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Abstract:

This research investigates the factors influencing systematic and unsystematic credit risk within the Egyptian commercial banking sector through an empirical analysis. The study utilized an empirical approach, gathering secondary data spanning the years 2010 to 2022. To accomplish this, the study formulated nine hypotheses and employed an empirical random panel data regression model. The investigative results affirm the validity of the five hypotheses with theory. Three hypotheses contradict with the prevailing theory and partially agree with some literature. The rest hypothesis is rejected. Future research should explore alternative models of credit risk determinants to gain a broader perspective by including diverse time periods and banking sectors beyond commercial banks. Additionally, incorporating significant political and market events, such as the Egyptian revolutions, the 2016-pound floatation, the COVID-19 pandemic, and ongoing conflicts, could provide deeper insights into their impact on credit risk. Lastly, investigating bidirectional effects between research variables using Granger causality tests or the Toda and Yamamoto method could help elucidate the causal relationships and interactions between systematic and unsystematic factors that impact credit risk within the Egyptian commercial banking sector.

Keywords: *Credit Risk, Systematic (Macroeconomic) Determinants, Unsystematic (Bank Specific) Determinants, Commercial Banking Sector, Random Panel Data Regression Model, Egypt.*

1. INTRODUCTION:

In the contemporary and ever-fluctuating landscape of commerce, financial institutions grapple with a myriad of formidable risks, encompassing credit defaults, liquidity crises, operational disruptions, market fluctuations, foreign exchange (forex) volatility, and interest rate uncertainties (Tole et al., 2019). Undoubtedly, credit risk emerges as a preeminent and impactful peril, exerting profound effects on the sustainability and holistic performance of banking entities (Bhattarai 2019). The major objective of the banking sector revolves around mobilizing funds of the public citizens to extend credit, foster business expansion, and bolster economic prosperity. Nonetheless, the looming threat of borrowers failing to meet their financial commitments poses a significant challenge for banks, with ramifications reverberating across the financial ecosystem (ALrfai et al. 2022). The seismic events of the worldwide financial crisis, the crisis in the eurozone, and Noteworthy corporate failures stand as poignant exemplars, vividly illustrating the extensive ripple effects of credit risk (Bhattarai 2019).

Academics and financial institutions present various perspectives on the credit risk, yet it generally speaking connotes the probability that a borrower may falter in meeting the terms that were agreed upon, including the timely repayment of both interest and principal (Saunders & Cornett, 2008). Deficient Procedures for evaluating credit risk may markedly impede the functional efficacy of different financial institutions and potentially precipitate crises of liquidity (Tesfay, 2016). The genesis of bank failures and hurdles often stems from a multitude of factors, with commonly cited elements including inadequate credit risk standards for both clients and borrowers, suboptimal management of credit risk within portfolios of loan, and a dearth of vigilance concerning shifts in economic fluctuations that could adversely affect the creditworthiness of counterparties (Raiter, 2021).

Egypt, a burgeoning African nation, navigates through parallel challenges. Its banking sector stands as the bulwark, representing a staggering 90% of the financial system's assets. It intertwines with diverse non-banking activities, including insurance, postal services, the capital market, investment funds, and non-banking financial institutions. Over the past two decades, Egypt's banking sector has displayed remarkable resilience, weathering numerous economic and financial storms such as the worldwide financial crisis between 2007 and 2009, the reverberations of the revolutions of 2011 and 2013, and that disruptive force of the COVID-19 pandemic in 2020. This resilience, borne out of the implementation of the Egyptian banking reform program by the Central Bank of Egypt in 2004 and adherence to the Basel Committee's banking standards, has bolstered the sector's solvency and liquidity. Furthermore, the banking sector's financial robustness surpasses the minimum regulatory thresholds set by both the Basel Committee and the Central Bank of Egypt, contributing to its strength in the face of adversity, thus maintaining its pivotal role in financial intermediation and upholding a high level of banking stability (www.cbe.org.eg).

Commercial banks are obligated to maintain minimum reserves in their current accounts at the CBE for a two-week maintenance period. The amount of these reserves, contingent upon the commercial banks' balance sheet from one month prior to the commencement of the maintenance period, is determined based on a specified percentage of certain liabilities, primarily customer deposits (www.cbe.org.eg).

In the third quarter (Q3) of 2023, the Central Bank of Egypt (CBE) reported key financial soundness indicators for banks in the Egyptian market. According to a recent CBE report, the percentage of non-performing loans (NPLs) in banks remained steady at 3.3% of their total loan portfolio in Q3 2023, unchanged from Q2 2023. Among the ten largest banks in the Egyptian market, the percentage of non-performing loans stood at 2.6% of the total loans, and at 2.3% for the five largest banks (www.dailynewsegypt.com).

Nonetheless, this substantial dependence on loans renders Egyptian commercial banks vulnerable to considerable risks tied to non-performing loans (NPLs), which could jeopardize the stability of the overall financial system (www.fitchsolutions.com). The buildup of NPLs within Egyptian commercial banks can be traced to various factors, including economic recissions, macroeconomic instability, and particular problems within individual banks that elevate the credit risk (Kotiso, 2018). Macroeconomic elements affecting credit risk include the growth of GDP, price inflation, joblessness, interest rates, and exchange rate fluctuations (Morina, 2020). On the other hand, microeconomic factors impacting the credit risk in the sector of banking include attributes such as bank size, lending volume, profitability, deposits level, liquidity degree, and capital sufficiency (Naili and Lahrichi, 2022).

To forge a robust management framework of credit risk, it's imperative to undertake empirical inquiries scrutinizing present practices of management and pinpointing the determinants contributing to credit risk. While different studies conducted across diverse economies to probe the determinant factors of credit risk, the final output have exhibited disparities. For example, the work of Carvalho et al. (2022) unearthed a negative relationship between the growth of GDP and credit risk in their scrutiny of macroeconomic determinant factors within the Eurozone. Conversely, Lu (2013), in research conducted within China, underscored that inflation size, foreign exchange rates, rate of unemployment, and finally interest rates affect significantly credit risk, while discerning no tangible impact stemming from the rate of GDP growth. The study of Wairimu and Gitundu (2017) noted a positive correlation between the rate of loan growth and credit risk within Kenya, but noted that the influence of the rate of GDP growth and that of lending on credit risk was less significant in comparison with other factors. Conversely, Raiter (2021) discovered that in Ethiopia, the rate of GDP growth, level of efficiency, and size of bank were negatively correlated with credit risk. These variations between results may arise from differences in data analysis methodologies used by researchers or the distinct economic environments of the countries studied. The inconsistencies in previous findings highlight the need for further research, suggesting that there is considerable scope for expanding and refining the existing body of knowledge in this domain.

In contrast, prior studies on the determinant factors of credit risk in Egypt has resulted a wide array of outputs, highlighting the severe complexity of this form of financial analysis. Prominent scholars have contributed significant insights into this area within the Egyptian context. On the other side, it is important to take into consideration that certain critical variables, such as rates of foreign exchange, profitability level, and ratio of capital adequacy, have not been thoroughly examined in these different studies. To the best of knowledge of the researcher, none of the previous investigations have extensively explored these variables. Additionally, the foreign

exchange variable has been largely disregarded in many earlier studies, revealing a promising future research area.

In a summarized conclusion, with taking into consideration the pronounced level of credit risk prevalent within Egyptian commercial banking sectors, coupled with the contradicted results unearthed in prior research findings, and notably, that foreign exchange rates significantly affect credit risk, a facet largely overlooked in previous studies, the researcher's major objective is mainly to bridge these gaps using his research. This research endeavors to delve into the determinant factors of credit risk in the Egyptian commercial banking sector, incorporating diverse variables such as GDP growth rates, inflation rates, interest rates, forex rates, size of bank, ratio of capital adequacy, efficiency of loan growth efficiency, and profitability level measured by return on equity (ROE). Through this study initiative, the researcher aims to enhance the comprehension and management of credit risk in Egypt's financial landscape.

2. RESEARCH PROBLEM:

Previous research has predominantly indicated that various macroeconomic and bank-specific factors directly influence credit risk within financial institutions. Given this premise, these two categories of variables are likely to have a noteworthy impact on the non-performing loans (NPL) ratio in Egypt. Consequently, the research question can be framed as follows:

"*To what extent does macroeconomic (systematic) and bank-specific (unsystematic) variables affect credit risk in the Egyptian commercial banking sector*?"

3. RESEARCH OBJECTIVES:

The research endeavors to empirically evaluate the macroeconomic (systematic) and bank-specific (unsystematic) variables' impacts of on the nonperforming loan ratio in the Egyptian commercial banking sector. In line with this, the primary objectives can be succinctly outlined as follows:

- ✓ Investigate the correlation between macroeconomic (systematic) variables and nonperforming loans.
- ✓ Determine the association between bank-specific (unsystematic) variables and nonperforming loans.

