



The Impact of Credit Risk and Liquidity Risk on Bank Profitability: An Empirical Study on the Egyptian Banks

**اثر مخاطر الائتمان ومخاطر السيولة على ربحية البنوك :
دراسة تطبيقية على البنوك المصرية**

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Abstract:

Purpose: The study aims to examine the impact of credit risk and liquidity risk on bank profitability in Egypt

Design/Methodology/ Approach: The study used annual data from a sample of 8 Egyptian banks registered in the EGX100 index between 2010 and 2022. The research methodology was built upon quantitative approach by collecting panel data (secondary data) for the assigned period to test the research hypotheses. The fixed effect and random effect analyses were used as the statistical tools to analyze the collected data.

Findings/ Originality/Value: Results revealed that credit and liquidity risks have significant negative effect on profitability measures in the period 2010 to 2022 in the Egyptian banking sector.

Recommendation: The negative impact of credit risk on bank profitability indicates that credit departments in banks need to study financing requests from customers in accordance with policies related to the feasibility study, which contributes to reducing the credit risks that affect the profitability of banks. Additionally, improving risk management systems and including more reliable information about liquidity measurements can help in predicting credit risk, and can be used as one way to help in managing both risks in banks.

Keywords: Credit risk, Liquidity risk, Bank profitability, EGX100 index, Panel data, Egypt.

المستخلص:

الهدف: تهدف الدراسة إلى فحص تأثير مخاطر الائتمان ومخاطر السيولة على ربحية البنك في مصر.

التصميم/المنهجية/الأسلوب: اعتمدت الدراسة على بيانات سنوية لثمانية بنوك مصرية مدرجة بمؤشر EGX100 في الفترة من ٢٠١٠ إلى ٢٠٢٢. وقد اعتمدت المنهجية على المدخل الكمي من خلال جمع البيانات الزمنية المقطعية لإختبار فروض الدراسة. وقد تم استخدام تحليل التأثير الثابت والتأثير العشوائي لتحليل البيانات المجمعة.

النتائج/الأصالة/القيمة: أظهرت النتائج أن هناك تأثيراً سلبياً معنوياً لمخاطر كلٍ من الائتمان والسيولة على مقاييس الربحية عن الفتره من ٢٠١٠ إلى ٢٠٢٢ في قطاع البنوك المصري.

التوصيات: يشير الأثر السلبي لمخاطر الائتمان على ربحية البنوك إلى أن إدارة الائتمان في البنوك يجب عليها دراسة طلبات التمويل المقدمة من العملاء وفقاً للسياسات المتعلقة بدراسة الجوى، بما يساهم في تقليل مخاطر الائتمان التي تؤثر على ربحية البنوك، وبالإضافة إلى ذلك فإن تحسين أنظمة إدارة المخاطر، وإدراج معلومات أكثر موثوقية حول مقاييس السيولة، يمكن أن يساعد في التنبؤ بمخاطر الائتمان. كما يمكن استخدامه كوسيلة للمساعدة في إدارة كلٍ من مخاطر السيولة والائتمان في البنوك.

الكلمات المفتاحية: مخاطر الائتمان، مخاطر السيولة، ربحية البنك، المؤشر المصري ١٠٠، بيانات زمنية مقطعية، مصر.

1. Introduction

The banking industry plays an extremely vital part in any country's economic growth (Batten & VO, 2019). The banking industry is a business full of risks, even though the business prospects are good and managed prudently. This is owing to the fact that most bank operations rely on third-party money such as demand deposits, savings, and time deposits. These three banking products have substantial quantity variations, which may not necessarily coincide with credit placements (Ekadjaja et al., 2020).

Banks give credit because they assume that credit consumers will meet their obligations. However, the provision of bank credit may diverge from expectations when the debtor and/or other parties fail to meet their responsibilities to the bank. According to Imbierowicz & Rauch (2014), the higher the distribution of money in the form of credit compared to deposits or public deposits in a bank, may have implications, namely the bigger the risk faced by the bank's concern. If credit distribution fails or has complications, the bank will have difficulty in recovering the public's deposits. To avoid this, banks must develop appropriate liquidity risk management procedures.

Liquidity risk is one of the most important risks affecting their activity, as evidenced by their inability to manage their commercial activities when there is a shortage in their liquidity, and they reach the point of bankruptcy when this shortage continues (Effendi & Disman, 2017). According to previous study results, Purbaningsih & Fatimah (2018) and Rasul (2013), Liquidity risk, which occurs in all banks, has a significant impact on their profitability. A gap is found in the debate that exists in the previous studies regarding whether there is a positive or negative effect of liquidity risk on bank profitability. Arief & Annes (2012) discovered that bank liquidity risk negatively affects bank profitability in Pakistan. However on the contrary, Lartey, Antwi, & Boadi (2013) in Ghana show that liquidity has a positive influence on banking ROA (Return on Asset), but Purbaningsih & Fatimah (2018) shows that LAD (Liquid Asset to Deposit) has a positive effect on ROA of Commercial banks in Indonesia.

