مجلة البحوث المحاسبية

https://abj.journals.ekb.eg/

كلية التجارة – جامعة طنطا

العدد : الرابع

ديسمبر 2023

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Bank Opacity and Risk-Taking: The Moderating Role of Competition

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Bank Opacity and Risk-Taking: The Moderating Role of Competition

المستخلص:

الهدف: تهدف هذه الدراسة إلى فحص تأثير التعتيم البنكي على سلوك البنوك تجاه المخاطرة مع تناول ما إذا كانت التنافسية البنكية تؤثر على قوة العلاقة بين التعتيم البنكي والمخاطرة.

التصميم/المنهجية/الأسلوب: اعتمدت الدراسة على تحليل بيانات تسعة بنوك مقيدة في البورصة في الفترة من ٢٠١٠-٢٠١٩ (١٠ سنوات). تم استخدام Z-score لقياس درجة المخاطرة، أما التعتيم البنكي فتم الاعتماد على مقياس نسبة الأوراق المالية المتاحة للبيع (AFS) إلى إجمالي الأصول(TA) . في حين تم استخدام مؤشر ليرنير (Lerner Index) لقياس التنافسية البنكية وذلك باستخدام نموذج التأثيرات العشوائية للمربعات الصغرى المعممة Random Effect Generalized Least Squares Model

النتائج: أظهرت نتائج البحث تأثيراً سلبياً غير معنوياً للتعتيم البنكي على الاستقرار المالي للبنوك. كما أن زيادة التنافسية البنكية تؤثر تأثيراً سلبياً غير معنوياً على استقرار البنوك. على الجانب الآخر، أظهرت النتائج وجود دور معنوي إيجابي لمعدل للتنافسية البنكية في العلاقة بين التعتيم البنكي ومستوى المخاطرة في البنوك.

الأصالة البحثية/أهمية البحث: تساهم هذه الدراسة في إثراء أدبيات المحاسبة المالية المتعلقة بالقطاع المصرفي من خلال تقديم أدلة على القضايا المتعلقة بالتعتيم البنكي في مصر بعد الأزمة المالية العالمية وثورتي ٢٥ يناير و٣٠ يونيو.

الكلمات المفتاحية: التعتيم البنكي، المخاطرة، التنافسية البنكية، مصر

Abstract:

Purpose: This study examines the influence of bank opacity on banks' risk-taking. It also investigates whether bank competition can affect the strength of the relationship between bank opacity and risk-taking.

Design/Methodology/Approach: Using annual data obtained from 9 listed Egyptian banks over the 2010 – 2019 period (10 years), the study assessed risk-taking using Z-score, bank opacity utilizing the ratio of Available-For-Sale (AFS) securities to Total Assets (TA), and competition is measured by Lerner Index. The Random Effect Generalized Least Square (RE GLS) model is utilized for empirical analysis.

Findings: Results show that bank opacity has a negative insignificant effect on the financial stability of banks. Competition also has a negative insignificant effect on banks' stability. However, bank competition positively and significantly moderates the relationship between bank opacity and risk-taking.

Originality/Value: The study contributes to the banking literature by offering evidence on opacity-related issues after the Global Financial Crisis (GFC) and the January 25th and June 30th uprisings in Egypt.

Keywords: Bank opacity, Bank competition, risk-taking, Egypt

1. Introduction:

The banking industry is a significant contributor to the development of the world economy. Banks, the industry's hub, support domestic and global trade by funding individuals and firms (Atkins et al., 2015; Hildreth, 1837; Marcu, 2021). They act as a go-between for fund suppliers (i.e., savers), who have an excess of capital, and demanders, who have a deficit of capital (Allen et al., 2008; Wang et al., 2021). As a result, banks divert savings into productive activities, contributing to economic growth and stability (Allen et al., 2008; Estrada et al., 2010). Jeucken and Bouma (2017) contend that banks, as financial intermediaries, have a tremendous impact on economic development. As a result, banks fuel economic stability; however, they confront various risks and occasionally suffer, causing the stability to quiver.

Reviewing banks' financial positions to ensure their soundness is one of the safeguards that bank regulators and other stakeholders (e.g., depositors) usually take. However, it has been argued that banks are naturally opaque institutions (Flannery et al., 2004; Blau et al., 2017; Fosu et al., 2017). Blau et al. (2017) have argued that banks are more opaque than other organizations. So, banks, particularly troubled ones, tend to limit the quantity of released information, such as risk and liquidity information.

The advent of a string of global crises, including the 2008 Financial Crisis, had severely impacted the banking sector, raising concerns about how banks would operate under such circumstances. In brief, easy lending resulted in bad loans that, in conjunction with lax regulation and oversight of complex financial products, led to debt defaulting, insolvency of financial institutions, loss of trust, and financial panic (widespread selling of stocks and hoarding of cash by banks and individuals). The interdependence of financial systems among developed nations further aggravated the situation, resulting in a broad credit crunch (i.e., lack of credit) and steep decreases in consumption, investment, and trade (Naudé, 2009). The exposure of developed-country financial systems, particularly in Europe, to US financial markets, has expedited the spread of the crisis (Murphy, 2008;

Naudé, 2009). According to Ngowi (2015), the GFC had a sequence of effects on global economies, beginning with a liquidity crisis and financial institution collapse, which reduced demand and, as a result, production, employment, and income. The repercussions of the crisis were conveyed to developing countries through increased bank failures, decreased domestic credit, decreased export revenues, and decreased financial flows (Naudé, 2009).

Although developing-country banks have less exposure to global financial institutions and complex financial products, they were impacted by the crisis. These banks were directly damaged by their ownership of assets tainted by subprime mortgages. However, the indirect consequences were primarily attributable to stock and property price declines. This lowered bank capital, forcing them to reduce lending to maintain adequate capital levels. Some banks declared bankruptcy, necessitating recapitalization. The sharp fall in loans lowered investment, increased unemployment, and reduced demand, resulting in lower economic growth, which reduced government income and poverty alleviation capacity (Naudé, 2009; Ngowi, 2015).