4. RESEARCH IMPORTANCE:

• ***Theoretical Implication***: This study contributes to the current literature on nonperforming loans (NPLs) by examining the impact of bank-specific and macroeconomic variables on credit risk within Egypt's commercial banking sector. The research fills a gap in the literature, as few studies, to best of the researcher's knowledge, have explored these specific relationships in the context of Egyptian banks.

• ***Practical Implication***: This research will introduce an analytical model that aids credit risk analysts in better predicting the NPL ratio by identifying key factors influencing NPLs in Egyptian banks. Consequently, it will enhance the effectiveness of credit risk management within Egypt's financial services sector.

• ***Policymaker Implication***: The findings of this research will provide valuable insights to policymakers in Egypt's banking sector regarding the factors influencing credit risk levels in banks. This understanding will support the development of robust regulations aimed at controlling NPL levels and mitigating the risks of credit and insolvency within the banking industry.

5. LITERATURE REVIEW:

According to the study of Apostolik et al. (2009), credit risk delineates the probability of a borrower failing to fulfill their obligations as stipulated in an agreement of loan. Commercial banks face their most significant risk in the form of credit risk, as it imperils them with potential losses if borrowers default on their debts (Saunders and Cornett, 2008). To avoid insolvency and safeguard profitability, financial institutions must meticulously discern and oversee their credit-related risks (Basle Committee, 2000). Insufficient risk evaluation and mitigation can have dire consequences for banks, jeopardizing their financial stability (Abiola and Olausi, 2014). The credit five Cs—comprising repayment capacity, capital, conditions of loan, character of borrower, and the used collateral— have historically served as pivotal factors for commercial banks in evaluating credit risk (Oseni, 2023). In response to the evolving risk landscape and advancements in technology, financial entities, economists, and stakeholders are innovating new credit risk assessment tools. These include different models like the KMV model, that estimates the default probability depending upon the market value of assets of borrower; modern portfolio theory, that enables investors manage risk through their portfolios' diversification; and the credit metrics model, that determine the default probability at the portfolio level by analyzing correlations with borrowers' payment defaults (Matanda et al., 2022). These sophisticated methods have been applied across diverse sectors within the finance discipline, particularly among different financial institutions and several economists.

The interplay between macroeconomic or systematic conditions and specific factors unique to individual banks or unsystematic conditions significantly influences credit risk within commercial banks (Twum et al., 2021).

1. Assessment of Systematic Factors (Macro-Economic Determinants):

Voluminous investigations reveal that the prevailing economic milieu of a nation profoundly influences the credit impairments encountered by financial institutions (De Bock and Demyanets, 2012; Keeton and Morris, 1987; Klein, 2013; Salas and Saurina, 2002). The parameters routinely employed to gauge the fluctuations in non-performing loans (NPLs) are delineated below:

1.1 GDP growth:

Scholars concur that during periods of robust economic health, both households and enterprises demonstrate greater aptitude in fulfilling their financial commitments. Gross Domestic Product (GDP) growth stands prominently as the major barometer to signify the favorable phase of what is formally named as economic cycle (Carey, 1998; Nkusu, 2011; Salas and Saurina, 2002). In this vein, Carey (1998) posits that the rates of default within portfolios of debt typically find explication through the economic climate. Indeed, the inverse correlation between growth of GDP and non-performing loans (NPLs) is elucidated by the constrained streams OF revenue of

borrowers in trying periods, precipitating a surge in the NPL inventory (Jiménez and Saurina, 2005; Makri et al., 2014; Vouldis and Louzis, 2017). Quagliariello (2007) embarked on a study scrutinizing the influence of economic conditions on NPLs, leveraging a panel of Italian banks spanning from 1985 to 2002. He demonstrates a cyclic behavior among banks, signifying an uptick in bad loans during economic downturns, with a converse trend manifesting during economic upswings. This discovery finds further validation through Nkusu's (2011) examination encompassing 26 advanced nations between 1998 and 2009. He attests that decelerated economic growth precipitates a rise in NPLs, attributing this phenomenon to escalating asset valuations and unemployment rates amidst economic turmoil. Recent scholarly inquiries echo and reinforce this established nexus, asserting that the country's economic cycle exerts a profound influence on the prevalence of NPLs within banks (Dimitrios, Helen, and Mike, 2016; Gulati, Goswami, and Kumar, 2019; Jabbouri and Naili, 2019a; Kuzucu and Kuzucu, 2019; Podpiera and Ötker, 2010; Vouldis and Louzis, 2017).

1.2 Unemployment:

A substantial body of previous studies employs the rate of unemployment as a barometer for gauging the economic state of a nation, attributing it to the degradation in banks' quality of credit (Dimitrios et al., 2016; Klein, 2013; Louzis et al., 2012). All of these inquiries contend that the rate of unemployment hampers economic functionality, precipitating an uptick in non-performing loans (NPLs). The study of Louzis et al. (2012) documents a direct relationship between unemployment and NPLs, asserting the latter's paramount significance as a macroeconomic determinant of adverse loans. Echoing this sentiment, the study of Lawrence (1995) links this positive association to the robust relationship between levels of income and rates of default. The study posits that individuals with lower incomes have more probability for heightened susceptibility to the case of unemployment, rendering debt repayment more challenging. Moreover, financial institutions seek to levy higher rates of interest on low-income clientele, deeming them as risk-prone as a result of income uncertainty, exacerbating their repayment capacity (Lawrence, 1995). Rinaldi and Sanchis-Arellano (2006) further elaborate on this model to corroborate Lawrence's assertions, suggesting that default rates hinge significantly on the income of borrowers and statuses of employment. Recent scholarship validates these earlier findings, reiterating the unemployment rate's pivotal role as the primary systematic NPLs determinant (Dimitrios et al., 2016; Jabbouri and Naili, 2019a; Kuzucu & Kuzucu, 2019).

1.3 Inflation:

It stands as a pivotal systematic non-performing loans (NPLs) determinant. Numerous investigations have endeavored to ascertain a causal relationship between inflation and banks' credit risk, yet agreement remains elusive (Amuakwa-Mensah et al., 2017; Ghosh, 2015; Gulati et al., 2019; Nkusu, 2011; Us, 2017). The previous research posits that heightened inflation exacerbates the incidence of NPLs. For instance, within a European context, the study of Rinaldi and Sanchis-Arellano (2006) unearthed that elevated inflation corrodes the real value of income of borrowers, thereby impeding their capacity to fulfill obligations of debt (Ghosh, 2015). The study of Klein (2013) corroborates this assertion through an examination spanning Central, Eastern, and Southeastern European (CESEE) countries from 1998 to 2011, providing evidence

that inflationary environments pose heightened challenges for borrowers, particularly concerning floating-rate loans (Klein, 2013). These findings find support from Amuakwa-Mensah et al. (2017), Ghosh (2017), and Jabbouri and Naili (2019a).

Conversely, an alternative strand of previous research suggests an inverse correlation between inflation and non-performing loans (NPLs) (Makri et al., 2014; Nkusu, 2011). These studies argue that higher inflation reduces the real value of existing debt, thereby enhancing the repayment capacity of both households and businesses (Nkusu, 2011). Similarly, the study of Khemraj and Pasha (2009) scrutinized the sector of banking in Guyana, revealing an inverse association between inflation and NPLs. They attribute their results of statistical analysis to the uptick in wages accompanying inflation, which sustains repayment capabilities. Moreover, recent evidence by Gulati et al., (2019) from the banking sector in India suggests that during inflationary times, the risk of failure of bank diminishes.

Other researchers demonstrate inconclusive findings regarding the influence of inflation on credit quality in banks. The research of Kuzucu and Kuzucu (2019) contend that the repercussions of inflation vary across regions. They argue that heightened inflation correlates with reduced NPLs in emerging economies, whereas in advanced nations, it tends to escalate NPLs (Kuzucu & Kuzucu, 2019). These assertions are contested by scholars positing that inflation exerts an insignificant influence on NPLs. For instance, the study of Tanaskovic and Jandric (2015) examined banks operating inside countries of CESEE from 2006 to 2013, documenting a lack of significant correlation in between inflation and NPLs. This observation was reaffirmed by the Peric and Konjusak (2017) study, that investigated NPL determinants in select EU countries from 1999 to 2013. These divergent outcomes render this stream of previous studies nebulous, necessitating the need for more comprehensive inquiry.

1.4 Interest Rate:

Prior research provides compelling evidence regarding the impact of high interest rates on banks' lending practices, resulting in elevated levels of non-performing loans (NPLs). This policy-driven determinant was initially scrutinized by the Sinkey and Greenawalt (1991) study, which examined large commercial banks sample in the United States spanning from 1984 to 1987. Their findings illustrate that an upsurge in interest rates correlates with heightened credit losses. In the same way, Berge and Boye (2007) conducted a study within Norway, concluding that the escalation in bad loans is closely tied to interest rates increase. Additionally, the research of Espinoza and Prasad (2010) explored Gulf Cooperation Council (GCC) countries banking sector, positing those elevated rates of interest lead to augmented borrowing costs, thereby impairing borrowers' ability for repayment due to inflated payments of interest. Different investigations corroborate the detrimental impact of higher interest rates on borrowers' ability to repay (Beck et al., 2015; Ghosh, 2015; Us, 2017).