Credit risk is the most critical and expensive risk associated with financial institutions and its impact on profitability is quite significant compared to any other risk associated to the banking sector as it is a direct threat to solvency of the institution (Chijoriga, 2011). Jane (2016) found that

NPL (Non-Performing Loan) had a negative impact on ROE (Return on Equity) in banking. The similar conclusion was reached by Poudel (2012), who discovered that NPL levels are a predictor of banking performance in Nepal. Whereas, Muriithi, Waweru, & Muturi (2016) found that LLPR (Loss Loan Provision Ratio) has a negative and significant relationship with bank profitability in Kenya.

Therefore, this research comes to fill such gap in literature and investigates the effect of credit risk and liquidity risk on bank profitability in the Egyptian context. Credit risk is measured by LLPR (Loss Loan Provision Ratio) (Muriithi, Waweru, & Muturi, 2016), and liquidity risk is measured by LDR (Loan to Deposit Ratio) (Imani & Pracoyo, 2018), while bank profitability dimensions are measured by Return on Assets (ROA) and Return on Equity (ROE) (Rose &Hudgins, 2013).

2. Research Problem:

The research will focus on credit risk and liquidity risk of banks in Egypt, due to their major importance in the banking literature. They are considered to be pure risk indicators that result in actual losses to the bank if not accurately and carefully measured and monitored through a coherent risk management system to protect the bank from adverse effects and expected losses. The main focus here will be to illustrate the impact of the two risk types on bank Profitability, and to answer the research question **"To what extent do the credit and liquidity risks affect the profitability of the Egyptian banks?"**

3. Research Objectives

The main objective of this study is to determine the effect of credit risk and liquidity risk on bank Profitability in Egypt.

4. Literature Review

4.1 Theoretical Literature Review

The study anchored its variables on two theories namely: (i) Finance distress theory which is linked with the credit and liquidity risks, (ii) Shiftability Theory which is linked with liquidity risks.

4.1.1 Finance Distress Theory

Baldwin and Mason (1983) purported that when a firm's business deteriorates to the point where it cannot meet its financial obligation, the firm is said to have entered the state of financial distress. The first signals of financial distress are violations of debt payments and failure or reduction of dividends payouts. Whitaker (1999) defines entrance into financial distress as the first year in which cash flows are smaller than current maturities' long-term debt. The firm has enough to pay its creditors as long as the cash flows exceeds the current debt obligations. The key factor in identifying firms in financial distress is their inability to meet contractual debt obligations.

However, substantial financial distress effects are incurred well prior to default. Wruck (1990) stated that firms enter into financial distress as a result of economic distress, declines in their performance and poor management especially on risks. Boritz (1991) depicts a process of a financial distress that begins with an incubation period characterized by a set of bad economic conditions and poor management which commits costly mistakes. In the case of commercial banks, inability to provide cash to depositors and loans to borrowers as and when the demand may constitute a liquidity crisis. Other creditors also need to be taken into account when firms are putting in place risk management measures. Credit risk in banks also need to be addressed since it may lead to financial distress. Loan portfolio management is an important determinant of the firm's liquidity. The banks should manage the credit and liquidity risk in order to avoid the financial distress.

The theory of financial distress emanates from the liquidity and credit risk facing a firm. This theory provides for a non-biased perspective on the relationship between credit risk and financial performance variables employed by the study. By providing information that the effects of financial distress occur prior default risk, the theory offers a neutral platform to undertake an incisive empirical analysis of this relationship within the commercial banks.

4.1.2 Shiftability Theory of Liquidity

Formally developed by Harold G, Moulton in 1915, the shiftability theory held that banks could most effectively protect themselves against

massive deposit withdrawals by holding, as a form of liquidity reserve, credit instruments for which there existed a ready secondary market. The theory is based on the proportion that banks liquidity is maintained if it holds assets that could be shifted or sold to other lenders or investors for cash. Also, these assets could be shifted to the Central Bank for cash without material loss in case of necessity than relying on maturities to solve their liquidity problems (Ngwu, 2006). This theory posits that a bank's liquidity is maintained if it holds assets that could be shifted or sold to other lenders or investors for cash. This viewpoint says that a bank's liquidity might be improved if it always has assets to sell and the Central Bank and the discount market are ready to buy the asset offered for discount. Thus this theory recognizes and contends that shiftability, marketability or transferability of a bank's assets is a basis for ensuring liquidity. This theory further contends that highly marketable security held by a bank is an excellent source of liquidity.

According to Dodds (1982), liquidity management theory consists of the activities involved in obtaining funds from depositors and other creditors and determining the appropriate mix of funds for a particularly bank. Liquidity theory has been subjected to critical review by various authors. The general consensus is that during the period of distress, a bank may find it difficult to obtain the desired liquidity since the confidence of the market may have seriously affected and credit worthiness would invariably be lacking. However, for a healthy bank, the liabilities constitute an important source of liquidity.