In Egypt, the Global Financial Crisis has affected the banking sector. However, the reform program followed by the Central Bank of Egypt that started in 2004 lessened the detrimental effect of the crisis (CBE, 2009). The GFC was followed by two successive revolutions, on January 25, 2011, and June 30, 2013, significantly burdened the Egyptian economy and banking system. Egypt's economy has suffered due to the January 25th revolution, with a drop in foreign direct investment and an increase in the budget deficit, debt, unemployment, and poverty rates, all of which have hampered GDP growth (Abdou & Zaazou, 2013). Egypt's tourism receipts and government reserves fell by 60% and 22%, respectively, while public wages climbed by 25%, resulting in a 12 billion EGP external financial deficit. The Egyptian banking system suffered tremendously during the revolutions (Galal, 2017). Following the revolution on January 25, 2011, the financial performance of banks deteriorated (Kassem & Sakr, 2018). The drop in foreign investment and increase in government borrowing have had a detrimental impact on

banking institutions, as the credit rating of international banks operating in Egypt has been downgraded (Abdou & Zaazou, 2013).

Consequently, the affected banks opted for opacity by withholding crucial information (e.g., risk exposure, capital, asset quality, and liquidity). Numerous studies indicate that bank opacity negatively affects banks' stability as it increases the opportunity for bank managers to choose risky investments (Morgan, 2002; Acharya & Ryan, 2016; Fosu et al., 2017; Cao & Juelsrud, 2022; Dang & Huynh, 2023). Despite the increasing amount of research studying the relationship between bank opacity and risk-taking or financial stability, the findings of these papers are still inconclusive, either on the theoretical or empirical level and do not geographically cover various economies. Some researchers reported that bank opacity is helpful and supports its financial intermediation role as it protects it from rollover risk and reduces bank runs (Moreno & Takalo, 2016; Jungherr, 2018). On the other hand, various studies reported the negative consequences of bank opacity on various aspects of banks' activities (Jones et al., 2013; Blau et al., 2017).

Given the non-consensus between studies on the consequences of bank opacity on the performance of banks, this paper contributes to the banking sector literature by investigating the impact of bank opacity on the risk-taking behavior in banks. Additionally, it has been noted that literature about bank opacity in Egypt is scarce. So, this research also contributes to the research in the Egyptian banking sector by discovering an unclear area about the performance of Egyptian banks in terms of opacity and its consequences on financial stability. It investigates whether competition can affect the intensity of the relationship between bank opacity and risk-taking. It uses unbalanced panel data of Egyptian commercial banks listed on the Stock Exchange during 2010-2019 to conduct the empirical study. The current research followed Cao & Juelsrud (2022) approach in measuring bank opacity using the Available-For-Sale (AFS) securities to total assets. Other measures suggested by other literature about the Egyptian banking sector were hard to obtain. The study determined bank risk-taking using

Z-score, widely used in literature to measure risk-taking and stability (Laeven & Levine, 2009; Noman et al., 2017). The study measured the bank competition using the Lerner index because this measure provides a bank-specific indication of competition rather than a country index of competition (Clark et al., 2018; Abou-El-Sood & Shahin, 2023). Researchers analyzed the effect of bank opacity on bank risk-taking and the role of competition in mediating this relationship using Random Effect Generalized Least Square (RE GLS) regression.

The study found that the increasing level of opacity and competition leads to higher levels of risk-taking. However, their effect on bank risk-taking is insignificant in the Egyptian market. On the other hand, the impact of competition on mediating the relationship between opacity and risk-taking is positive and significant. The results about the significance of the opacity effect on bank risk-taking are inconsistent with most of the literature that previously investigated the same relationship (Fosu et al., 2017; Cao & Juelsrud, 2022).

The remainder of the paper is organized as follows: the next section reviews the related literature and the development of research hypotheses. Section 3 is describing the data, sample selection, the variable measures, and the empirical model developed. In section 4, describes the statistical results and the discussion of these results in comparison with the previous literature and hypotheses developed in the paper. The paper is concluded in section 6 with an emphasis on the research implications and recommendations for future research.

2. Related Literature and Hypotheses Development:

Bank opacity arises from the problem of information asymmetry between the management and the outsiders (Flannery et al., 2004). Information asymmetry can arise because of either of two reasons (Cao & Juelsrud, 2022). The first one is the unavailability of sufficient information disclosed in financial statements. The second reason is the lack of usability of information either due to high cost accompanied with processing it to relevant metrics (Cao and Juelsrud, 2022) or due to its complexity and difficulty to be further processed and used in decision making (Boulland

et al., 2019). Morgan (2002) argued that this opaqueness may prevent the regulators from monitoring the risk-taking behavior. This consequently can lead to exposure of bank runs and other forms of risks (Morgan, 2002). So, the effect of bank opacity on risk-taking behavior has been of interest to many researchers (Morgan, 2002; Fosu et al., 2017; Cao & Juelsrud, 2022; Mies, 2022; Rastogi & Kanoujiya, 2022).

The opaqueness of banks may result in negative consequences because of exposure to higher risks, including the risk of banks' stock prices crash (Dewally & Shao, 2013). So, many questions can be raised such as what motivates banks to practice opacity? It is necessary to understand that there is no clear-cut answer to this question. Delis et al. (2018) argued that banks with high-risk activities tend to hide their accounting choices so they will keep an image of being healthy institutions. Other researchers claim that although the relationship between bank opacity and regulatory intervention is debatable, banks' management prefer opaqueness over transparency to avoid regulatory intervention (Gallemore, 2013; Fosu et al., 2018; Wheeler, 2019; Gallemore, 2022). It is claimed that regulatory intervention might result in negative consequences to banks such as bank runs and damaging trust in banks among stakeholders (Moreno & Takalo, 2016).

Another question that can be raised is what qualifies banks to be more opaque than other firms? Morgan (2002) argued that banks' distinctive assets as well as leverage are main reasons of their opacity. He added that banks' assets may be highly liquid, and their value are quickly changeable in a way that makes it difficult to be subject to monitoring and prediction (Morgan, 2002). Banks' major part of assets are financial instruments that are subject to valuation using fair value (Barth et al., 2012). Financial instruments as Available-for-Sale (AFS) securities constitute a large proportion of banks' assets (Barth et al., 2017). Boulland et al. (2019) argued that the information related to this type of asset is opaque to stakeholders as its unrealized gains and losses are difficult to be traced. Barth et al. (2012) further claimed that the volatility accompanying the financial assets in banks makes it difficult

for the market to perceive the risk accompanying such type of assets and hence increase the opacity of banks.

