coefficient* | *T-statistic* | *Coefficient* | *T-statistic* | *Coefficient* | *T-statistic* | *Coefficient* | *T-statistic* |
| *CCTA* | -0.137 | -1.9** | | | | | | |
| *TCTA* | | | -0.298 | -4.8*** | | | | |
| *CCRWA* | | | | | 0.115 | 2.11** | | |
| *TCRWA* | | | | | | | 0.083 | 2.15** |
| *CIR* | -0.208 | -22.3*** | -0.214 | -23.7*** | -0.204 | -10.7*** | -0.199 | -10.9*** |
| *SIZE* | -1.856 | -1.9* | -2.273 | -2.7*** | -5.783 | -3.1*** | 0.963 | 0.7 |
| *DTA* | -0.115 | -2.4** | 0.043 | 1.0 | -0.373 | -3.8*** | -0.214 | -2.1** |
| *NPL* | -0.238 | -5.9*** | -0.224 | -5.8*** | -0.355 | -5.9*** | -0.319 | -4.1*** |
| Constant | 26.245 | 31.1*** | 26.395 | 32*** | 26.223 | 13.2*** | 17.148 | 1.7* |
| $R^2$ | 0.83 | | 0.84 | | 0.79 | | 0.77 | |
| Adj. $R^2$ | 0.82 | | 0.83 | | 0.75 | | 0.72 | |
| F-statistic | 69.9*** | | 72.9*** | | 19.4*** | | 18.6*** | |
| DW | 1.99 | | 1.99 | | 2.07 | | 1.98 | |

*Note: *, **, and *** signify 10%, 5%, and 1%, respectively.*

## 5. CONCLUSION

The objective of this paper is to explore the impact of capital adequacy ratios on bank profitability in the context of Basel II Accord implementation in Jordan. The aim is to contribute to the existing literature by shedding light on the relationship between Basel II and bank performance. The study achieves this by empirically quantifying the impact of Basel II on bank financial performance in Jordan. The methodology comprises multiple regression analyses using a number of financial ratios as measures of bank performance. *ROA* and *ROE* are used to measure bank profitability. The capital adequacy ratios used in this study are core capital to total assets ratio (*CCTA*), total equity capital to total assets ratio (*TCTA*), risk-core capital to weighted-risk assets ratio (*CCRWAR*), total capital to weighted-risk assets ratio (*TCRWA*). In addition to capital adequacy ratios, the study controls several potential determinants of profitability including cost-income ratio, leverage ratio, bank size, and non-performing loans by using panel data regression with a sample of 24 banks in Jordan for the period 2008–2018.

Using ROA as a proxy for bank profitability, the paper finds bank profitability is negatively affected by the four capital adequacy ratios. Furthermore, using ROE as a proxy for bank profitability produces mixed results. Both core capital to risk-weighted assets and total capital to risk-weighted assets ratio have a significant positive relationship with bank profitability. The differences between the results with ROA and ROE could be due to the fact that ROE, as a measure of profitability, is sensitive to bank's previous performance (via retained earnings) while ROA is more stable (notice in the descriptive

statistics the ROE has a very high standard deviation relative to the standard deviation of ROA). On the other hand, the empirical test results show that the core capital to total assets ratio and total equity capital to total assets ratio have a negative relationship with bank profitability. These results indicate that capital adequacy requirements limit the risk profile of investment of a bank and therefore affect its capacity to achieve a target level of profitability. The most significant finding in this study, which other similar studies have not emphasized adequately, is that bank profitability is affected differently according to the proxy used for capital adequacy. This study finds out that bank profitability measured by ROE is positively affected by both core capitals to risk-weighted assets and total capital to risk-weighted assets ratio. This implies that an increase in capital may raise expected earnings by reducing the expected cost of financial distress, including bankruptcy. The positive relationship between bank profitability and the capital adequacy ratio is consistent with the finding of Berger (1995).

Another major contribution in the study is that the CIR is negatively related to both bank profitability measures. The study also reveals that banks in Jordan have low CIRs and should strive to keep the CIR at a minimum to be more efficient. In addition, the results show that both bank profitability measures are negatively affected by the non-performing loan ratio. This makes the bank costs increase and induces a lower ROA. This is in accordance with the study conducted by Akhtar et al. (2011). Furthermore, the debt ratio positively affects bank profitability measured by ROA, while it is related negatively to bank profitability measured by ROE. Finally, the bank size has a positive relationship with bank profitability measured by ROA and a negative relationship with bank profitability measured by ROE.