The liquidity shiftability theory provides for explicit understanding of how the liquidity risk affects the financial performance using liquidity coverage and net stable funding ratios as stated by new Basel III framework. The analysis of this study provides the information as to whether liquidity maintained by the commercial banks affect the returns to the shareholders.

4.2 Empirical Literature Review and hypotheses development

4.2.1 The effect of credit risk on bank profitability

Credit is normally the process of borrowing and lending money. Commercial banks regularly complete investment banking activities by allowing their customers to acquire new debt (Gande, 2008). There are several possible risk sources, such as credit risk, liquidity risk, market risk

and political risk. Unfortunately, credit risk is the highest risk that banks face (Chen & Pan, 2012). In the banks' case, credit risk and the problems associated with it can be the cause for greater alarm, due to the higher level of how the risks are perceived. This is due to some of the characteristics of the clients and the business conditions they end up in, which in most cases need comprehensive empirical examination. Moreover, while banks are likely to take the losses from normal earnings, unexpected losses may be present which cannot be absorbed by normal earnings (Olalekan & Adeyinka, 2013).

Hosna, Manzura & Juanjuan (2009) studied the relationship between non-performing loan and capital adequacy ratios and profitability for four Swedish banks covering a period of 2000 to 2008. The study showed that rate of non-performing loan and capital adequacy ratios was inversely related to ROE, though the degrees vary from one bank to another. Such inverse relationships between profitability, performance and credit risk measures were also found in other studies (Achou & Tenguh, 2008; Musyoki & Kadubo 2011; and Tomak, 2013) conducted on the Determinants of Bank's Lending Behavior of commercial banks in Turkish for a sample of eighteen from 25 banks. The main objective of the study was to identify the determinants of bank's lending behavior. The data were covered 2003 to 2012 periods. The variables used were size, access to long term funds, interest rates, GDP growth rate, and inflation rate. The finding reveals that bank size, access to long term loan, and inflation rate have significant positive impact on the bank's lending behavior but, interest rates and GDP are insignificant.

The same result was obtained by Kolapo, Ayeni & Oke (2012) using panel model approach carried out an empirical investigation into the quantitative effect of credit risk on the performance of commercial banks in Nigeria over the period of 11 years (2000-2010). The traditional profit theory was employed to formulate profit, measured by Return on Asset (ROA), as a function of the ratio of Non-performing loan to loan and advances (NPL/LA), ratio of Total loan and Advances to Total deposit (LA/TD) and the ratio of loan loss provision to classified loans (LLP/CL) as measures of credit risk. Five commercial banking firms were selected on a cross sectional basis for eleven years. Panel model analysis was used to estimate the determinants of the profit function. The results showed that the effect of credit risk on bank performance measured by the Return on Assets

of banks is cross-sectional invariant. Their findings show that profitability is reduced by increase of non-performing loan and loan loss provision and that the effect of credit risk is similar across banks in all banks considered in the study. However, an increase in total loan and advances increases the profitability.

Furthermore, Sujeewa (2015) evaluated the effect of credit risk on the profitability of the commercial banks in Sir Lanka. Return on Assets (ROA) ratio is used as measure of bank performance and Loan provision to Total Loan (LP/TL), Loan Provision to Non-Performing Loans (LP/NPL) and Non-Performing Loans/ Total Loans (NPL/TL) ratios were used to measure credit risk. Data were collected from 8 commercial banks which have superior financial performance from the 24 commercial banks in Sir Lanka from the period starting from 2009 to 2013 for five years. The findings reveal that non-performing loans and provisions have an adverse impact on profitability.

In a study to investigate the effect of credit risk on financial performance of commercial banks in Kenya, Muriithi, Waweru, & Muturi (2016) used credit risk measured by capital to risk, weighted assets, assets quality, loss loan provision, loan and advance ratio and financial performance by return on equity (ROE). The data were taken from 43 commercial banks for the period between the years 2005 and 2014. The results show that credit risk has a negative and significant relationship with bank profitability, poor asset quality or high non-performing loan to total asset is related to poor bank performance both in short run and long run.

Sun and Chang (2018) examined the relationship between credit risk and profitability of commercial banks. The study was conducted on 83 U.S. commercial banks from December 2010 to December 2017. Sun and Chang used Ordinary least squares regression and did use Non-Performing Loan Ratio (NPLR) and Capital Adequacy Ratio (CAR) as independent variables and used ROA and ROE as dependent variables. The study found that credit risk has an important effect on profitability as an increase in NPLR decreases both ROA and ROE.