On the other hand, contrasting viewpoints suggest that high rates of interest only affect quality of loan only when banks adhere to a variable interest rate regime (Messai & Jouini, 2013). In reality, fixed-rate loans remain insulated from interest rate fluctuations, thereby preserving borrowers' capacity to fulfill their debt obligations.

1.5 Real Exchange Rate:

In theory, when a depreciation in currency happens, it diminishes in its value relative to one or more than one foreign currency as a reference, rendering unexpected currency movements a significant source of risk, or simply uncertainty. Consequently, the banking previous research has endeavored to assess the impact of the rate of real exchange on banks' credit risk, taking into account that banks as one of the financial entities which are more vulnerable to exchange rates fluctuations. However, this relationship remains vague.

The study of Beck et al. (2015) highlights the substantial and adverse effect of currency depreciation on credit quality of banks. This research underscores the notion that the impact of depreciation is particularly pronounced in countries characterized by widespread currency mismatches. Furthermore, it is posited that banks operating in nations with a significant proportion of debt of non-public sector denominated in other countries' currencies experience more significant shocks in non-performing loans (NPLs). This link is elucidated through the inverse implications of the channel of balance sheet, wherein borrowers who are unhedged with foreign currency-denominated debts incur servicing costs of elevated debt using local terms, thereby heightening the likelihood of default. Hence, policymakers and governments should be cognizant of the critical role of other countries exchange reserves in mitigating these economic crises during periods of rate of exchange volatility (Beck et al., 2015).

Conversely, other researchers argue for a positive correlation between the real rate of exchange and NPLs (Klein, 2013). For example, the study of Klein (2013) scrutinized 16 Central, Eastern, and Southeastern European (CESEE) countries for the period from 1998 to 2011. He observed that in nations with substantial export volumes and negligible currency which are mismatched, depreciation of exchange rate correlates with a reduction in NPL levels. Klein substantiates his findings through the concept of the competition channel, which proposes that currency depreciation bolsters export activities, thereby enhancing the financial standing of enterprises and augmenting their repayment capacity (Klein, 2013).

1.6 National Debt:

The resurgence of interest among researchers in sovereign or governmental debt stems from its profound impact on the economy, notably underscored by the European sovereign crisis of debt happened in 2009. To elucidate the nexus between both governmental debt and the banking sector's downturn, the study of Reinhart and Rogoff (2011) conducted a comprehensive analysis encompassing 290 banking crises and 209 instances of sovereign default across 70 of emerged and emerging nations during the period from 1800 till 2009. Its findings unveil a robust correlation between these two economic phenomena, positing that banking crises frequently coincide with governmental crises of debt (Reinhart & Rogoff, 2011).

To this day, a compelling school of thought posits a positive linkage between public debt and non-performing loans (NPLs). Elevated public debt can precipitate tax hikes, adversely affecting the financial standing of individual people and businesses entities (Perotti, 1996). Furthermore, it prompts governmental spending cuts, culminating in reductions in both social expenditures and salaries (Perotti, 1996). These ramifications can result in a surge in bad borrowed loans due to the adverse impact on household income, subsequently impeding debt

repayment. Moreover, evidence suggests that burgeoning governmental debt undermines governmental finances, deleteriously affecting the national banks' creditworthiness by imposing a "governmental ceiling" for their solvency level (Reinhart & Rogoff, 2011). Thus, banks encounter heightened liquidity challenges, making it arduous to attract market financing. In this milieu, banks are compelled to curtail lending activities, thereby diminishing borrowers' capacity to refinance their debts (Reinhart & Rogoff, 2011).

In this context, researchers have been motivated to further corroborate or refute this relationship, which may not immediately appear linked in a direct way to banks' credit risk. The study of Louzis et al. (2012) articulated this notion, postulating that an upsurge in the budget deficit engenders higher number of NPLs, encapsulated within the governmental debt hypothesis. Numerous researches ensued to scrutinize the validity of this hypothesis. Employing dynamic models of panel, these researchers examined and affirmed this hypothesis using a study spanning between 2004 and 2009 among the nine largest Greece banks. Similarly, the research of Makri et al. (2014) investigated banks across sixteen European countries for the period between 2000 and 2008, with findings buttressing the "governmental hypothesis of debt" and indicating that deficit debt woes lead to elevated NPLs. Ghosh (2015) delved into this correlation across the largest commercial and savings banks in fifty U.S. states from 1984 till 2013, confirming that a decrease in public debt correlates with an enhancement in the quality of banks' loans, thereby reinforcing the "governmental hypothesis of debt".

1.7 Institutional Environment:

Highlighting that even though the pivotal role of the environment of an institution at the national level is worth, research thus far has paid scant mind to its influence on shaping risk profiles of banks. Several articles posit that a conducive institutional environment enhances credit quality by fostering better corruption control, bolstering regulatory frameworks, and fostering more accountability (Boudriga et al., 2010). Indeed, corruption is often cited as a primary catalyst behind financial crises (Park, 2012). Within the banking sector, corruption manifests when entities seek credit by circumventing credit rating processes or when banks resort to legal leniency provisions (Park, 2012). Moreover, borrowers may resort to corrupting bank officials to expedite loan processing or ease access to credit, thereby leading to heightened non-performing loans (NPLs) attributable to inadequate loan screening and deficient documentation (Park, 2012).

In an article encompassing 22 countries from 2008 till 2012, The study of Bolisani (2016) corroborates the positive correlation between corruption and NPLs. The researcher observes that the quality of credit for banks located in emerging markets, corruption is undermined, impeding the development of a well-functioning banking sector and thereby thwarting sustainable growth of economy (Bolisani, 2016).

2. Assessment of Unsystematic Factors:

2.1 Bank-Specific Determinants:

The association between bank-specific or unsystematic factors and the starting point of non-performing loans (NPLs) has been extensively explored in numerous studies. Internal factors

within banks can wield a profound influence on the prevalence of NPLs, with several underlying determinants being prominently highlighted in the literature.

2.1.1 Capitalization of the Bank:

In 1988, the inaugural Basel Agreement was drafted to establish minimum banks' requirements of capital and enforce constraints on their financial leverage, aiming to mitigate credit risk. The Capital Adequacy Ratio (CAR), globally employed by oversight authorities, delineates the proportion of own funds that banks must reserve as a safeguard against undue risk (World Bank, 2006, p. 23). This safeguarding mechanism was primarily crafted to safeguard creditors and also depositors and ensure the banking system stability (Koehn & Santomero, 1980). Several studies have scrutinized the influence of capital requirements on behaviors of banks' risk-taking.

Initially, the study of Shrieves and Dahl (1992) examined a sizable sample of U.S. banks from 1984 to 1986, contending that the held capital as a percentage of risk-weighted assets of banks significantly influences their risk appetite. Undercapitalized banks tend to bolster their capital responding to heightened exposure of risk (Shrieves & Dahl, 1992). The underlying justification for the inverse relationship between CAR in one side and NPLs in the other side is that banks endowed with ample risk capital are inclined to make loans cautiously, rigorously screening loans to safeguard the reserved capital (Sinkey & Greenawalt, 1991). Conversely, under-capitalized banks are susceptible to optimistic risk-taking behavior, subsequently escalating NPLs. These findings find resonance in subsequent studies. For instance, the study of Barth, Caprio, and Levine (2004) argued by covering 107 countries that banks with low CARs often adopt more risky lending procedures to enhance their profits. Similarly, the study of Boudriga et al. (2009) validated this inverse correlation by employing data from different 59 countries spanning from 2002 to 2006, contending that a more solvency ratio enhances the banks' lending quality by curbing exorbitant risk-taking. Moreover, the hypothesis of moral hazard, postulated by the research of Keeton and Morris (1987), furnishes an additional rationale for the CAR-NPL relationship. This hypothesis suggests that managers of under-capitalized banks pursuing riskier ventures, given the capped losses they might incur in case of collapse, justifying elevated NPL levels (Berger & Deyoung, 1997). The studies of Salas and Saurina (2002) and Us (2017) demonstrated supplementary practical evidence affirming this relationship.

Conversely, other studies espouse contrasting perspectives, positing that CAR is statically and positively associated with NPLs. Ghosh (2017) examined the influence of CAR on quality of loan, concluding, using a sample of 100 US commercial banks spanning from 1992 to 2016, that banks with high CARs experience greater credit losses. This outcome is ascribed to the elevated regulatory capital encouraging banks to engage in risk-laden activities, translating into elevated bad loans (Koehn & Santomero, 1980). Subsequently, the research of Kim and Santomero (1988) utilizing a mean-variance model, and that of Rime (2001) examining Swiss banks, confirmed a positive correlation between CAR and credit risk. Indeed, banks with substantial regulatory capital are inclined toward liberal lending policies, often lacking prudence in risk evaluation (Ghosh, 2017).

This correlation remains a domain of considerable uncertainty. However, these contradicting findings underscore the significance of CAR as NPLs key determinant, necessitating particular focus from central banks in formulating regulatory policies.