The results of this paper could be used as a starting point for further examination on the impact of capital adequacy ratios under Basel II in relation to other dimensions of bank performance such as quality management performance, bank reputation, bank market share, and bank brand image. Finally, like any study, this paper suffers some limitations. Some of these limitations may be attributed to the 2008 Global Financial Crisis and the ensuing global recession, which might have had an impact on the financial statements of Jordanian banks, and therefore on the financial ratios used in this study. Additionally, considering the fact that bank structures in Jordan (in terms of organizational structures, foreign ownership, minority interest, corporate governance practices, and regulatory compliance) might arise endogenously due to specific features of each bank, the model selected does not factor in such variables. As such, the findings of this study could be limited and may have a restricted practical implication for banks in Jordan and the policymakers in Jordan.

## REFERENCES


1. Abiola, I., & Olausi, A. S. (2014). The impact of credit risk management on the commercial banks performance in Nigeria. *International Journal of Management and Sustainability, 3*(5), 295–306. Retrieved from http://www.conscientiabeam.com/journal/11/abstract/2676
2. Ahmed, S. U., Ahmed, S., Islam, M. D., & Ullah, G. M. (2015). Impact of Basel II implementation on the financial performance of private commercial banks of Bangladesh. *European Journal of Economics, Finance and Administrative Sciences, 77*. https://doi.org/10.2139/ssrn.2645671
3. Akhtar, M. F., Ali, K., & Sadaqat, S. (2011). Factors influencing the profitability of Islamic banks of Pakistan. *International Research Journal of Finance and Economics, 66,* 125–132. Retrieved from https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.458.8877&rep=rep1&type=pdf
4. Alemu, D. (2015). Assessment of banking performance using capital adequacy in Ethiopia. *Economics, 4*(6), 106–111. https://doi.org/10.11648/j.eco.20150406.12
5. Al-Matari, E. M., Al-Swidi, A. K., & Fadzil, F. H. B. (2014). The measurements of firm performance's dimensions. *Asian Journal of Finance & Accounting, 6*(1), 24–49. https://doi.org/10.5296/ajfa.v6i1.4761
6. Almazari, A. A. (2013). Capital adequacy, cost income ratio and the performance of Saudi banks. *International Journal of Academic Research in Accounting, Finance, and Management Sciences, 3*(4), 284–293.
7. Alshatti, A. S. (2016). Determinants of banks' profitability — The case of Jordan. *Investment Management and Financial Innovations, 13*(1), 84–91. https://doi.org/10.21511/imfi.13(1).2016.08
8. Andersen, H. (2009). *Norwegian banks in a recession: Procyclical implications of Basel II.* Norges Bank. Retrieved from https://www.norges-bank.no/en/news-events/news-publications/Papers/Working-Papers/2009/WP-20094/
9. Andersson, M., & Nordenhager, I. (2013). *The impact of Basel II regulation in the European banking market — A panel data analysis approach* (Bachelor thesis, Gothenburg University). Retrieved from https://gupea.ub.gu.se/bitstream/2077/33424/1/gupea_2077_33424_1.pdf
10. Anggriani, R., & Muniarty, P. M. (2020). The effect of non-performing loans (NPL) and capital adequacy ratio (CAR) on profitability (ROA) at PT. Bank Central Asia (BCA), TBK. *Ilomata International Journal of Management, 1*(3), 121–126. https://doi.org/10.52728/ijjm.v1i3.121
11. Ara, H., Bakaeva, M., & Sun, J. J. (2009). *Credit risk management and profitability of commercial banks in Sweden* (Master thesis, University of Gothenburg). Retrieved from https://gupea.ub.gu.se/handle/2077/20857
12. Athanasoglou, P. P., Brissimis, S. N., & Delis, M. D. (2008). Bank-specific, industry-specific and macroeconomic determinants of bank profitability. *Journal of International Financial Markets, Institutions and Money, 18*(2), 121–136. https://doi.org/10.1016/j.intfin.2006.07.001
13. Bank of International Settlements (BIS). (1988). *Basel Committee — Operational risk.* Retrieved from https://www.bis.org/list/bcbs/tid_28/index.htm
14. Bank of International Settlements (BIS). (n.d.). *History of the Basel Committee.* Retrieved from https://www.bis.org/bcbs/history.htm
15. Beltratti, A., & Paladino, G. (2016). Basel II and regulatory arbitrage. Evidence from financial crises. *Journal of Empirical Finance, 39*(Part B), 180–196. https://doi.org/10.1016/j.jempfin.2016.02.006
16. Bentum, W. (2012). *The determinants of profitability of the commercial banks in Ghana during the Recent Years of Global Financial Crisis* (Unpublished master thesis, Aarhus University).