Also, Mensah et al. (2019) re-examined in their study the impact of credit risk on the profitability of banks in Ghana. Panel data covering period 2010-2015 were gathered from 20 banks. The study included three determinants of the credit risk which were Asset Quality Ratio (AQR), Non-

Performing Loan Ratio (NPLR) and Liquidity Risk Ratio (LRR) while the profitability was measured by the ROA. Authors found that while the relationship between asset quality, non-performing loan and profitability were statistically significant, the relationship between liquidity ratio and banks' profitability was found to be insignificant. This shows that banks with huge non-performing loans are less profitable

In the same way, Ekinici & Poyraz (2019) and Ahmed, El-Halaby, & Soliman (2022) in their studies found that one of the most significant elements negatively impacting banks' financial performance is credit risk. Based on the previous studies that were illustrated, the researcher can develop the first hypothesis of the current research, as follows:

H1: There is a negative significant impact for credit risk on bank profitability.

4.2.2 The effect of liquidity risk on bank profitability

Liquidity risk is a risk caused by banks not being able to meet short-term obligations that have matured (Imani & Pracoyo, 2018). The assessment of liquidity risk cannot be separated from the role of bank liquidity itself. Liquidity describes the capability of the financial service companies to meet the customers' cash requirements and provide advances in the form of overdraft and financial loans. Liquidity is also bank cash and cash equivalent such as treasury bills and commercial papers, etc. According to Acharya & Mora (2015), banks have an important role as liquidity providers at the time of financial crisis. With the strong support and help of government and government sponsor agencies, banks became able to provide liquidity. At the start of the financial meltdown of 2007-2008, the inflow of deposits became weakened and loan to deposit deficit was widened, which exposed banking institutions to higher undrawn commitments.

Ruziqa (2013) examined liquidity risk influence on ROA in Indonesia through collecting secondary data for 23 traditional banks for the period of 2007 to 2011. A positive and significant effect between liquidity risk and ROA was obtained by analyzing panel data using regression analysis. The result slightly changed in Indonesia when data was collected from 10 Islamic Banks in the period 2014 to 2016. Different liquidity risk indicators were used, where Liquid Asset to Deposit (LAD) showed a

positive effect on ROA, while financing deposit ratio (FDR) showed a negative effect on ROA (Purbaningsih & Fatimah, 2018). This could be shown by the fact that a high FDR ratio indicated a low bank liquidity and led to high liquidity risk, as the amount of funds needed for financing or lending is growing.

The same result was obtained by Ouma (2015) who evaluated the impact of liquidity risk on the profitability of commercial banks in Kenya. The sample of the study was forty-three banks during the period between 2010-2014. The descriptive and analytical approach was used. The study concluded that liquidity has a positive impact on the profitability of commercial banks and that there is a statistically significant relationship between Liquidity and profitability in Kenyan banks. The study concluded that increasing the unity of the current liquidity ratio and the deposit ratio would lead to an improvement in net interest income.

Also, a positive relationship was obtained between liquidity risk and ROA in Jordan by Dahiyat (2016), through collecting secondary data from financial statement of 15 banks listed in stock exchange of Amman in 2012 till 2014. After collection of the data, the researcher analyzed it using simple regression analysis. Similarly, Sukmana & Suryaningtyas (2016) clarified the liquidity risk management impact on ROA of Islamic and other banks in Indonesia. Secondary data was collected for 13 banks (8 Islamic banks & 5 Conventional banks) in Indonesia during 2010-2014 and data was analyzed using panel regression analysis. The results showed the significant and positive relationship between liquidity risk management and ROA of Islamic and Conventional banks in Indonesia.

However, a different result was obtained by some other researches, one of which is that conducted by Muriithi & Waweru (2017) aiming to examine the effect of liquidity risk on ROE in Kenya. Liquidity risk was measured by liquidity coverage ratio (LCR) and net stable funding ratio (NSFR). Panel data techniques of random effects estimation were used to analyze the data obtained for the period between year 2005 and 2014 for 43 registered commercial banks in Kenya. The study found that net stable funding ratio (NSFR) was negatively associated with bank profitability in both long run and short run, while liquidity coverage ratio (LCR) did not significantly influence ROE in both the long run and short run. However, the overall effect was that liquidity risk had a negative effect on ROE.

In addition, Zainuddin et al. (2017) investigated the relationship between liquidity risk through cash ratio and bank profitability measured by return on assets (ROA) of banks in Indonesia. The study methodology was built upon collecting panel data (secondary data) from financial reports of 10 banks in Indonesia listed in Indonesian Stock Exchange for the period 2011 to 2015, and was analyzed using multiple regression analysis with the least squares' equation (Ordinary Least Square). Analysis found that the liquidity risk through cash ratio had a positive significant influence on bank profitability measured by return on assets (ROA) in Indonesia. Moreover, Charmler et al. (2018) clarified the relationship between liquidity risk through liquid assets and bank profitability measured by return on assets (ROA) in Ghana. Secondary data was collected from 21 commercial banks in Ghana for the period 2007-2016 and data was analyzed using regression and correlation analyses. The conclusion referred to the fact that liquid assets was needed to improve and enhance bank profitability measured by return on assets (ROA) in Ghana.