2.1.2 Size of the Bank:

The impact of bank size on non-performing loans (NPLs) has been extensively explored in the literature, with noticeable differences in the behavior of larger banks compared to smaller ones. However, no unequivocal evidence has yet emerged regarding the effect of size of bank on credit risk.

A part of studies suggests an inverse relationship between bank size in one side and NPLs in the other side (Alhassan, Kyereboah-Coleman, and Andoh, 2014; Hu, Li, and Chiu, 2004; Salas and Saurina, 2002). Subject to this perspective, larger financial institutions are more equipped to behave thorough screening of credit, evaluate borrower credit quality, and manage defaulting parties due to their contemporary risk management frameworks and practices (Louzis et al., 2012; Salas and Saurina, 2002; Solttila and Vihriâlâ, 1994). Also, it is argued that larger banks allocate more resources to loan evaluation and analysis, thereby avoiding lending to low-quality borrowers (Hu et al., 2004). Conversely, limited risk management tools small banks may face challenges to handle delinquent borrowers, leading to an escalation in NPLs. Additionally, the diversification hypothesis posits that larger size banks are likely to have less NPLs due to their enhanced diversification compared to smaller banks (Louzis et al., 2012).

On the contrary, part of banks may be trapped into the "too big to fail" snare, wherein these banks engage in irresponsible lending practices under the assumption that they will receive government bailouts in the event of bankruptcy (Stern & Feldman, 2004). This TBTF hypothesis demonstrates that systemically important banks, whose failure could jeopardize the entire economy, are inclined to take more risks. The study of Louzis et al. (2012) supported this hypothesis by arguing that larger size banks may over-size their leverage and undertake more risks, thereby compromising their loan portfolios quality. The positive correlation between the size of bank and NPLs was additionally corroborated in a study spanning 15 countries in euro zone from 1996 to 2010, which affirmed that larger size banks, often shielded by protection of government, are more inclined to adopt riskier lending practices, knowing they will not face the full repercussions of their decisions (Haq & Heaney, 2012).

2.1.3 Efficiency of the Bank:

The link between efficiency of cost in one side and bad loans in the other side has been a subject of extensive research, yet the results remain inconclusive. An influential study by Berger and Deyoung (1997) was among the first to illuminate this relationship, proposing three key hypotheses that continue to be scrutinized and refined by researchers worldwide to this day.

The first hypothesis, termed the poor management hypothesis, posits that banks exhibiting low-cost efficiency tend to harbor more non-performing loans (NPLs) due to the subpar managerial skills of their leaders (Berger & Deyoung, 1997). In this scenario, managers of such banks may demonstrate inadequate credit assessment, insufficient collateral evaluation, and/or lax borrower oversight, thereby leading to a deterioration in the balance sheet of the bank (Berger

& Deyoung, 1997). Conversely, banks with cost-efficiency and competent management are more subject to curtail the incidence of bad loans. The study of Podpiera and Weill (2008), employing a GMM dynamic panel estimator using a sample of Czech banks in order to build upon Berger and Deyoung's (1997) groundwork, furnish compelling evidence in support of this hypothesis. This viewpoint finds further validation in the works of Espinoza and Prasad (2010), Louzis et al. (2012), and Dimitrios et al. (2016), asserting that inefficiency of cost is indicative of poor performance management practices culminating in an accumulation of NPLs.

The second proposition, termed the "bad luck" hypothesis, suggests a negative correlation between cost efficiency in one side and NPLs in the other side (Berger & Deyoung, 1997). This hypothesis posits that banks may experience higher NPLs because of unforeseen external events like GDP downturns or slowdowns of economics, necessitating additional managerial efforts and operational costs to address these bad loans, thereby exacerbating the bank's efficiency of cost (Berger & Deyoung, 1997; Podpiera & Weill, 2008). This notion has been corroborated by other researchers like Rossi et al. (2009).

Contrarily, the third proposition, referred to as the "skimped hypothesis," presents a contradictory perspective to the aforementioned results, linking a portfolio quality of bank's loan to monitoring and underwriting costs. This proposition suggests that banks allocating few resources to underwriting and monitoring of credit may exhibit short-term cost efficiency but are likely to encounter a growing pool of NPLs in the long-term (Louzis et al., 2012). Hence, the significance of credit underwriting is crucial. According to this vein, research utilizing a dynamic panel data model on large size Australian banks from 1997 till 2003 contends that banks allocating adequate resources into credit underwriting, management of risk, and supervision are more likely to prevent problematic loans (Rossi et al., 2009).

2.1.4 Bank Performance:

A substantial number of previous studies has endeavored to elucidate the relationship between performance of banks in one side and non-performing loans (NPLs) in the other side, especially examining whether lagging profitability ratio, as a metric of performance, influences the NPL levels. High profitability banks typically indicate a greater appetite for growing and possess a robust shocks buffer, potentially leading to reduced NPLs. In this context, the study of Louzis et al. (2012) hypothesize an inverse relationship between lagged profitability and NPLs, proposing the "poor management proposition" to expound this link. They posit that low levels of profitability may signal deficient management skills and capabilities regarding credit strategies. This notion finds support from Ghosh (2015), who, based on research covering 50 US states from 1984 till 2013, suggests that higher profitability correlates with decreased NPLs. Ghosh further asserts that profitable banks are less inclined to take excessive risks, thereby enhancing their loan portfolios quality. Moreover, a study encompassing aggregate data from a panel of 14 countries in Euro zone starting from 2000 till 2008 revealed that banks, in a bid to offset previous losses, use more risky lending practices, thereby exacerbating their NPLs (Makri et al., 2014).

Contrarily, other researchers contend that high levels of profitability can elevate NPL levels. For example, the study of Rajan (1994) argues that high profitability may compromise quality

of loan if the bank changes its lending policies. Banks, leveraging their superior creditworthiness, may manipulate the market by concealing the extent of their bad quality loans. This may be attained through tactics such as extending credit terms, enlarging borrowers' credit lines to prevent insolvent borrowers from being classified as borrowers in default, and loosening agreements to reduce loan defaults. This strategy, also known as permissive credit policy or inverse net present value granting of credit, aims at boosting current revenues through increased advance payments, yet such risky practices can lead to increase in NPLs and substantial losses in future (Louzis et al., 2012). Additionally, the study of García-Marco and Robles-Fernández (2008) furnishes evidence from inside the Spanish banking sector spanning from 1993 to 2000, suggesting that policies of profit-maximization correlate with heightened risk levels. Their findings support a positive correlation between both profitability and NPLs, positing that underperforming banks are more predisposed to adopt cautious lending practices to mitigate further losses.

Thus, while profitability remains a pivotal determinant of NPL levels, the direction of its impact remains inconclusive in the literature.

2.1.5 Loan Growth:

Economic scientists and scholars have long pondered whether financial institutions, especially banks can expand without concurrently increasing their risks (Foos, Norden, and Weber, 2010). In the quest to identify factors contributing to the subprime mortgage crisis, practical research has unearthed substantial evidence suggesting that rapid credit expansion served as a pivotal harbinger of bank failures (Jin, Kanagaretnam, & Lobo, 2011). In response, scholarly attention has zeroed in on the nexus between credit growth and credit risk.

Pioneering studies in this realm, such as that by the two scholars Keeton and Morris (1987), scrutinized a sample of 2,470 banks in the U.S. from 1978 till 1985. The scholars correlated swift growth of credit with riskier borrowing behavior, noting that as banks diversify their offerings, loan screening standards may be relaxed, consequently precipitating quality of loan deterioration (Keeton and Morris, 1987). Expanding on this, the study of Keeton (1999) contended that in their pursuit of a comprehensive loan portfolio, banks may reduce interest rates or relax lending conditions.

Subsequent investigations by Foos et al. (2010) across 16 countries from 1997 to 2007 yielded compelling findings. They suggested that while losses on subordinate loans may not materialize swiftly, banks might prioritize short-term gains by easing credit conditions, albeit at the cost of losses in long-term. The study of Salas and Saurina (2002) bolstered these assertions through their survey of Spanish banks from 1985 to 1997, documenting credit expansion as a primary driver of bad quality loans.

This correlation with positive sign may be dissected using various angles. Firstly, an uptick in growth of credit may strain banks' resources devoted into underwriting and also screening, leading to risk analysis insufficiency and also heightened default risks (Solttila & Vihriâlâ, 1994). Secondly, banks vying for market share often grapple with negative selection issues; as they endeavor to retain high-quality borrowers, they may inadvertently lose customers deemed risky, thus exacerbating negative selection (Salas & Saurina, 2002). Thirdly, in cases of agency

problems, managers may be incentivized to pursue rapid expansion of credit and embrace severe risk-taking to bolster market share, buoyed by increased prestige, status, and authority (Salas & Saurina, 2002).