17. Berger, A. N. (1995). The relationship between capital and earnings in banking. *Journal of Money, Credit and Banking, 27*(2), 432–456. https://doi.org/10.2307/2077877
18. Bourke, P. (1989). Concentration and other determinants of bank profitability in Europe, North America and Australia. *Journal of Banking & Finance, 13*(1), 65–79. https://doi.org/10.1016/0378-4266(89)90020-4
19. Brastama, R. F., & Yadnya, I. P. (2020). The effect of capital adequacy ratio and non performing loan on banking stock prices with profitability as intervening variable. *American Journal of Humanities and Social Sciences Research (AJHSSR), 4*(12), 43–49. Retrieved from https://www.ajhssr.com/wp-content/uploads/2020/12/F204124349.pdf
20. Brealey, R. A., & Myers, S. C. (2003). *Principles of corporate finance* (7th ed.). New York, NY: McGraw-Hill Higher Education.
21. Căpraru, B., & Ihnatov, I. (2014). Banks' profitability in selected Central and Eastern European countries. *Procedia Economics and Finance, 16,* 587–591. https://doi.org/10.1016/S2212-5671(14)00844-2
22. Central Bank of Jordan (CBJ). (2017). *50 years of achievements*. Retrieved from https://www.cbj.gov.jo /EchoBusv3.0/SystemAssets/PDFs/EN/50th%20acheivements.pdf
23. Central Bank of Jordan (CBJ). (2018). *Financial stability report 2018*. Retrieved from https://www.cbj.gov.jo /EchoBusv3.0/SystemAssets/PDFs/EN/JFSR2018E%20-20-10-2019.pdf
24. Central Bank of Jordan (CBJ). (n.d.). *Banking sector directory*. Retrieved from https://www.cbj.gov.jo/Pages /viewpage.aspx?pageID=307
25. Christian, C., Moffitt, J. S., & Suberly, L. A. (2008). Fundamental analysis for evaluating bank performance: What variables provide the greatest insight into future earnings? *Bank Accounting & Finance, 21*(6), 17–25. Retrieved from https://go.gale.com/ps/i.do?id=GALE%7CA187961788&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=089439 58&p=AONE&sw=w&userGroupName=anon%7Ef5b1dc9c.
26. Damodaran, A. (2007). *Return on capital (ROC), return on invested capital (ROIC) and return on equity (ROE): Measurement and implications*. http://doi.org/10.2139/ssrn.1105499
27. Demirgüç-Kunt, A., & Detragiache, E. (2011). Basel core principles and bank soundness: Does compliance matter? *Journal of Financial Stability, 7*(4), 179–190. https://doi.org/10.1016/j.jfs.2010.03.003
28. Demsetz, H., & Lehn, K. (1985). The structure of corporate ownership: Causes and consequences. *Journal of Political Economy, 93*(6), 1155–1177. https://doi.org/10.1086/261354
29. Dietrich, A., & Wanzenried, G. (2011). Determinants of bank profitability before and during the crisis: Evidence from Switzerland. *Journal of International Financial Markets, Institutions and Money, 21*(3), 307–327. https://doi.org/10.1016/j.intfin.2010.11.002
30. Eakins, S. G., & Mishkin, F. S. (2012). *Financial markets and institutions* (7th ed.). Harlow, England: Pearson Education Limited.
31. Efayena, O. (2014). Financial intermediaries and economic growth: The Nigerian evidence. *Acta Universitatis Danubius. Œconomica, 10*(3), 125–135. Retrieved from http://journals.univ-danubius.ro/index.php/oeconomica /article/view/2325/2698