Also, Chowdhury & Zaman (2018) aimed to clarify the effect of liquidity risk on ROE, as liquidity crisis was affecting the banking industry in Bangladesh. Data were collected for six Islamic banks for the period 2012 to 2016. Liquid risky asset to total asset, Capital to total asset ratio were used as liquidity indicators and results revealed that there was a negative relation between liquidity indicators and ROE. Furthermore, Alalade, Ogbemor & Akwe (2020) investigated the impact of management of liquidity risk on bank profitability measured by return on assets (ROA) in Nigeria banks. Secondary data were collected from financial statements of 14 banks in Nigeria during the period 2009 to 2018 and data were analyzed using pooled, fixed and random effect models. Results revealed that there was a positive significant influence of liquidity risk management on bank profitability measured by return on assets (ROA) in Nigeria.

H2: There is a negative significant impact for liquidity risk on bank profitability.

5. Methodology

5.1 Sample and Data Collection

According to the Central Bank of Egypt (CBE), the Egyptian banking system consists of 38 banks categorized as commercial, noncommercial

public and private sector. Hence, the Egyptian banks are the targeted research population. Yet, all banks that had been publicly traded and were listed in the EGX100 index in 2023 had to be included in the sample in order to meet the eligibility requirements. The initial sample included 8 banks. These included Commercial International Bank, Egyptian Gulf Bank, QNB Alahli, Housing&Development Bank, Al Baraka Bank Egypt, Credit Agricole Egypt , Faisal Islamic Bank and Abu Dhabi Islamic Bank . The EGX100 tracks the performance of the top 100 companies in terms of Liquidity and activity which includes the constituents of EGX30 and the constituents of EGX70.

The data were covered 13 years from 2010 to 2022. The choice of 2010 as the starting point is associated with the establishment of the EGX 100 index committee in August 2009. Data that will be needed for this study is secondary data and it will be collected from Egyptian Stock Exchange Website (www.egx.com.eg), Central Bank of Egypt Website (www.cbe.org.eg) and Egypt for Information Dissemination (EGID) that is the licensed distributor for the Egyptian Exchange's listed firms' information.

5.2 The Study Variables

5.2.1 Bank Profitability

Rose & Hudgins (2013) mentioned that any firm tries to maximize the value for their shareholders while bearing the minimum acceptable level of risk. Therefore, the two main dimensions of evaluating any firm's performance are profitability and risk. Better management of these two important dimensions represents the ultimate goal of any firm, especially financial firms. However, measuring firm profitability is not an easy task and there are different ways to do so. Rose & Hudgins (2013) stated that the most commonly used measures of bank profitability are; ROA, ROE, NIM, net noninterest margin, net operating margin and earnings per share. Whereas the NIM, net noninterest margin, and net operating margin are considered to be not only profitability measures but also efficiency measures. While, ROA is intended to indicate the managerial efficiency in generating dollar amounts for each investment in assets. Alternatively, ROE represents the return that shareholders receive for each dollar of their investment.

The efficiency of banks can be evaluated by applying ROE, since it shows that banks reinvest its earnings to generate future profit. The growth of ROE may also depend on the capitalization of the banks and operating profit margin. However, the increase of the operating margin can smoothly enhance the ROE. ROE also hinges on the capital management activities. If the banks use capital more efficiently, they will have a better financial leverage and consequently a higher ROE. Because a higher financial leverage multiplier indicates that banks can leverage on a smaller base of stakeholder's fund and produce higher interest bearing assets leading to the optimization of the earnings. On the contrary, a rise in ROE can also reflect increased risks because high risk might bring more profits. This means ROE does not only go up by increasing returns or profit but also grows by taking more debt which brings more risk. Risk management becomes more and more significant in order to ensure sustainable profits in banks (Hosna, Manzura& Juanjuan, 2009)

Return on equity is considered to be the most practiced measure of profitability for a firm. ROE is used to measure the return on stockholders investments in the bank. Therefore, the values of this variable depends on the bank's equity multiplier and the amount of debt used to finance assets This variable is used as another measure for bank profitability following (Islam & Nishiyama, 2016; Ahamed, 2017; Bouzgarrou, Jouda & Louhichi , 2018; Bucevska & Misheva, 2017 and Trad, Trabelsi & Goux , 2017).

Return on Assets (ROA) is considered to be the single most commonly used measure of bank profitability in many of the previously mentioned studies. ROA is used as a measure of operational performance and managerial efficiency (Pasiouras & Kosmidou, 2007 and Trujillo-Ponce, 2013). Therefore, ROA is used as the main measure of bank profitability in Egypt for this study following (Islam & Nishiyama, 2016; Ahamed, 2017; Bouzgarrou, Jouda & Louhichi, 2018; Bucevska & Misheva, 2017 and Trad, Trabelsi & Goux, 2017).