Previous literature has focused on studying the relationship between bank opacity and risk-taking in developed economies such as the US and Norway (Fosu et al., 2017; Cao & Juelsrud, 2022; Tran et al., 2022). Significantly, few studies are related to emerging and developing economies (Dang & Huynh, 2023). Detected papers about the Egyptian context studied financial statements' opacity or transparency from various perspectives besides this study. Studies examining bank opacity can be classified into several categories relevant to the measures used to proxy bank opacity. Some studies used market-based indicators.

Flannery et al. (2004) and Flannery et al. (2013) used bank equity trading properties such as bid-ask spread. On the other hand, Fosu et al. (2017) proxied bank opacity by analysts' forecast errors in bank earnings. Majority of studies proxied bank opacity using accounting-based measures that reflect the quality of banks' financial statements, such as discretionary loan loss provision (Beatty & Liao, 2014; Iannotta & Kwan, 2014; Jiang et., 2016; Kim et al., 2019; Zheng, 2020). In this section, two main hypotheses are developed: the first is related to bank opacity and risk-taking, and the second is related to the moderating effect of competition on the strength of the relationship between bank opacity and risk-taking.

2.1 Bank Opacity and Risk-Taking

According to the literature, it has been known that banks are inherently opaque (Flannery et al., 2013; Fosu et al., 2017). This situation raised concerns about the impact of bank opacity on bank risk-taking behavior and, consequently, bank financial stability (Fosu et al., 2017; Dang & Huynh, 2023). Theoretically, this impact is unclear, especially when considering the bank-level characteristics and the macroeconomic environments in which these banks operate (Cao & Juelsrud, 2022; Dang & Huynh, 2023). So, the effect of bank opacity

on bank risk-taking behavior in an emerging economy such as Egypt might differ from the literature findings in developed markets.

Theoretically, bank opacity increases the risk-taking behavior of banks. The mechanism behind this argument is that when banks are not transparent, they become subject to higher funding costs, leading to high risk-taking behavior (Fosu et al., 2017). Banks' transparency allows the external users of financial statements to practice more market discipline on banks (Fosu et al., 2017; Tran et al., 2022; Dang & Huynh, 2023). This discipline forces banks to choose lower-risk choices and consequently can reduce the cost of funding. Conversely, when banks are opaque, the disciple practices become loose, and banks are considered high-risk banks. This assumption leads to increasing the cost of funds, which, in turn, incentivizes banks to increase their risk-taking behavior (Dang & Huynh, 2023).

Contrary to such argument, other researchers argue that bank opacity can lead to low risk-taking behavior and positively support bank stability. However, this argument was justified according to the characteristics of markets in developing countries (Dang & Huynh, 2023; Cao & Juelsrud, 2022) and banks' characteristics. Different justifications for this argument were raised; one of them is that bank transparency will allow for more regulatory intervention, which, especially in times of exogenous shocks, can be perceived negatively by banks' stakeholders (Morris & Shin, 2002; Nier, 2005), leading to inefficient bank runs. This may affect management decisions and lead them to inefficient decisions (Dang & Huynh, 2023).

H1: *Higher bank opacity is associated with increased risk-taking behavior.*

2.2 The Moderating Impact of Competition on Bank Opacity and Risk-Taking Relationship

How competition affects risk-taking behavior in banks has been subject to study by many researchers due to the unsettled debate about the possible impact of competition. At the theoretical level, there are two main streams of arguments about the relationship between competition and risk-taking

behavior: the competition-fragility hypothesis and the competition-stability hypothesis. The supporters of the competition-fragility point of view argue that higher levels of competition will lead to more risk-taking actions and consequently increase the level of instability in banks (Beck et al., 2013; Bushman et al., 2016). The modelers of this theoretical claim, Marcus (1984) and Keeley (1990), argued that the increasing levels of competition would lead to lowering the "charter value" of banks because of reducing the interest income and profit of banks (Beck et al., 2013; Akins et al., 2016; Adu, 2022). These effects of competition can lead bank managers to choose risky investment portfolios, consequently increasing banks' fragility (Adu, 2022).

By contrast, supporters of the competition-stability perspective argue that banks' stability increases, i.e., risk-taking decreases, with the increase in the competition level (Atkins et al., 2016; Adu, 2022). They claimed that competition's effect on the cost of capital allows entrepreneurs to access low-interest rate loans and funds, consequently allowing banks to widen the base of customers served. In turn, banks will increase profitability, enhance stability, and lower credit risk (Adu, 2022).

The debate on the empirical level is not settled as well. Some research findings confirm the competition-fragility view, while others support the competition-stability view (Anginer et al., 2014). In a study of 1872 public banks from 63 countries, Anginer et al. (2014) found a negative relationship between competition and systemic risks. This supports the view that higher levels of competition motivate banks to diversify their risk and make banks more stable when facing shocks (Anginer et al., 2014). Akins et al. (2016) findings also supported the competition-stability view. Examining US banks in different states, they found that banks in states with lower levels of competition tend to engage in risky activities and are more likely to fail than banks in highly competitive states (Akins et al., 2016).

While many studies examined the impact of competition on risk-taking behavior, very few of them aimed to understand the moderating effect of competition on the strength of the relationship between bank opacity and risk-taking (Fosu et al., 2017; Rastogi & Kanoujiya, 2022).

Fosu et al. (2017) examined US banks during the period from 1995 to 2013. They concluded that competition increased the effect of bank opacity on risk-taking (Fosu et al., 2017). Rastogi and Kanoujiya (2022) tested the impact of competition on the relationship between bank opacity and financial distress in India from 2016 to 2019. They concluded that competition increases financial distress. This finding supports the competition-fragility hypothesis (Rastogi & Kanoujiya, 2022). Unlike previous literature, in terms of the moderating role of competition, they found that "competition significantly and negatively impacts the association between transparency and disclosure with financial distress" (Rastogi & Kanoujiya, 2022: p. 704). The different findings between the two studies can be justified by the difference in the country where banks are investigated. Another reason can be the difference in the measures used to reflect opacity and risk-taking. Fosu et al. (2017) used the Z-score as a measure of risk-taking, while Rastogi and Kanoujiya (2022) used the Altman Z-score to measure financial distress. While Fosu et al. (2017) used analysts' forecasts as a proxy for bank opacity, Rastogi and Kanoujiya (2022) developed a Transparency and Disclosure index to reflect the opacity-transparency spectrum.