32. European Central Bank (ECB). (2011). *Annual report 2010*. Retrieved from https://www.ecb.europa.eu/pub/pdf /annrep/ar2010en.pdf
33. European Central Bank (ECB). (2017). *Annual report 2016*. Retrieved from https://www.ecb.europa.eu/pub/pdf /annrep/ar2016en.pdf
34. European Central Bank (ECB). (n.d.). *Euro area bank lending survey*. Retrieved from https://www.ecb.europa.eu /stats/ecb_surveys/bank_lending_survey/html/index.en.html
35. European Commission (EC). (2018). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions*. Retrieved from https://ec.europa.eu/info/sites/default/files/cwp_2019_en.pdf
36. Ghosh, S., Nachane, D. M., Narain, A., & Sahoo, S. (2003). Capital requirements and bank behavior: An empirical analysis of Indian public sector banks. *Journal of International Development, 15*(2), 145–156. https://doi.org/10.1002/jid.947
37. Gilbert, R. A., & Wheelock, D. C. (2007). *Measuring commercial bank profitability: Proceed with caution*. https://doi.org/10.3886/ICPSR21301.v1
38. Goddard, J., Liu, H., Molyneux, P., & Wilson, J. O. (2013). Do bank profits converge? *European Financial Management, 19*(2), 345–365. https://doi.org/10.1111/j.1468-036X.2010.00578.x
39. Goodhart, C., Hartmann, P., Llewellyn, D. T., Rojas-Suarez, L., & Weisbrod, S. (1998). *Financial regulation: Why, how and where now?* London, England: Routledge.
40. Greene, J. C. (2007). *Mixed methods in social inquiry* (Vol. 9). Hoboken, NJ: John Wiley & Sons.
41. Griffith-Jones, S., & Persaud, A. (2008). The pro-cyclical impact of Basle II on emerging markets and its political economy. *Capital Market Liberalization and Development, 27,* 262–288. https://doi.org/10.1093/acprof:oso /9780199230587.003.0010
42. Gul, S., Irshad, F., & Zaman, K. (2011). Factors affecting bank profitability in Pakistan. *The Romanian Economic Journal, 61*(39), 61–87. Retrieved from https://www.researchgate.net/publication/227487619_Factors_Affecting _Bank_Profitability_in_Pakistan
43. Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica, 46*(6), 1251–1271. https://doi.org/10.2307/1913827
44. Herring, R. (2005). Implementing Basel II: Is the game worth the candle? *Financial Markets, Institutions & Instruments, 14*(5), 267–287. https://doi.org/10.1111/j.0963-8008.2005.00108.x
45. Hess, K., & Francis, G. (2004). Cost income ratio benchmarking in banking: A case study. *Benchmarking: An International Journal, 11*(3), 303–319. https://doi.org/10.1108/14635770410538772
46. Hossain, S. A., & Islam, K. M. A. (2017). Impact of Basel II & III implementation to mitigate bank risk: A study on Al-Arafah Islami Bank Limited. *Indian Journal of Finance and Banking, 1*(2), 42–51. https://doi.org/10.46281/ijfb.v1i2.88
47. Huertas, T. (2018). Are banks still special? *Journal of Financial Perspectives, 5*(1). https://doi.org/10.2139/ssrn.3000194
48. Hutchison, D., & Cox, R. A. (2006). *The causal relationship between bank capital and profitability*. https://doi.org/10.2139/ssrn.956396
49. Kim, H.-W., & Lee, H. (2006). *Bank capital regulation and procyclicality of bank lending: Implications for Basel II implementation*. Retrieved from https://www.kdi.re.kr/upload/7808/a2_1.pdf