5.2.2 Credit risk

Credit risk is a potential loss due to the failure or inability of the customer to return the amount of the loan obtained from the bank and the interest in accordance with a predetermined period of time. Credit risk comes from a variety of bank functional activities such as credit, treasury

and investment, and trade finance, which are recorded in the banking books, as well as trading books (Imani & Pracoyo, 2018).

In addition, credit risk can be caused by customer factors as borrowers in the presence of moral hazards and adverse choices. High risk borrowers hope to get high returns (high risk, high return), but to get them they make adverse choices. After obtaining a loan, the problem of moral hazard arises because the borrower has the intention to invest his loan funds into investments which he thinks provide a high return (Imani & Pracoyo, 2018).

This study will use loan loss provisions to loans ratio as a measure of credit risk. Based on Cooper, Jackson & Patterson (2003), fluctuations in credit risk can mirror changes in the health of the bank's loan portfolio, which can distress bank performance. The more the financial institutions are exposed to high-risk loans, the higher the buildup of unpaid loans will be, thus reducing the banks' profitability.

5.2.3 Liquidity risk

Liquidity risk is a risk caused by banks not being able to meet short-term obligations that have matured. The assessment of liquidity risk cannot be separated from the role of bank liquidity itself. Liquidity is the ability of a company to fulfill its short-term obligations in a timely manner. Liquidity of a bank with bank liquidity risk and profitability is inversely proportional. High bank liquidity will produce low profit, on the contrary when the level of liquidity is low, it will generate high profit (Imani & Pracoyo, 2018).

In liquidity activities, there can be 2 types of risk, namely the risk of excess funds and the risk of lack of funds. When a lot of funds in a bank are unemployed or not running, causing a high interest rate sacrifices, it can be stated that the bank is at risk of excess funds. However, when the funds available to complete the term liability needs are not fulfilled, it means that the bank is at risk of lack of funds (Imani & Pracoyo, 2018)

Loan to Deposit Ratio (LDR) is chosen as a measurement tool because this ratio shows the availability of data and sources of funds of the bank at present and in the future. Based on the formula, LDR can find out how much the loan can be financed from loan funds received which are sensitive to changes in interest rates. The greater this ratio indicates the bank is more aggressive or the bank is quite active in channeling its credit funds,

while the smaller this ratio means the greater the third party funds that are not used for lending (Imani & Pracoyo, 2018).

5.2.4 Bank Size

Bank size is another factor that will be investigated for its effect on bank profitability through the main indicator of bank assets; following previous literature. The direction of the relationship between bank size and profitability is either positive or negative. On one hand, economies of scale cause large banks to earn higher efficiency and lower costs which enhance profitability. On the other hand, large sizes means more diversification and lower risk which might affect profitability; in addition to system complexity that might also affect profitability of large banks. Therefore, the impact of bank size on bank profitability is considered to be undetermined in the literature, as it differs from one study to another. Some studies found economies of scale for large banks and others found diseconomies of scale for large banks. Bank size will be measured by the natural logarithm of total assets following (Islam & Nishiyama, 2016; Ahamed, 2017; Bouzgarrou, Jouda & Louhichi, 2018; Bucevska & Misheva, 2017 and Trad, Trabelsi & Goux , 2017).

5.2.5 GDP growth

It is considered to be one of the most important macroeconomic indicators, and is commonly calculated in the literature through the percentage change in GDP or GDP per capita, as an indicator of the macroeconomic condition and business cycle. This variable affects the overall supply and demand of loans and deposits for banks. Good economic conditions support the financial conditions of bank customers and increase demand for loans by both firms and individuals. On the other hand, bad economic conditions deteriorate the credit quality and affect bank profitability negatively by increasing credit losses. Therefore, GDP growth is expected to affect bank's profitability positively, as better macroeconomic conditions help banks to operate more efficiently. The measure of GDP growth for a country's economic growth will be used following (Islam & Nishiyama, 2016; Ahamed, 2017; Bouzgarrou, Jouda & Louhichi , 2018; Bucevska & Misheva, 2017 and Trad, Trabelsi & Goux , 2017).

5.2.6 Inflation

Inflation rate is another important measure of the macroeconomic conditions, which will be measured by the inflation index or the percentage

change in consumer prices. Inflation has an undetermined effect on bank profitability based on the level of its anticipation. In case of anticipating changes in inflation rate, banks can adjust interest rates in a way that makes changes in revenues large enough to more than offset changes in costs and affect profitability positively. However, if changes in inflation rate are not anticipated, adjustments in interest rates might not be enough to offset changes in costs, in a way that affects bank profitability negatively. Previous studies who investigated the effect of this variable on bank profitability include (Islam & Nishiyama, 2016; Ahamed, 2017; Bucevska & Misheva, 2017 and Trad, Trabelsi & Goux , 2017).