This paper is adopting the competition-fragility hypothesis. So, the impact of competition as a moderating for the relationship between bank opacity and risk-taking can be stated as follows:

H2: *The effect of bank opacity on risk-taking increases with banking competition*

3. Data and Empirical Methodology

As stated in the previous section, the main aim of this study is to test the two hypotheses of the impact of bank opacity on the risk-taking behavior in Egyptian listed banks and the effect of competition as a moderator on the strength of this relation.

3.1 Sample Selection

This study focuses on the listed banks in the Egyptian Exchange from 2010 to 2019. During this period, the total number of listed banks

is 11; 8 are commercial banks, and 3 are Islamic banks. Islamic banks are excluded from the sample as they are subject to different regulatory and supervisory frameworks (Farooq & Zaheer, 2015). Islamic banks provide intermediary financial services that comply with Islamic Shariah. They prohibit the payment and receipt of fixed interest rates, and instead, they use profit- and -loss-sharing arrangements (Cihak & Hesse, 2008). The nature of Islamic banks can be reflected in their risk-taking behavior and financial stability. Previous literature provided mixed results when comparing the financial stability of Islamic and conventional banks (Farooq & Zaheer, 2015; Cihak & Hesse, 2008). These results were also conditioned by the size of both Islamic and conventional banks (Cihak & Hesse, 2008). Also, Islamic banks have a capital structure different from conventional banks (Sowar et al., 2016). These differences may affect the study's overall results if Islamic banks are included in the sample. So, as this study does not compare conventional and Islamic banks, excluding Islamic banks from the sample is more justifiable. So, Abu Dhabi Islamic Bank (ADIB), Faisal Islamic Bank, and Al Baraka Bank are excluded from the sample.

So, researchers included only listed commercial banks in the study. Some bank- years were excluded due to a lack of data to assess the research variables. A total of 54 bank-year observations were obtained for the period 2010-2019. The data is unbalanced panel data meaning that not all banks have the same number of observations or covering the same period. However, the whole period covered ranges from 2010 to 2019.

3.2 Variables Measurement

3.2.1 Measuring Opacity:

The literature has employed various methods to assess bank opacity. Some researchers used accounting measures to measure the opacity of banks' financial statements (Jiang et al., 2016; Dang & Huynh, 2023), such as Loan Loss Provision, discretionary loan loss provision, and Delayed Expected Loan Loss Recognition ($DELR$). The DELR approach assesses bank opacity by estimating $\boldsymbol{DELR}$ as the difference between ($\boldsymbol{adjusted\ R^2}$) of two models. The first model is:

$$LLP_{jt} = b_0 + b_1 \Delta NPL_{jt-1} + b_2 \Delta NPL_{jt-2} + b_3 Tier\ 1\ Ratio_{jt-1} + b_4 EBLLP_{jt} + b_5 Size_{jt-1}$$

Where LLP_{jt} is the loan loss provision of bank j at period t, ΔNPL_{jt-1}do total loans of bank scale the change in non-performing loans j at period $t-1$, $Tier\ 1\ Ratio_{jt-1}$ is the tier 1 capital ratio of bank j at period $t-1$, $EBLLP_{jt}$ is the earnings before tax and LLP of bank j at period t, and $Size_{jt-1}$ is the natural logarithm of the assets of bank j at period $t-1$. The second regression model is:

$$LLP_{jt} = b_0 + b_1 \Delta NPL_{jt} + b_2 \Delta NPL_{jt+1} + b_3 \Delta NPL_{jt-1} + b_4 \Delta NPL_{jt-2} + b_5 Tier\ 1\ Ratio_{jt-1} + b_6 EBLLP_{jt} + b_7 Size_{jt-1}$$

However, researchers found difficulties collecting the necessary data required for this approach, especially since this approach requires quarterly data for each bank, with a minimum of 12 consecutive quarters.

Opacity can also be measured using *Analysts' Forecast Errors (AFE)* as an alternative that overcomes the limitations of accounting measures (Fosu et al., 2017; Fosu et al., 2018). This approach assesses bank opacity by estimating the analysts' forecast error using the following equation:

$$Forecast\ Error = \frac{AEPS_{jt} - FEPS_{jt}}{Price_{jt}}$$

Where $AEPS_{jt}$ is the actual earnings per share of bank j at period t, $FEPS_{jt}$ is the mean of earnings forecasts per share of bank j at period t, and $Price_{jt}$ is the share price of bank j at the beginning of period. t.

Similarly, researchers found difficulties collecting data regarding analysts' forecasts in each quarter. Even the consensus target prices of shares, which serve as a proxy for analysts' forecasts, were not available for the period of the study.

Accordingly, the researchers followed Cao and Juelsrud (2022) in estimating bank opacity by using the ratio of Available-For-Sale

($\boldsymbol{AFS}$) securities scaled by Total Assets (TA). A higher ratio indicates higher bank opacity and vice versa. AFS securities have been claimed to be a good indicator for bank opacity. Ansari (2014) has used the AFS percentage to total assets as a securitization measure that is considered as a source of opacity in banks. Also, as mentioned earlier in the literature review section, many researchers (e.g., Barth et al., 2012; Barth et al., 2017; Boulland et al., 2019) emphasized the significant role played by AFS securities in making banks opaque. Cao & Juelsrud (2022) claimed that using AFS percentage to total assets depends on measuring opacity from the perspective of investors and creditors by relying on balance sheet information.

3.2.2 Measuring Risk-Taking:

Various measures have been also used to capture risk-taking. The risk-weighted asset ratio is the regulatory measure of risk-taking (Abou-El-Sood & Shahin, 2023). At the same time, the most common measure used in research is the Z-score, considered the accounting-based measure of risk-taking in banks. Z-score is used to predict the distance, i.e., "the number of standard deviations by which profit has to fall for a bank to go bankrupt" (Fosu et al., 2017, p. 9) of a bank from default (Abou-El-Sood & Shahin, 2023). Therefore, researchers assessed bank risk-taking (stability) using the $\boldsymbol{Z\ score}$, which is estimated using the following equation:

$$\boldsymbol{Z - score = \frac{ROA_{jt} + \frac{Equity}{Assets}}{\sigma_{ROA_{jt}}}}$$

Where $\boldsymbol{ROA_{jt}}$ is the Return on Assets of bank j at period t, $\frac{\boldsymbol{Equity}}{\boldsymbol{Assets}}$ is the ratio of total equity to Total Assets (TA) of bank j at period t, and $\boldsymbol{\sigma_{ROA_{jt}}}$ is the standard deviation of $\boldsymbol{ROA}$ for the whole sample of banks throughout the study.