50. Kretzschmar, G., McNeil, A.J., & Kirchner, A. (2010). Integrated model of capital adequacy — Why banks are undercapitalised. *Journal of Banking and Finance, 34*(12), 2838–2850. https://doi.org/10.1016/j.jbankfin.2010.02.028
51. Laeven, L., & Levine, R. (2009). Bank governance, regulation and risk taking. *Journal of Financial Economics, 93*(2), 259–275. https://doi.org/10.1016/j.jfineco.2008.09.003
52. Ludlow, P. (2018). The European Commission. In R. O. Keohane & S. Hoffmann (Ed.), *The New European Community* (1st ed., pp. 85–132). Routledge. https://doi.org/10.4324/9780429496189-3
53. Mathura, V. (2009). *The influence of strategic leadership in an organization. A case study: Ellerine Holdings Limited* (Master's thesis, Rhodes University). Retrieved from https://core.ac.uk/reader/145045320
54. Mathuva, D. M. (2009). Capital adequacy, cost income ratio and the performance of commercial banks: The Kenyan scenario. *The International Journal of Applied Economics and Finance, 3*(2), 35–47. https://doi.org/10.3923/ijaef.2009.35.47
55. Mei, C. L., Nsiah, T. K., Barfi, R., & Bonsu, M. O. A. (2019). Credit risk and bank profitability of commercial banks in Ghana. *EPRA International Journal of Research & Development (IJRD), 4*(12), 74–83. https://doi.org/10.36713/epra3836
56. Merton, R. C. (1977). An analytic derivation of the cost of deposit insurance and loan guarantees: An application of modern option pricing theory. *Journal of Banking & Finance, 1*(1), 3–11. https://doi.org/10.1016/0378-4266(77)90015-2
57. Navapan, K., & Tripe, D. (2003). An exploration of the relationship between bank capital levels and return on equity. In *Proceeding of the 16th Australasian Finance and Banking Conference (AFBC'03)* (pp. 1–15).
58. Nguyen, T. H. (2020). Impact of bank capital adequacy on bank profitability under Basel II accord: Evidence from Vietnam. *Journal of Economic Development, 45*(1), 31–46. Retrieved from http://jed.or.kr/full-text/45-1/2.pdf
59. Ozili, P. K. (2015). Determinants of bank profitability and Basel capital regulation: Empirical evidence from Nigeria. *Research Journal of Finance and Accounting, 6*(2), 124–131. https://doi.org/10.2139/ssrn.2544647
60. Ozili, P. K. (2021). *Bank profitability determinants: Comparing the United States, Nigeria and South Africa*. https://doi.org/10.2139/ssrn.3776082
61. Pennacchi, G. G. (2005). Risk-based capital standards, deposit insurance, and procyclicality. *Journal of Financial Intermediation, 14*(4), 432–465. https://doi.org/10.1016/j.jfi.2004.09.001
62. Petria, N., Capraru, B., & Ihnatov, I. (2015). Determinants of banks' profitability: Evidence from EU 27 banking systems. *Procedia Economics and Finance, 20,* 518–524. https://doi.org/10.1016/S2212-5671(15)00104-5
63. Podpiera, R. (2006). Does compliance with Basel Core Principles bring any measurable benefits? *IMF Staff Papers, 53*(2), 306–326. Retrieved from https://www.imf.org/External/Pubs/FT/staffp/2006/02/podpiera.htm
64. Saeed, M. S., & Zahid, N. (2016). The impact of credit risk on profitability of the commercial banks. *Journal of Business & Financial Affairs, 5*(2), 2167–0234. https://doi.org/10.4172/2167-0234.1000192
65. Saona, P. (2016). Intra-and extra-bank determinants of Latin American Banks' profitability. *International Review of Economics & Finance, 45,* 197–214. https://doi.org/10.1016/j.iref.2016.06.004
66. Seddighi, H. R., & Theocharous, A. L. (2002). A model of tourism destination choice: A theoretical and empirical analysis. *Tourism Management, 23*(5), 475–487. https://doi.org/10.1016/S0261-5177(02)00012-2
67. Seddigi, H., & Lawler, K. A. (2000). *Econometrics: A practical approach*. New York, NY: Routledge.
68. Summer, M. (2003). Banking regulation and systemic risk. *Open Economies Review, 14*(1), 43–70. https://doi.org/10.1023/A:1021299202181
69. Sundararajan, V., Marston, D., & Basu, R. (2001). *Financial system standards and financial stability: The case of the Basel Core Principles*. https://doi.org/10.2139/ssrn.879547
70. Swandewi, N. K. M., & Purnawati, N. K. (2021). Capital adequacy ratio mediates the effect of non-performing loan on returns on assets in public commercial banks. *American Journal of Humanities and Social Sciences Research (AJHSSR), 5*(1), 651–656. Retrieved from https://www.ajhssr.com/wp-content/uploads/2021/01/ZZX21501651656.pdf
71. Teixeira, J. C., Silva, F. J., Fernandes, A. V., & Alves, A. C. (2014). Banks' capital, regulation and the financial crisis. *The North American Journal of Economics and Finance, 28,* 33–58. https://doi.org/10.1016/j.najef.2014.01.002
72. Teixeria, A. L. S., Narciso, J. C. A., Salomão, T. I., & Dias, M. R. C. (2014). Bilateral deficit in maximal isometric knee extension in trained men. *Journal of Exercise Physiology, 16*(1), 28–35. Retrieved from https://www.researchgate.net/publication/259760443_Bilateral_Deficit_in_Maximal_Isometric_Knee_Extension_in_Trained_Men
73. Towhid, A. S. M., Havidz, S. A. H., & Alnawah, M. A. Q. A. (2019). Bank-specific and macroeconomic determinants of non-performing loans of commercial banks in Bangladesh. *Dinasti International Journal of Management Science, 1*(1), 86–101. https://doi.org/10.31933/dijms.v1i1.28