Table (1): Presents Variables Description, Expected Effects and Data Sources

Class	Variable Name	Description	Expected Effect	Data Source
Dependent	Return on Equity (ROE)	Net Income/ Total Assets		Banks' Annual Reports
	Return on Asset (ROA)	Net Income/ Total Equity		
Independent	Credit Risk	Loans Loss Provisions/ Loans	-	
	Liquidity Risk	Total Customer Loans/Total Customer Deposits	-	
Control	Bank Size	Natural Logarithm of Total Assets	+/-	
	GDP Growth	% change in GDP	+	
	Inflation	Consumer Prices (%change)	+/-	

5.3 Research Design

This research depends on quantitative design using the deductive approach. After collecting data from annual reports of banks, data were

analyzed using Generalized Least Squares method of regression (GLS), where fixed and random effects are tested using Hausman test. Fixed effects regression is an estimation technique employed in a panel data setting that allows one to control for time-invariant unobserved individual characteristics that can be correlated with the observed independent variables, while Random effects model estimates the effects of time-invariant variables, but the estimates may be biased because omitted variables are not controlled. The Hausman test is used to determine which effect of the fixed versus random effects is dominant in the data under study. The detailed analysis as well as discussion of the main findings are shown in the following section.

6. Data Analysis and Results:

6.1 Descriptive Statistics:

Table 2 illustrates the descriptive analysis for the research variables using mean, standard deviation, maximum and minimum. The mean value of ROA is found to be 0.019 with a standard deviation of 0.009 and minimum and maximum values of -0.060 and 0.046 respectively. In addition, the mean value of ROE is 0.199 with a standard deviation of 0.073 and minimum and maximum values of -1.920 and 0.364 respectively. Moreover, the mean value of LDR is 0.649 with a standard deviation of 0.274 and minimum and maximum values of 0.115 and 1.233 respectively. Furthermore, the mean value of LPR is 0.082 with a standard deviation of 0.068 and minimum and maximum values of 0.025 and 0.366 respectively. The mean value of Size is 24.78 with a standard deviation of 0.995 and minimum and maximum values of 22.55 and 27.17 respectively. In addition, the mean value of GDP is 16.01 with a standard deviation of 6.273 and minimum and maximum values of 8.300 and 28.10 respectively. Finally, the mean value of Inflation is 11.83 with a standard deviation of 6.128 and minimum and maximum values of 4.700 and 23.27 respectively.

Regarding normality, it is one of the assumptions that have to be verified in order to be able to use ordinary least squares method for regression analysis. Table 2 clarifies the skewness and kurtosis values for the research variables, where it could be observed that some of the skewness and kurtosis values are not in the acceptance level of ± 1 , which means that the data under study are not normally distributed. Consequently, Pooled

Regression used to describe the relationships between the research variables by using GLS Technique.

Table (2): Descriptive Analysis and Normality Test of Research Variables

	Mean	Standard Deviation	Minimum	Maximum	Skewness	Kurtosis
ROA	0.019	0.009	-0.060	0.046	0.372	0.189
ROE	0.199	0.073	-1.920	0.364	-0.337	0.485
LDR	0.649	0.274	0.115	1.233	-0.339	-0.421
LPR	0.082	0.068	0.025	0.366	2.649	7.571
SIZE	24.78	0.995	22.55	27.17	0.199	-0.128
GDP	16.01	6.273	8.300	28.10	0.724	-0.433
Inflation	11.83	6.128	4.700	23.27	0.820	-0.676

6.2 Effect of credit risk and liquidity risk on ROA

Table 3 refers to the fixed versus random effect in regression analysis for ROA. It can be observed that there is a negative significant effect of LDR and LPR (P-value < 0.05) in both fixed and random effects. On the other hand, there is an insignificant effect of Size, GDP and Inflation (P-value > 0.05) in both fixed and random effects. Applying Hausman test to know which one of fixed test and random test is appropriate, it was found that the p-value of Hausman test is 1.00 (P-value > 0.05), which means that the fixed effect is not supported in favor of the random effect. The independent variables in this model have an adjusted R-squared value of 47.8%. Furthermore, the F-statistic is significant at a level lower than 1%, indicating a robust fit for the model.

Table (3): fixed versus random effect credit risk and liquidity risk on ROA

Variable	Fixed Effect			Random Effect			Hausman Test
	Coefficient	T	Sig.T	Coefficient	T	Sig.T	
C	0.0011	0.02	0.97	-0.0122	-0.3	0.74	1.00
LDR	-0.0161	-2.2	0.02	-0.0145	-2.3	0.02	
LPR	-0.1208	-7.9	0.00	-0.1198	-7.9	0.00	
SIZE	0.0013	0.87	0.38	0.0018	1.2	0.20	
GDP	0.0002	1.7	0.08	0.0002	1.7	0.08	
Inflation	0.0004	0.31	0.75	0.0003	0.25	0.79	
Adjusted R ²	0.6420			0.4786			
F	16.394			19.910			
Sig.F	0.0000			0.0000			

6.3 Effect of credit risk and liquidity risk on ROE

Table 4 refers to the fixed versus random effect in regression analysis for ROE. It can be observed that there is a negative significant effect of LDR and LPR (P-value < 0.05) in both fixed and random effects. On the other hand, there is an insignificant effect of Size, GDP and Inflation (P-value > 0.05) in both fixed and random effects. Applying Hausman test to know which one of fixed test and random test is appropriate, it was found that the p-value of Hausman test is 1.00 (P-value > 0.05), which means that the fixed effect is not supported in favor of the random effect. The independent variables in this model have an adjusted R-squared value of 58.9%. Furthermore, the F-statistic is significant at a level lower than 1%, indicating a robust fit for the model.