3.2.3 Measuring Competition:

Literature has employed a plethora of measures to assess competition at different levels. Generally, literature is divided into two

schools of thought concerning the measurement of competition: the Traditional Industrial Organization (IO) "structure" and the New Empirical Industrial Organization (NEIO) "non-structure" approaches (Abou-El-Sood & Shahin, 2023). The IO approach measures market concentration rather than directly measuring competition. Measures applied in this approach, such as the Herfindahl–Hirschman Index (HHI), are more relevant for use in cross-country studies (Fosu et al., 2018). On the other hand, the NEIO approach was built to assess bank competition directly using non-structural (direct) measures, which are based on either a static model of competition, such as the Panzar-Rosse H statistic, the Lerner index, and conjectural variation model, or a dynamic model of competition, such as the Boone indicator.

In this study, researchers employ the Lerner index to measure bank competition. The Lerner index is the only measure of competition that varies at the bank level (Fosu et al., 2017). The Lerner index takes values that range between 0 and 1 (Nygangu, 2022), where 1 indicates complete monopoly and 0 indicates perfect competition, and can be assessed as follows (Nguyen & Nghiem, 2020):

$$\boldsymbol{Lerner_{i,t} = \frac{P_{i,t} - MC_{i,t}}{P_{i,t}}}$$

Where *i* is an index for banks, and t is an index for period. $P_{i,t}$ is the price of assets for bank i at time t, proxied by the ratio of interest and non-interest income to total assets. $MC_{i,t}$ is the marginal cost of total assets for bank i at time t, which can be computed by:

1- Estimating the parameters of the following translog cost function using the fixed effects (FE) model:

$$ln(TC/W_3) = \alpha_0 + \alpha_1 ln\, Q + \frac{1}{2}\alpha_2 (ln\, Q)^2 + \sum_{n=1} \beta_n \ln(W_n/W_3) + \frac{1}{2}\sum_{n=1}^{2}\sum_{l=1}^{2} \beta_{nl} ln\,(W_n/W_3)\ln(W_l/W_3) + \frac{1}{2}\sum_{n=1}^{2} \delta_n\, ln\, Q\, \ln(W_n/W_3) + \gamma_1 t + \frac{1}{2}\gamma_2 t^2 + \gamma_3 t \ln Q + \sum_{n=1}^{2} \gamma_{3+n}\, t \ln(W_n/W_3) + \gamma_5 dummysize + \varepsilon$$

Where TC is the sum of interest expense, other operating expenses, and personnel expenses; Q is the output, proxied by total assets; W_1 is the price of funds, proxied by the ratio of interest expense to total deposits, W_2 is the price of fixed assets, proxied by the ratio of other operating expenses to fixed assets, and W_3 is the price of labor, proxied by the ratio of personnel expenses to total assets; t =1 for year 2010, 2 for year 2011, and so on.

2- The parameters estimate in (1) can be then integrated in the following formula to compute the marginal cost for each bank, each period:

3.2.4 Control Variables:

$$MC_{TA_{it}} = \frac{\delta TC}{\delta Q} = \left(\alpha_1 + \alpha_2 ln\, Q + \frac{1}{2}\sum_{n=1}^{2} \delta_n \ln(W_n/W_3) + \gamma_3 t\right)\frac{TC}{Q}$$

The empirical model utilized in this paper, which will be presented in the next section, employs various bank-level control variables that are expected to influence banks' risk-taking behavior (Beck et al., 2013; Fosu et al., 2017; Abou-El-Sood & Shahin, 2023). The first measure is the bank size, $SIZE_{it.}$ The natural logarithm of total assets measures bank size. Some previous studies indicated that larger banks tend to be more financially stable than smaller ones and consequently exposed to fewer risks (Kabir & Worthington, 2017; Abou-El-Sood, 2017; Adu, 2022). These findings were similar among developed economies, such as the US, or developing and sub-Saharan countries. So, the situation in Egypt is expected to not differ from previous findings. The other variable used to control the model for bank specific features is ratio of total loans to total assets (Beck et al., 2013; Fosu et al., 2017). Table 1A provides a description of variables used in the study.

3.3 The Empirical Model

Based on the discussion about the research hypothesis and the measures of variables included in the research hypothesis, the model is formulated as follows:

$$Risktaking_{it} = B_0 + B_1 Opacity_{it} + B_2 Competition_{it} + B_3 OpacityCompetition + B4Controlit + E_{it}$$

The paper uses RE GLS regression to examine the model. The following section will explain the statistical results of running the model.

4. Results and Discussion:

This section summarizes the statistical analysis and hypotheses testing results. First, researchers use a measure of central tendency, the arithmetic mean, and another of dispersion, the standard deviation, to describe the data. Afterwards, the correlation of research variables is analyzed using Pearson product moment correlation coefficient (r). Finally, Hausman and Breusch-Pagan Lagrange Multiplier (LM) were used to select the appropriate model (Pooled Ordinary Least Squares (OLS), Fixed Effects (FE) model, or Random Effects Generalized Least Squares (RE GLS)) to test the research hypotheses.

4.1 Descriptive analysis:

The variables are mainly bank specific, they include bank opacity (the ratio of Available for Sale (AFS) securities to Total Assets (TA)) bank competition (Lerner index), bank stability (Z-score), bank size (the natural logarithm of TA), and bank debt (the ratio of Total Loans (TL) to TA). Table1 summarizes the descriptive analysis results. Only the overall variation results are reported. However, the detailed results of within and between variations are shown in the STATA results appendix.