While some researchers contend that heightened growth of credit results in improving quality of lending, positing that financial institutions, especially banks with credit-centric business models are more subject to possess robust risk analysis tools and techniques to manage default people (Boudriga et al., 2010), others, like Jabbouri & Naili (2019a), found a negative but statistically insignificant correlation between credit growth and NPLs across 98 banks in 10 MENA countries as a sample from 2003 up to 2016. They attributed this inverse sign to the effect of crowding-out prevailing in the MENA region during the study time-period, which restricted access to loans for risky firms and individuals, consequently curbing the accumulation of NPLs. However, dissenting voices argue that credit growth's impact on banks' bad loan levels is dynamic rather than static (Klein, 2013; Makri et al., 2014; Vithessonthi, 2016).

2.1.6 Diversification:

The impact of bank diversification on NPLs has been a subject of considerable importance in the previous studies. Studies have explored both positive and negative associations between diversification and banks' risk behavior, shedding light on the nuanced relationship between the two.

Research demonstrating a positive impact of diversification on banks' risk behavior argues that diversified banks stand to benefit from economies of scale, distributing fixed costs across a broad array of various products, thereby reducing risk. However, Stiroh (2004a) challenged this notion in his study of U.S. banks spanning from 1970 up to 2001. He found that diversification of bank did not necessarily lead to reduce risk, a finding corroborated by the study of DeYoung and Roland (2001). While numerous literatures have studied the influence of diversification of bank on both profitability and insolvency, its direct link to credit risk has received comparatively less attention.

Nonetheless, the few numbers of literature on the relationship between both diversification and credit risk have yielded intriguing insights. The study of Louzis et al. (2012) argue that diversification, particularly when coupled with non-interest income, exerts a negative impact on NPLs, a phenomenon which may be attributed to the diversification "dark side", which posits that banks venturing into unfamiliar activities lacking comparable advantage are prone more to failure and inclined towards severe risk-taking (Louzis et al., 2012; Stiroh, 2004b). Similarly, conclusions from a study of banks in China spanning from 1997 up to 2012 support the notion that diversification introduces more risks (Zhou, 2014). These findings echo earlier research by Boyd and Graham (1986), who argued that diversification raises the likelihood of failures in bank, particularly in deregulation phases.

In sum, while some studies suggest that diversification can mitigate risk through economies of scale, others highlight the potential downsides, emphasizing the importance of carefully managing diversification strategies to mitigate associated risks, particularly in unfamiliar or non-core areas of operation.

2.1.7 Management Factors:

In the intricate tapestry of global financial discourse, executive remuneration policies within the banking sector stand as a focal point, designed to mitigate agent-client conflicts and curtail business risks (Jensen and Meckling, 1976; Shleifer and Vishny, 1986). The fallout from the mortgage crisis of 2007-2008 spurred a surge in public and academic interest in executive pay, with scholars attributing it as a catalyst for the rampant risk-taking that precipitated the market collapse (John et al., 2010; Vallascas and Hagendorff, 2013). This contentious subject has since undergone rigorous examination, fueled by the belief that CEO compensation correlates with heightened risk-taking. Some argue that as option-based compensation swells, CEOs become more risk-averse, opting for conservative investment decisions to safeguard their personal wealth portfolios (Ross, 2004). Conversely, an opposing school of thought posits that escalating executive compensation at high-risk banks incentivizes management to engage in excessive risk-taking, chasing performance goals at the expense of prudence (Chen, Steiner, & Whyte, 2006; Vallascas and Hagendorff, 2013). Despite the wealth of previous studies illuminating the nexus between CEO remuneration and banks' risk appetites, its straight forward influence on credit risk, exemplified by NPLs, remains a neglected facet ripe for exploration. Further investigations into this realm hold paramount importance for market stakeholders, bank boards, and policymakers.

Another pivotal factor contributing to the credit market upheaval of 2007-2008 was the overconfidence exhibited by banks, evidenced by their reckless lending practices during the housing bubble and precipitous credit expansion in the U.S. (Ho et al., 2016). The literature suggests that managerial hubris played a role, skewing decision-making processes and precipitating a surge in non-performing loans (Malmendier & Tate, 2008). Empirical studies underscore the pernicious effects of overconfidence, linking it to relaxed lending standards and amplified bank leverage, culminating in an overheated economy plagued by soaring NPL levels (Ho et al., 2016). Despite these findings, conflicting arguments posit that overconfident managers may exert more effort and enthusiasm in pursuing risky investment projects, yielding potentially lucrative rewards during economic upswings (Gervais et al., 2011). This duality of perspectives underscores the need for comprehensive scrutiny into whether over-reliance on the banking sector exacerbates NPL levels, necessitating further exploration and nuanced analysis.

The ongoing debate surrounding Corporate Social Responsibility (CSR) has garnered substantial attention, with proponents advocating for its integration into core business strategies as an indispensable priority for business leaders worldwide (Porter & Kramer, 2006). While CSR has been extensively studied in the line with its influence on performance of business, its influence on the risk profiles of financial institutions, particularly banks, remains underexplored (Bushman and Williams, 2012; Shen et al., 2016). Empirical evidence suggests that banks which are socially responsible cultivate stronger reputations and engender greater trust among clientele, potentially translating into enhanced loan quality and reduced NPL occurrences (Wu & Shen, 2013). These findings underscore the pivotal role of CSR in fortifying credit quality and merit further investigation to unravel its intricacies and implications for market dynamics.

2.1.8 Ownership Structure:

The subject of corporate governance remains ensconced in controversy, with notable efforts by the BCBS to enhance its efficacy within banks, acknowledging the sector's distinct regulatory landscape, intricate business dynamics, and the pivotal role it plays in mitigating risk and bolstering investor confidence (Mehran, Morrison, & Shapiro, 2011). Conversely, lapses in corporate governance have been implicated in recent financial crises, incentivizing banks to undertake undue risks (Dong, Meng, Firth, & Hou, 2014). Ownership structure emerges as a linchpin of corporate governance, reflecting worth of firms and the safeguarding of rights of investor (Bebchuk, Cohen, and Ferrell, 2009; Connelly, Limpaphayom, and Nagarajan, 2012). Numerous studies have delved into the influence of shareholders' identities controlling and ownership levels on risk proclivities of banks (GarcíaMarco and Robles-Fernández, 2008; Laeven and Levine, 2009; Louzis et al., 2012; Shehzad et al., 2010), underscoring that imperative for understanding this interplay in shaping banking activities and informing ongoing regulatory reforms (Haw et al., 2010). Yet, divergent viewpoints persist, evading conclusive resolution.

Ownership Concentration elicits various conjectures in financial discourse, with divergent perspectives on its impact on banks' risk profiles. The traditional view posits that concentrated ownership empowers shareholders to oversee management effectively, curbing agency problems (Berle & Means, 1933). Conversely, dispersed ownership breeds lax oversight and control, inviting risks (Sullivan & Spong, 2007). Empirical findings corroborate the inverse relationship between ownership concentration and NPLs, attributing it to better capital adequacy and prudent lending practices (Shehzad et al., 2010). Conversely, dissenting voices argue that concentrated control may stifle effective decision-making and foster tunneling of resources, amplifying risks (Shleifer & Vishny, 1986; Haw et al., 2010). While research in the MENA region and China substantiates the positive impact of ownership concentration on credit quality (Srairi, 2013; Us, 2017), contradictory evidence posits a nexus between concentrated control and heightened risk-taking (Laeven & Levine, 2009). The dialogue remains inconclusive, warranting further exploration.

Ownership Identity emerges as a pivotal determinant of banks' risk appetite, with state-owned banks exhibiting a propensity for elevated risks and subpar performance (La Porta, Lopez-De-Silanes, & Shleifer, 2002). State control engenders susceptibility to political and economic upheavals, compromising financial stability (Berger et al., 2005). Conversely, institutional ownership heralds a more favorable outlook, with institutional investors fostering robust oversight and risk mitigation (Shleifer & Vishny, 1986). Institutional owners' expertise and profit-oriented approach enhance banks' efficiency and risk management, contrasting starkly with the governance milieu of state-owned entities (Sheshinski, 2003; Dong et al., 2014). While empirical evidence underscores the inverse relationship between both institutional investor ownership and NPLs (Barry et al., 2011; Deng et al., 2013), the debate persists, beckoning further inquiry into the intricate dynamics of ownership and risk-taking.

In summation, the literature presents a mosaic of perspectives on the influence of ownership structure on banks' risk behaviors, shrouded in ambiguity and ripe for exploration. The paucity of studies addressing the straight forward connection between structure of ownership and NPLs

underscores the need for future research to unravel this intricate nexus and inform prudent policymaking.

2.2 Industry-Specific Determinants:

2.2.1 Competition:

Competition among banks stands as a pivotal force driving growth and stability in the financial realm, attracting keen interest from economists, market participants, and scholars, particularly following the global mortgage crisis. The aftermath of this crisis prompted a profound reevaluation of the influence of competition on stability of bank, with a specific focus on its ramifications for banks' risk appetite.