Table (4): fixed versus random effect credit risk and liquidity risk on ROE

Variable	Fixed Effect			Random Effect			Hausman Test
	Coefficient	T	Sig. T	Coefficient	T	Sig. T	
C	0.747	0.91	0.36	0.4993	0.74	0.45	1.00
LDR	-0.327	-2.2	0.02	-0.3601	-3.4	0.00	
LPR	-3.353	-10.7	0.00	-3.3021	-10.9	0.00	
SIZE	-0.007	-0.22	0.82	0.0039	0.15	0.87	
GDP	0.001	0.50	0.61	0.0012	0.43	0.66	
Inflation	0.004	1.36	0.17	0.0039	1.29	0.19	
Adjusted R ²	0.6359			0.5894			
F	15.995			30.578			
Sig.F	0.000			0.000			

7. Discussions and Conclusion

The data are analyzed empirically to test the research hypotheses by measuring the variables concluded from the literature review through a descriptive and regression analysis. Testing the first research hypothesis for the impact of credit risk on bank profitability, it was found that there is a negative significant impact for credit risk on profitability measures. This is consistent with Sun & Chang (2018), who found that credit risk has an important effect on profitability in U.S. Similarly, the result obtained with Mensah et al. (2019) who examined the impact for credit risk on profitability measured by (ROA) in Ghana.

Testing the second research hypothesis for the impact of liquidity risk on bank profitability, it was found that there is a negative significant impact for liquidity risk on profitability measures. This result is consistent with Chowdhury & Zaman (2018), who found a negative significant impact for liquidity risk on profitability measured by (ROE) in Bangladesh. Table 5 shows a summary for the conducted analysis.

Table (5): Summary of Research Hypotheses Testing

Hypothesis	Description	Results
H1	There is a negative significant impact for credit risk on bank profitability.	Fully Supported
H2	There is a negative significant impact for liquidity risk on bank profitability.	Fully Supported

8. Recommendations

Developing countries like Egypt need to have more research on how to improve bank profitability in order to help in economic development and improvement of investment opportunities. Therefore, this research provides some recommendations that might help banks and policy makers develop appropriate strategies to help improving bank performance. In the light of the research findings the following recommendations can be concluded;

Firstly, the negative impact of credit risk on bank profitability indicates that credit departments in banks need to study financing requests from customers in accordance with policies related to the feasibility study, which contributes to reducing the credit risks that affect the profitability of banks.

Additionally, the negative effect of liquidity risk on bank profitability is the result of lower liquidity that does not support solvency and protection against potential problems. In addition to the effect of increasing loans on decreasing customer deposits which will have an adverse effect on profitability. This is evident in the analysis, as revenues diversification has a significant positive effect on bank profitability. Therefore, it is recommended to pay more attention to the positive impact of revenues diversification and use it to provide necessary earnings needed to mitigate the risk of lower liquidity.

Finally, improving risk management systems and including more reliable information about liquidity measurements can help in predicting credit risk, and can be used as one way to help in managing both risks in banks. Indeed, some Egyptian banks started taking important steps towards better enterprise risk management systems and better management of risk limits and delegations. It's also recommended to take into consideration the effect of the "flight for quality" by depositors when they leave banks flushed with large amounts of liquidity (low liquidity risk), during times of bad economic conditions, which affects banks' monitoring of the quality of loans, and consequently deteriorates the quality of loan portfolio (high credit risk), which was the case during the periods of deteriorated economic conditions in Egypt.

9. Research Limitations

The data were collected for a total number of 8 banks using their financial reports, forming a panel data covering the period 2010 to 2022. Therefore, this research has several limitations through the study handled. First, this research investigates the impact of credit risk and liquidity risk on bank Profitability in Egypt, however, there might be other variables that may affect banks profitability which are not included in this research. Therefore, future research could study the effect of other variables on banks profitability, such as Operational, technological, reputational and strategic risks.

Another limitation for this research is that it focused only on the private banks which make it impossible to generalize the results. In addition to the data were collected from one country Egypt. Moreover, future research could also consider studying the effect of credit risk and liquidity risk on bank Profitability in the developing versus developed countries. In addition, the effect of credit risk and liquidity risk on bank Profitability could be also be considered public versus private banks.

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