Table 1: Descriptive Statistics of Variables

Variable	N	Mean	Std. Dev.	Min	Max
Dependent Variable					
Risk_Taking (Z-score)	54	15.39793	14.73589	4.366515	65.8142
Independent Variables					
Opacity (AFS/TA)	54	.1147399	.1314277	.0010215	.5027878
Competition (Lerner)	54	.4645195	.2655733	.0110965	.94407
Control Variables					
lnTA	54	17.66971	1.143862	14.76021	19.77327
TL_TA	54	.3796144	.0881407	.2115344	.5716338

The average of Z-score (the inverse of risk-taking measure) for the Egyptian banks is 15.3797, this means that banks profit will have to fall about 15 times before the average bank is exposed to default and bankruptcy. The standard deviation of this variable is 14.7358 which is very close to the mean, a minimum score of 4.3665 and a maximum score of 65.8142. The results of Z-score indicate that the stability of Egyptian banks can then be classified as low.This indicates that banks in Egypt are involved in risky investments.

Egyptian listed banks used as a sample in this study showed a low opacity level. The mean of the ratio of AFS to total assets is 11.473%. The standard deviation is 0.1314, a minimum ratio of 1.02% (belongs to QNB 2017), and a maximum ratio of 50.27% (belongs to SAIB 2014). The Lerner index averaged at 0.4645, with a standard deviation of 0.2655, a minimum score of 0.011 (HDB 2017), and a maximum score of 0.944 (EGB 2018). The Lerner index ranges from 0

to 1 where 0 means highly competitive markets and 1 refers to a monopolistic market. Accordingly, the results of the descriptive statistics of Lerner index indicates that banks in Egypt are exposed to moderate level of competition.

4.2 Correlation Analysis:

The study examines the correlation among the research variables using the Pearson product moment correlation coefficient. Results are shown in Table 2. Z-score is significantly correlated with opacity (at α =0.10) and competition (at α =0.05). The correlation with bank opacity is positive, and weak (r = 0.3906; significance (0.0.842)). Similarly, the correlation with competition is positive and weak (r = 0.3588; significance (0.0077)). Bank Z-score is also significantly, positively, and weakly correlated with bank size (r = 0.3056; significance (0.0246)) at α =0.05. On the contrary, there is no significant correlation between Z-score and TL/TA ratio (r = 0.1736; significance (0.2094).

Table 2: Pearson Correlation Results

Variables	r & Sig	Risk_Taking	Opacity	Competition	LnTA	TL_TA
Risk_Taking	Coefficient	1.000				
	Significance	-----				
Opacity	Coefficient	0.2372	1.000			
	Significance	0.0842**	-----			
Competition	Coefficient	0.3588	0.3098	1.000		
	Significance	0.0077*	0.0226*	-----		
LnTA	Coefficient	0.3056	-0.3111	0.3363	1.000	
	Significance	0.0246*	0.0220*	0.0129*	-----	
TL_TA	Coefficient	0.1736	-0.2827	0.2514	0.4465	1.000
	Significance	0.2094	0.0383*	0.0666*		-----

*Significant at 0.05.

**Significant at 0.10.

4.3 Statistical Analysis and Hypotheses Testing:

Our study involves an unstructured panel dataset of Egyptian listed banks over the 2010 – 2019 period. The study used Hausman and Breusch-Pagan Lagrange Multiplier (LM) tests to select whether Pooled Ordinary Least Squares (OLS), Fixed Effects (FE) model, or Random Effects Generalized Least Squares (RE GLS) should be used to test the research hypotheses. Wooldridge test, VIF and Tolerance, and Breusch-Pagan LM were used to test for serial autocorrelation, multicollinearity, and heteroskedasticity, respectively. Table 3 summarizes the results of Hausman and Breusch-Pagan LM tests.

Table 3: Summary of Hausman and Breusch-Pagan LM tests

Hausman		**Breusch-Pagan LM**	
Chi-squared χ^2	**Significance**	**Chi-bar-squared $\bar{\chi}^2$**	**Significance**
7.57	0.1817	0.80	0.1862
P>0.05		P>0.05	

Hausman test was applied first to examine whether Pooled OLS or RE GLS is appropriate. According to the results, χ^2 (7.57) is not significant at α =0.05. Therefore, the analysis is extended by applying the Breusch-Pagan LM test. Similarly, the results of the Breusch-Pagan LM test showed a $\bar{\chi}^2$ value (0.80) that is not significant at α =0.05, indicating the appropriateness of the RE GLS model for the analysis. The study report the results of RE GLS model only. The results of the FE model are shown in the STATA results appendix.

Variance Inflation Factors (VIF) and Tolerance (1/VIF) are used to check for multicollinearity (significant correlation between factors). The values of VIF were below 10 (VIF<10) and the values of Tolerance also exceeded 0.1 (Tolerance>0.1), indicating no multicollinearity. Serial autocorrelation is examined using Wooldridge test for autocorrelation in panel data. The F value of the Wooldridge test (2.7) is not significant (0.1515) α =0.05, indicating no serial correlation in the

panel dataset. For heteroskedasticity, researchers relied on the results of the Breusch-Pagan LM test, which is not significant at α =0.05, and thus indicates that error terms are not heteroskedastic (i.e., homoscedastic). Table 4 summarizes the results of VIF, Tolerance, Wooldridge test, and Breusch-Pagan LM test.

Table 4: Summary results of VIF, Tolerance, Wooldridge test, and Breusch-Pagan LM test

Multicollinearity		
	VIF	**Tolerance**
Opacity*Competition	7.60	0.131519
Opacity	5.32	0.187889
Competition	2.70	0.370937
lnTA	1.55	0.644348
TL_TA	1.50	0.667061
Serial Autocorrelation		
Wooldridge test for autocorrelation	***F***	**Significance**
	2.700	0.1515
Heteroskedasticity		
Breusch-Pagan LM test	**Chi-squared χ^2**	**Significance**
	7.57	0.1817

The RE GLS model results are shown in Table 5. The test showed that bank opacity has a negative coefficient where β: -17.01786. This means that as opacity level, measured by the ratio of AFS to TA, increases, the bank stability decreases. This means that there is a positive relationship between bank opacity and risk-taking behavior. However, the impact of bank opacity in explaining the change in risk-taking is insignificant

(0.583). The positive relationship between bank opacity and risk-taking is consistent with findings from previous literature (Fosu et al., 2017; Tran et al., 2022) although these studies used measures of bank opacity that are different from the measure used in our paper. In their study, Cao & Juelsrud (2022) also reported a negative correlation between AFS securities ratio to total assets and Z-score. So, despite the variation in the country under investigation, the direction of the relationship was similar. Although Dang & Huynh (2023) was conducted in an emerging economy that might share similar characteristics with the Egyptian economy, their findings supported the existence of positive relationship between bank opacity and stability.