In a seminal work, Keeley (1990) proposed the "franchise value hypothesis," positing that heightened competition correlates with increased risk exposure among banks. This hypothesis suggests that intensified competition squeezes profit margins, thereby diminishing banks' discounted capital and elevating their tolerance for risk (Keeley, 1990). Hellmann, Murdock, and Stiglitz (2000) further elucidated this notion, contending that competition erodes banks' franchise value by curbing profitability, which in turn diminishes their incentive to engage in prudent lending practices (Hellmann et al., 2000). Consequently, in fiercely competitive banking landscapes, banks are predisposed to adopt riskier behaviors, potentially amplifying default risks and NPL levels (Hellmann et al., 2000). This perspective is encapsulated by Hellmann et al. (2000), who assert, "... If the markets are enough competitive, the bank earns relatively less from prudent investments, but the bank can always take a one-time gambling rental. Thus, increased competition tends to increase banking sector gambling."

Moreover, it is argued that in highly competitive environments, banks may resort to risky practices in a bid to enhance shareholder returns, precipitating systemic vulnerabilities, particularly in small banks that act as price takers within the interbank market (Allen & Douglas, 2000). Additionally, heightened competition may exacerbate adverse selection issues, as banks relax credit standards to attract borrowers, thereby augmenting the likelihood of extending credit to subpar borrowers (Broecker, 1990). Conversely, monopolistic banking landscapes tend to restrict credit access for low-quality borrowers, mitigating default risks (Boudriga et al., 2009). Wang (2018) corroborates these points of view through empirical analysis, revealing a positive correlation between competition and banks' credit risk, thereby underscoring the stabilizing influence of bank concentration. Similarly, Turk Ariss (2010) and De Haan and Poghosyan (2012) lend support to these arguments.

Contrary voices, however, challenge the competition-fragility paradigm, advocating for the potential benefits of interbank competition in enhancing financial system stability. Boyd and Nicolo (2005) contend that heightened competition can drive down lending rates, diminishing the profitability of defaults and incentivizing banks to undertake prudent credit decisions. Conversely, concentrated banks with greater market power may exploit moral hazard issues to charge higher interest rates, encouraging riskier investments by borrowers (Boyd & Nicolo, 2005). While this may not directly lead to elevated borrower defaults, it may partly account for heightened default levels in highly concentrated interbank markets (Wang, 2018). Furthermore, competition may spur managers of bank to minimize credit risk through rigorous borrower

screening and prudent credit decisions, thereby garnering favorable assessments from banking supervisors and investors (Jiménez and Saurina, 2005; Ozili, 2019).

The discourse surrounding the competitive fragility/stability model remains a focal point in banking literature, with numerous studies shedding light on its implications for bank stability and risk exposure. However, research in this domain is notably silent on its impact on banks' NPL levels, presenting a fertile area for further exploration that could yield valuable insights for banking stakeholders and academics alike.

Thus, the discrepancies in literature findings and the omission of critical variables prompted my study. The objective is to address these gaps by investigating the influence of these variables on credit risk within Egypt's financial sector. It is clear that additional research is needed to gain a deeper understanding of the factors determining credit risk in this context. Based on the literature reviewed, the following nine alternative hypotheses have been formulated to achieve the research objective.

H1. GDP has a negative and significant impact on credit risk.
H2. Inflation has a positive and significant impact on credit risk.
H3. Interest rate has a positive and significant impact on credit risk.
H4. Foreign exchange rate has a positive and significant impact on credit risk.
H5. Bank size has a positive and significant impact on credit risk.
H6. Loan growth has a positive and significant impact on credit risk.
H7. Efficiency ratio has a negative and significant impact on credit risk.
H8. Profitability (ROE) has a negative and significant impact on credit risk.
H9. Capital adequacy has a negative and significant impact on credit risk.

6. THEORETICAL FRAMEWORK:

1. Introduction:

The economic development of any society hinges significantly on the ability of the banking system to mobilize savings and allocate them effectively towards projects that yield maximum economic returns. Consequently, many nations have established regulatory frameworks to guide credit operations, mitigating negative outcomes and promoting developmental objectives. Credit's importance extends beyond merely facilitating financial transactions and maintaining liquidity; it is intricately linked to production, income redistribution, and the utilization of idle resources for diverse investment opportunities. A significant portion of corporate revenues is derived from credit activities and associated interests.

Within the development paradigm, bank credit assumes a pivotal role by furnishing essential financial resources to fund diverse economic endeavors, thus channeling these resources efficiently across economic sectors. Scholars argue that fluctuations in credit magnitude exert a substantial influence on economic activity, either fostering prosperity or inducing contraction (Sherman & Kolk, 1996; Al-Zubaidi, 2002).

Bank credit stands out as one of the principal financial activities, significantly impacting a bank's overall financial performance, manifesting either profit or loss. The credit function serves as a primary source for generating operational profits for banks, necessitating comprehensive

risk management efforts, especially in credit risk (Koch & Macdonald, 2017). It is observed that increased profitability signifies prudent asset investments yielding optimal returns at minimized costs. However, a delicate balance exists between profit maximization and wealth maximization. To achieve high returns, banks may need to take on more risks or reduce operational expenses. Conversely, wealth maximization requires continuous evaluation by bank management to strike a balance between potential high returns and associated risks (Koch & Macdonald, 2017).

Successful credit management hinges on the ability of banks to strike a balance between return and its associated risk level elements. Effective management of risk in credit operations can lead to enhanced future profits, while inadequate management may have adverse consequences. Therefore, careful considerations must underpin credit granting decisions across various types (Qara, 2016).

2. The Concept of Credit risk:

"Credit risk" refers to the potential of a counterparty defaulting on their obligations, either due to inability or unwillingness to fulfill their commitments within the agreed timeframe. It is considered a significant risk factor in most banking operations, given that a substantial portion of bank assets are exposed to this risk. Evaluating a customer's creditworthiness involves assessing their capacity to repay both principal and its associated interest based on their profit generation, cash flow capabilities, as well as considering broader economic factors impacting the industrial and manufacturing sector within which the counterparty works (World Bank, 2020).

Another definition of credit risk is the risk of non-payment, a common form of risk encountered in bank credit operations, resulting from customers failing to repay borrowed amounts. Banks extend credit facilities to customers, making them susceptible to non-payment risks (Al-Harith and Hazouri, 2018).

Credit risk is closely tied to asset quality and the probability of default, which can be challenging to assess due to limited and often incomplete information. Banks assume the risk of non-payment or default when acquiring profitable assets, where borrowers may fail to repay the principal amount along with interest as per agreed terms (Al-Madara, 2021).

The impact of credit risk is significant on the net income of bank and equity market value due to potential non-payment or delayed payment. Various types of assets are associated with default risks, categorized as on-balance sheet (e.g., loans and bonds) besides off-balance sheet (e.g., documentary credits). Loans represent a significant credit risk, as fluctuations in economic conditions and business environments can affect available cash flows for debt repayment, making predictions challenging (Othman, 2013).

3. Sources of Credit risk:

Risks associated with credits can be categorized into various main categories, as identified by Titman et al. (2019) and elaborated upon by Koch & Macdonald (2017). These categories encompass different aspects of risk exposure within banking and lending operations:

1. Client Risks: These risks pertain to the nature of the client organization's activities, the quality of its management, and its operational performance. Client-specific factors can significantly impact credit risk.

2. Industry Risks: Risks associated with the industry in which the enterprise operates, including market dynamics, product quality, and industry-specific challenges.

3. Liquidity Risk: This risk arises from the possibility of a customer defaulting after credit has been extended, leading to their inability to repay the principal and interest on the loan.

4. Macroeconomic Risks: Risks stemming from the broader economic environment, such as low growth rates, political instability, and regulatory changes, which can influence creditworthiness.

5. Foreign Exchange Rate Fluctuation Risks: These risks emerge when credit is extended in a foreign currency subject to constant fluctuations against the local currency.

Furthermore, Koch & Macdonald (2017) identified specific sources of credit risk within banking operations:

1. Credit Concentrations: Risks arising from lending activities focused on specific areas or industries without adequate diversification.

2. Portfolio Diversification Failure: Risks associated with insufficient diversification in the credit portfolio, exposing the bank to concentrated risks.

3. Developing High Credit risk: Emerging risks due to evolving market conditions or changes in borrower creditworthiness.

4. Credit Analysis and Procedures Review: Emphasis on continuous credit analysis and review of credit procedures to mitigate risks effectively.

The concentration of credit exposures within credit portfolios is a critical aspect of credit risk management. Basel Committee on Banking Supervision (2006) distinguishes two types of concentrations:

1. Concentrations in Credit Exposures: Arises from poor diversification within the portfolio, either due to portfolio size limitations or significant exposures within specific borrower groups.

2. Sector Concentrations: Relates to portfolio diversification issues within specific sectors, exposing the portfolio to systemic sector-related risks.

Moreover, credit exposures are defined as potential losses or hedging needs resulting from default on credit contracts. These exposures represent the value deducted in the event of counterparty default during the credit contract period. Understanding and managing credit exposures are crucial, especially in credit derivatives, where value can fluctuate significantly over time based on market conditions (Aziz & Charpat, 1998).