Table 5: RE GLS Model Results

RE GLS (Risk-Taking)	$\boldsymbol{\beta}$	$\boldsymbol{Z}$	**Significance**
Opacity	-17.01786	-0.55	0.583
Competition	-5.401285	-0.50	0.620
Opacity*Competition	104.9347	1.96	0.050*
lnTA	4.380109	2.08	0.037*
TL_TA	17.05259	0.68	0.499
Constant	-70.86069	-2.01	0.045
Overall R^2	0.2919		
Wald	20.70; Significance 0.0009χ^2		

Contrary to the consistency with previous literature in terms of the direction of the relationship between AFS ratio and risk-taking, our study disagreed with previous literature in the significance of the impact of opacity on risk-taking. So, the first hypothesis of the study cannot be unconditionally accepted. The studies investigated in this paper showed a significant impact of opacity on stability and risk-taking (Fosu et al., 2017; Tran et al., 2022; Cao& Juelsrud, 2022; Dang & Huynh, 2023).

The insignificance of the impact of opacity on risk-taking can be due to several reasons. First, the sample size of the study is small compared to those in previous literature. Cao & Juelsrud (2022) study applied AFS ratio measure (similar to the one used in our study) for almost 2400 bank-quarter observations. Second, although our study used the same opacity measure utilized in Cao & Juelsrud (2022) study, their study is conducted in Norway which is a developed bank-oriented economy in which "the total assets of the Norwegian banking sector correspond to approximately 220% of Norwegian GDP" (p.3). While the banking sector in Egypt is considered as relatively mature (Chironga et al., 2018), it is still less grounded and stable as the Norwegian banking sector. Also, other studies about bank opacity tend to use other measures of opacity such as Analyst Forecast Error (Flannery et al., 2004; Fosu et al., 2017; Mies, 2022), Loan Loss Provision (Tran et al., 2022; Dang & Huynh, 2023), and the size of off-balance sheet items, relative to the on-balance sheet total assets (Cao &Juelsrud, 2022). Additionally, the majority of studies that used different measures of bank opacity are also performed in US or cross countries studies. So, the nature of the Egyptian economy in comparison with these economies may result in different findings. Third, the period in which the study is conducted, 2010-2019, witnessed economic turbulence that influenced the financial stability of banking sector and consequently may affect the significance of the impact of opacity on risk-taking. In 2011, the January 25th revolution occurred accompanied by a high level of economic instability that negatively impacted the whole economic growth and the decrease in the returns of tourism and investments (CBE, 2014). This revolution was followed by another one in 2013. The two economic shocks negatively affected the Egyptian economy. Although the banking sector was able to absorb these shocks, they, to certain extent, affected the stability of the banking sector. In 2016, the Egyptian government adopted some reform procedures that resulted in floating the exchange rate which caused an increase in the inflation rates. However, these fluctuations in return prices accompanied with the decision of floating the exchange price were met with decisions on the banking sector to minimize the available for sale securities and

reclassifying them to held to maturity securities to enhance the ability of banking sector to deal with the systemic risk raised due to economic fluctuations (CBE, 2016).

Bank competition coefficient is negative where β= -5.401285. This means that as Lerner index increases (i.e., getting closer to 1 and moving toward monopoly and lower competition), the stability of banks decreases. So, the sign of the Lerner index coefficient means that in the Egyptian banking sector risk-taking behavior increases (stability decreases) with lower levels of competition (high Lerner index). This finding supports the theoretical hypothesis of competition-stability approach referred to in the literature review section. This finding is consistent with the findings of Amidue & Wolf (2013) and Noman et al. (2017) studies conducted cross countries of emerging markets over the period 2000-2007 and in ASEAN countries over the period 1990-2014 respectively. The competition-stability view is also consistent with the findings from Clark et al. (2018) study conducted on the markets of the Commonwealth of Independent Stats (CIS) over the period 2005-2013. However, it is inconsistent with some empirical findings of previous literature that supported the competition-fragility hypothesis (Beck et al., 2013; Fosu et al., 2017; Akande et al., 2018; Adu, 2022; Desalegn et al., 2023). Additionally, the competition effect on risk-taking is insignificant (0.620) (cf. Amidue &Wolf, 2013).

In the research model, researchers included the interaction between bank opacity and competition to capture the moderating effect of competition on the relationship between bank opacity and risk-taking. The results showed that the interaction has a positive coefficient where β = 104.9347 and has a significant effect at 5% (0.050). The significant positive coefficient of the interaction means that competition plays a significant moderating role in the relationship between bank opacity and risk-taking. The significance of the competition as a moderator accompanied with the insignificance of opacity, as an independent variable, means that the effect of opacity on risk-taking depends heavily on the level of competition faced by the banks included in the research sample. The result supports and leads to accepting the

second hypothesis in this study. This result is consistent with the findings of Fosu et al. (2017) that the impact of opacity on risk-taking increases with competition.

In the model used in this paper, bank size is used as a control variable that affects the stability of the banking sector. The previous literature offered two explanations to the nature of the relationship between size and stability of banks. On one side, the claim that "too-big-to-fail" argued that banks with larger sizes are more likely to take risk (Mishkin, 1999). On the other hand, it is argued that large banks can have more experience in managing the risks and consequently will experience more financial stability than smaller banks. In this paper, the results of the RE GLS showed a positive coefficient to the size variable proxied by the natural logarithm of total assets (β= 4.380109). The direction of the relationship supports the view that larger banks are more likely to be financially stable than smaller banks. The impact of the size is significant at 5% (0.037).

5.Conclusion

This study examined the impact of bank opacity on the risk-taking behavior of banking sector in Egyptian context over the period 20100-2019. The paper also examined the expected impact of competition on the strength of the impact of opacity over risk-taking. Bank opacity was measured using the ratio of AFS securities to total assets. Competition was measured using Lerner index that provides bank-specific information about the market power of the banks. The current financial accounting literature in Egypt is very scarce in this research. So, this paper significantly contributes to the banking sector literature by opening a new avenue for research in an undiscovered context.

The results showed that bank opacity is positively impacting the risk-taking behavior in banking sector in Egypt, however, this impact is not significant. Additionally, higher levels of competition supported the stability of the banking sector. Again, the impact is insignificant. The interactive effect of bank opacity and competition is positively and significantly influencing the stability of the banking sector in Egypt.

Also, the size of the banks is negatively and significantly impacting the risk-taking behavior. Which means that smaller banks in Egypt are more likely to be exposed to risk than larger banks.

Despite the contribution of this paper to the banking sector literature in Egypt, it still has some limitations. The paper used a sample of the listed banks in the EGX over the period 2010-2019 and excluded the Islamic banks. Due to the unavailability of some information, the final size of the sample was 54 observation which is a relatively small size of sample compared to those utilized in previous literature investigating similar theme of research. So, to gain more insights about the nature of the Egyptian banking sector, future research can expand the period of the study by extending the sample to a more recent date once their data are available. Also, future research can provide a comparative study between the nature of the commercial and Islamic banks in terms of the impact of opacity on their stability. Future studies can also include non-listed banks as they include mainly state-owned banks that have higher market power in the Egyptian banking sector. Another limitation is that opacity is measured by only one measure while other measures can be used to provide more reliable indicators to the level of opacity. Future researchers can investigate the factors that determine and influence bank opacity and competition level.

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Appendix:

Table 1A: Description of Variables

Variable	Description
Z-Score	The inverse measure of bank risk-taking, measured as the sum of bank return on asset and equity-to-asset ratio divided by the standard deviation of return on assets over the sample period
Opacity (AFS/TA)	Available for sale securities to total assets is used as a measure of opacity level for each bank-year observation
Lerner	The Lerner index is used as a measure of competition at the bank level.
Size (lnTA)	Bank size is measured as the natural logarithm of each bank's total assets.
TL_TA	The ratio of total loans to total assets of each bank-year

STATA V. 14.2 Results

Descriptive analysis

Variable		Mean	Std. Dev.	Min	Max	Observations
Risk_T~g	overall	15.39793	14.73589	4.366515	65.8142	N = 54
	between		6.47322	9.611914	25.41585	n = 7
	within		13.44179	-4.567975	62.14673	T-bar = 7.71429
Opacity	overall	.1147399	.1314277	.0010215	.5027878	N = 54
	between		.0713366	.0438807	.2500746	n = 7
	within		.1093833	-.1252743	.3698414	T-bar = 7.71429
Compet~n	overall	.4645195	.2655733	.0110965	.94407	N = 54
	between		.0781627	.3636036	.5600584	n = 7
	within		.2549989	-.0622702	.9546515	T-bar = 7.71429
opacit~n	overall	.0639109	.0894473	.0000113	.3641406	N = 54
	between		.0435972	.0180496	.1419842	n = 7
	within		.077501	-.0750699	.2962709	T-bar = 7.71429
lnTA	overall	17.66971	1.143862	14.76021	19.77327	N = 54
	between		.7577187	16.28873	18.71645	n = 7
	within		.8257516	16.12256	19.55954	T-bar = 7.71429
TL_TA	overall	.3796144	.0881407	.2115344	.5716338	N = 54
	between		.0472634	.3228413	.4529366	n = 7
	within		.0752317	.2107824	.5636885	T-bar = 7.71429

Correlation analysis

	Risk_T~g	Opacity	Compet~n	lnTA	TL_TA
Risk_Taking	1.0000				
Opacity	0.2372*	1.0000			
	0.0842				
Competition	0.3588*	0.3098*	1.0000		
	0.0077	0.0226			
lnTA	0.3056*	-0.3111*	0.3363*	1.0000	
	0.0246	0.0220	0.0129		
TL_TA	0.1736	-0.2827*	0.2514*	0.4465*	1.0000
	0.2094	0.0383	0.0666	0.0007	

Hausman test

	Coefficients			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
Opacity	-15.36059	-17.01786	1.657264	9.755807
Competition	-.7095786	-5.401285	4.691707	3.474344
opacitycom~n	89.46418	104.9347	-15.47049	8.968996
lnTA	5.598671	4.380109	1.218563	1.710414
TL_TA	-11.26985	17.05259	-28.32244	11.38093

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 7.57
Prob>chi2 = 0.1817
(V_b-V_B is not positive definite)

Breusch-Pagan Lagrange Multiplier (LM) test

Breusch and Pagan Lagrangian multiplier test for random effects

Risk_Taking[bank,t] = Xb + u[bank] + e[bank,t]

Estimated results:

	Var	sd = sqrt(Var)
Risk_Ta~g	217.1464	14.73589
e	151.7929	12.32042
u	11.45095	3.383925

Test: Var(u) = 0

chibar2(01) = 0.80

Prob > chibar2 = 0.1862

VIF and Tolerance

Variable	VIF	1/VIF
opacitycom~n	7.60	0.131519
Opacity	5.32	0.187889
Competition	2.70	0.370937
lnTA	1.55	0.644348
TL_TA	1.50	0.667061
Mean VIF	3.73	

Wooldridge test

Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation

F(1, 6) = 2.700

Prob > F = 0.1515

FE model

Fixed-effects (within) regression — Number of obs = 54
Group variable: bank — Number of groups = 7

R-sq:
within = 0.3343
between = 0.0288
overall = 0.2550

Obs per group:
min = 4
avg = 7.7
max = 10

F(5,42) = 4.22
corr(u_i, Xb) = -0.1677 — Prob > F = 0.0034

Risk_Taking	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Opacity	-15.36059	32.51732	-0.47	0.639	-80.9832	50.26201
Competition	-.7095786	11.4196	-0.06	0.951	-23.75527	22.33612
opacitycompetition	89.46418	54.27864	1.65	0.107	-20.07455	199.0029
lnTA	5.598671	2.71205	2.06	0.045	.1255325	11.07181
TL_TA	-11.26985	27.64758	-0.41	0.686	-67.06493	44.52523
_cons	-82.87642	45.99961	-1.80	0.079	-175.7074	9.954555
sigma_u	6.8246236					
sigma_e	12.320425					
rho	.23479293	(fraction of variance due to u_i)				

F test that all u_i=0: F(6, 42) = 1.89 — Prob > F = 0.1051