4. Forms of Credit risks:

The various forms of credit risk as outlined by Al-Madara (2021) encompass specific challenges and exposures faced within banking and lending operations:

1. Risks of Non-Payment: Occurs when a customer lacks the financial capacity to meet their obligations. To assess this risk, banks analyze the customer's financial history and capability to fulfill repayment obligations.

2. Concentration Hazards: This risk emerges when a bank excessively focuses on a particular type of collateral or directs credit disproportionately towards specific entities, sectors, or individual customers. Over-reliance on concentrated exposures can amplify risk.

3. Legal Risks: Relates to changes in laws and regulations governing the bank's relationship with borrowing customers (Al-Harith and Hazouri, 2018). Legal changes can impact contractual obligations and risk management strategies.

4. Country Risks: Arises from exposure to potential losses due to dealing with countries facing adverse economic, political, or social conditions. Country risks can also result from reputational issues, such as associations with terrorism financing or failure to fulfill international obligations.

5. Settlement Risks: Stem from adjustments to cash flows, financial assets, and other obligations during the settlement process. These risks can impact the timely and accurate completion of financial transactions and obligations.

Each of these risks associated with credit forms underscores the complexity and multifaceted nature of risk management in banking, requiring banks to adopt robust strategies and frameworks to mitigate and address these risks effectively.

5. Basel II Committee Measurement Methods for Credit risk:

The Basel II Committee has developed multiple methodologies for assessing credit risks, drawing from international practices in credit classification and internal risk measurement within banks. Presented below are these methods:

5.1. Standardized Approach:

This method mirrors the credit risk measurement used in Basel II, employing a set of risk weights for asset classification. Two types fall under this approach:

5.1.1 Basic Standard Method: This method relies on external credit rating by international agencies. Alternatively, in regions where such agencies are lacking, a "simplified standard" approach is used (Basel Committee on Banking Supervision, 2018). It is utilized by banks unable to employ internal risk classification. It modifies Basel I regulations by using external credit ratings to determine risk weights. The Committee has set criteria for recognizing external rating institutions, and credit risk is calculated as total exposure multiplied by the assigned risk weight (World Bank, 2020).

Categories under this method include:

- Sovereigns and central banks claims
- Claims on international institutions
- Multilateral development banks Claims
- Claims on banks and securities companies

- Corporate claims
- Claims within retail portfolios
- Secured claims on residential or commercial properties
- Non-performing facilities
- Claims on high-risk assets
- Other assets
- Off-balance sheet items

The Basic Standard Method provides flexibility for regulatory authorities to adapt according to market needs, termed as "national discretion treatments."

5.1.2 Simplified Standardized Approach: This method addresses the absence of evaluation institutions in certain countries by relying on assessment and risk weights from export credit guarantee agencies (ECGA). It simplifies credit risk measurement for banks (Basel Committee on Banking Supervision, 2017).

5.2. Internal Rating Based Approach (IRB):

This approach is tailored to individual banks, reflecting their risk management practices. Banks meeting specific criteria can use internal estimates to measure credit risk components for capital requirement calculations. These components include Probability of Default (PD), Loss Given Default (LGD), Exposure at Default (EAD), and Maturity (M) (Central Bank of Egypt, 2018).

Under IRB, Basel II offers:
5.2.1 Foundation Internal Rating System (FIRB): Banks estimate Probability of Default (PD) while using regulatory estimates for other risk components.
5.2.2 Advanced Internal Rating System (AIRB): Banks use their estimates for all risk components (PD, LGD, EAD, M) based on specific criteria (Aziz & Charpat, 1998).

Both methods require banks to classify credit facilities based on inherent risk characteristics.

In summary, Basel II's methodologies encompass a range of approaches tailored to varying banking needs, from standardized external ratings to advanced internal risk modeling, enabling a nuanced understanding and management of credit risks in global financial systems. Although the classification of facilities in this way is largely in line with most banking practices, some banks use other definitions to manage and measure their risks, so banks must provide sufficient evidence to the supervisory authority to follow an appropriate methodology in listing each type of facility within its asset class (Al-Madarima, 2021).

7. METHODOLOGY:

7.1 Analytical framework

Panel data, within econometrics, denotes a dataset where observations are collected across multiple variables over distinct time intervals for the identical set of individuals, units, or even entities. It constitutes a multidimensional dataset conducive to the longitudinal analysis of data over time. Panel data analysis is a statistical method frequently employed across various disciplines, including social sciences and econometrics, to scrutinize data that extends over numerous periods and concerns the identical individuals or entities (Adefemi, 2017).

This study adopts a practical approach and utilizes secondary panel data compiled from 2010 to 2022. The analysis integrates three statistical techniques: descriptive analyses, panel data unit-root (stationarity) tests, and the analysis of panel data regression.

7.1.1 Descriptive Analysis

Descriptive analysis is a statistical method utilized to offer a comprehensive summary or overview of sample or population data. It encompasses examining the characteristics and distribution of data through diverse tools and techniques. This may involve presenting the data via tables, frequency distributions, graphs, diagrams, and pictograms. Descriptive analysis also entails computing measures like medians, means, and standard deviations to comprehend the central tendency and variability of the data (Anggraeni et al., 2021). Through the application of descriptive analysis, researchers can attain insights into the fundamental features and patterns of the data under scrutiny.

7.1.2 Panel Data Unit-Root (Stationarity) Tests

The tests for stationarity or unit-root tests in panel data owe their development to the pioneering work of Lin and Levin, who conducted a series of studies in 1992, 1993, and 2002. Their contributions were rooted in the unit root test originally developed by Dickey and Fuller for time series analysis (Badrawi, 2015). Conducting unit-root tests is vital in panel data analysis as it ensures the stability or stationarity of data series, thereby yielding reliable results and avoiding spurious regressions.

Within this category of tests, there are four notable options:

1. Levin, Lin, and Chu t-test

2. Im, Pesaran, and Shin W-stat

3. ADF-Fisher Chi-square test

4. PP-Fisher Chi-square test

In all four tests, the null hypothesis assumes the presence of a unit root, indicating non-stationarity. Conversely, the alternative hypothesis suggests the absence of a unit root, implying stationarity (Baltagi, 2014). The analysis of unit roots can be based on the results of a single test, multiple tests, or the majority of tests. Consequently, the stability of study variables can be determined based on the majority of test outcomes (Kadi & Belkour, 2017).

Maddala and Wu (1999) concluded that the ADF-Fisher Chi-square and PP-Fisher Chi-square tests are straightforward and easy to use, generally preferred over the Im, Pesaran, and Shin W-stat and Levin, Lin, and Chu tests. Moreover, a study by Hoang and Cnown (2005) highlighted the ADF-Fisher Chi-square test as the most effective for assessing unit roots and determining the stability or stationarity of panel data series in terms of test robustness.

7.1.3 Panel Data Regression Analysis

A fundamental panel data regression model can be expressed as follows (Adefemi, 2017):

$$\mathbf{Y_{it} = a + bX_{it} + \varepsilon_{it}}$$

Where:

- ✓ $\mathbf{Y_{it}}$ represents the dependent variable,
- ✓ $\mathbf{X_{it}}$ represents the independent or explanatory variable,
- ✓ **a** and **b** are coefficients to be estimated,
- ✓ **i** and **t** are indices for individuals and time, respectively,
- ✓ $\boldsymbol{\varepsilon_{it}}$ represents the error term.

Panel data regression analysis can be carried out using three primary methods (Adefemi, 2017):
(1) Independently Pooled OLS regression model.
(2) Fixed effects model
(3) Random effects model

(1) Independently Pooled OLS Regression Model

The model described is the Independently Pooled OLS (Ordinary Least Squares) regression model, often considered one of the simplest cross-sectional time series models. This model assumes constant regression coefficients across all time periods and cross-sectional units. It relies on the standard assumptions of the normal multiple linear regression model and is estimated using the ordinary least squares (OLS) method (Ramadan, 2017).

In essence, the Independently Pooled OLS model treats each observation (cross-sectional unit at a specific time) as independent and pools all data together to estimate the coefficients. However, this approach ignores potential differences across cross-sectional units and time periods, which can lead to biased and less reliable results.

The main drawbacks of the Independently Pooled OLS model include:
1. Assumption of Homogeneity: The model assumes that regression coefficients are constant across all units and time periods, which may not reflect the true underlying relationships in the data.
2. Potential Bias: Ignoring individual-specific effects and time trends can lead to biased estimates, especially when there are unobserved factors affecting the dependent variable within specific units or over time.
3. Limited Flexibility: This model does not account for individual-specific characteristics or time-varying effects, potentially oversimplifying the relationship between variables.

As a result, while the Independently Pooled OLS model is straightforward and easy to implement, researchers should be cautious about its limitations and consider more advanced panel data models (such as fixed effects or random effects models) that can better capture heterogeneity across units and over time, leading to more robust and accurate estimates of the relationships of interest.

(2) Fixed Effects Model

The model being described here is the Fixed Effects Model, which allows for heterogeneity or individuality among different cross-sections (Amer, 2015). In this model, each cross-section (individual, entity, or unit) is permitted to have its own intercept, which remains constant over time.

Key characteristics of the Fixed Effects Model include:
1. Individual-Specific Intercept: The model allows each cross-section to have its own intercept term, capturing unique individual attributes that do not vary over time and are correlated with the independent variables.
2. Non-Stochastic Error Term: The error term in the fixed effects model is assumed to vary non-stochastically across each entity and time, reflecting individual-specific effects that are constant over time.
3. Control for Time-Invariant Factors: By including individual-specific intercepts, the fixed effects model controls for time-invariant factors that may affect the dependent variable but do not change over time within each cross-section.
4. Estimation with Dummy Variables: One common method to estimate the fixed effects model is by using dummy variables to represent each cross-section. These dummy variables capture the fixed effects of individual units on the dependent variable.

In summary, the fixed effects model focuses on capturing within-unit variation over time while controlling for individual-specific characteristics that remain constant across time periods. This approach is particularly useful when there are unobserved individual-level factors that could bias the estimates in a pooled regression analysis. By accounting for fixed effects, the model provides a more accurate estimation of the relationship between variables within each unit over time.

(3) Random Effects Model

The description provided about the random effects model accurately captures its key characteristics and assumptions (Amer, 2015).

In the random effects model:
1. Incorporation of Differences into Error Term: Unlike the fixed effects model, which allows for differences in intercepts (or other parameters) across cross-sectional units, the random effects model incorporates these differences into the error term. This implies that the differences between units and time periods are treated as random parameters rather than fixed ones.
2. Random Parameters: The random effects model assumes that the differences between cross-sectional units and time periods are random and can be captured by the error term of the model. This approach is based on the idea that the sample used in the analysis is randomly drawn from a larger population.
3. Regression Model Parameters: In the random effects model, the regression model parameters (such as coefficients) represent the average effects across the entire sample, including variations related to different cross-sectional units and time intervals within the bounds of random error.
4. Assumption of Random Sampling: The random effects model relies on the assumption that the data used for analysis are randomly sampled from a population, allowing the model to generalize the findings to the larger population.

Overall, the random effects model provides a flexible framework for analyzing panel data by capturing both within-unit and between-unit variations. It allows for efficient estimation of parameters while accommodating unobserved heterogeneity across cross-sectional units and

time periods within the framework of random error. Researchers often choose between fixed effects and random effects models based on the underlying assumptions about the nature of individual-specific effects and the structure of the error terms in the data.

The comparison between the fixed effects, random effects, and pooled OLS models is commonly conducted using a set of tests and criteria to determine the most appropriate model for panel data analysis. Several studies (Ramadan, 2017; Akbar, 2011; Le, 2015; Baltagi, 2014) have proposed various methods for comparing these models, including:

(1) Correlated Random effects-Hausman test:

The Correlated Random Effects (CRE) Hausman test is a statistical method used to decide between the fixed effects and random effects models for panel data analysis. The test is based on comparing the estimated coefficients and variances of the two models to determine which model is more appropriate given the data and underlying assumptions.

Hypotheses:

- Null Hypothesis (H0): The random effects model is the most suitable for the data.
- Alternative Hypothesis (H1): The fixed effects model is the most suitable for the data.

Decision Criterion:

- If the probability value (p-value) from the Hausman test is less than 5% (common significance level), we reject the null hypothesis (H0) in favor of the alternative hypothesis (H1). This suggests that the fixed effects model is more appropriate than the random effects model for the dataset.
- If the p-value is greater than 5%, we accept the null hypothesis (H0), indicating that the random effects model is preferred over the fixed effects model.

In summary:

- Reject H0: Choose the fixed effects model if the p-value < 0.05.
- Accept H0: Choose the random effects model if the p-value > 0.05.

The decision based on the Hausman test helps researchers determine which model adequately captures the structure of the data, considering the presence of individual-specific effects and other potential sources of correlation in panel data analysis.

(2) Wald test:

The Wald test, in the context described, is used to determine whether the Fixed Effects model is more appropriate than the Pooled OLS regression model for panel data analysis. The test compares the fit of the two models based on a specific hypothesis and decision criterion.

Hypotheses:

- Null Hypothesis (H0): The Pooled OLS regression model is appropriate, which implies that all coefficients (including dummy variables) in the model are zero.
- Alternative Hypothesis (H1): The Fixed Effects model is appropriate, indicating that at least one coefficient (such as a dummy variable capturing individual-specific effects) in the model is non-zero.

Decision Criterion:

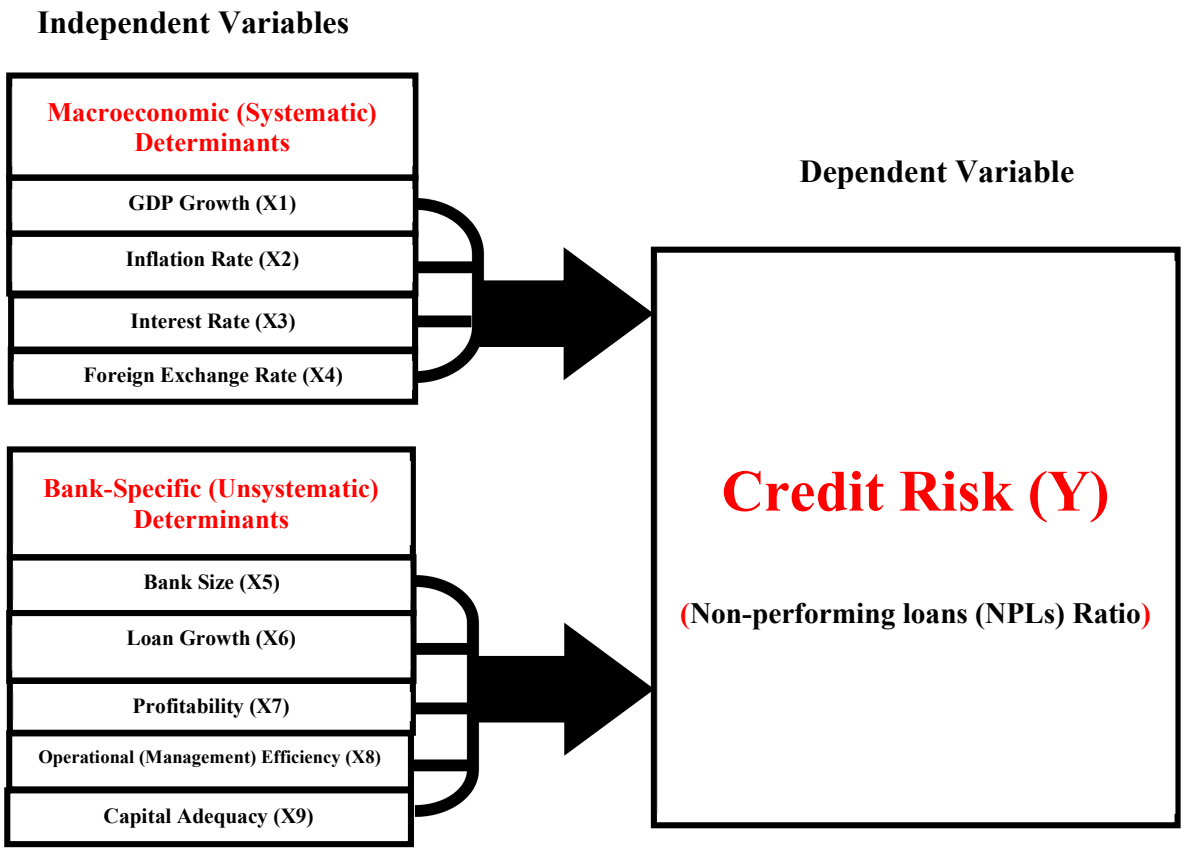
- If the probability value (p-value) from the Wald test is less than 5% (common significance level), we reject the null hypothesis (H0) in favor of the alternative hypothesis (H1). This suggests that the Fixed Effects model is more suitable than the Pooled OLS regression model for the dataset, indicating the presence of significant individual-specific effects.
- If the p-value is greater than 5%, we accept the null hypothesis (H0), indicating that the Pooled OLS regression model may be more appropriate, assuming that all coefficients are effectively zero.

In summary:

- Reject H0: Choose the Fixed Effects model if the p-value < 0.05.
- Accept H0: Consider the Pooled OLS regression model if the p-value > 0.05.

The decision based on the Wald test helps researchers determine the most appropriate model for panel data analysis, considering the presence of individual-specific effects and the overall fit of the models to the data. The Wald test is a valuable tool for model selection and hypothesis testing in econometrics and panel data analysis.

Figure 1 shows the main empirical model used to test the 9 hypotheses of this research, as shown below:



Source: prepared by the researcher

(**Figure 1**: The General Empirical Model)

7.2 Data and Sample Selection

Egypt's national banking institutions have been pivotal players in the nation's economic landscape, especially in times of turmoil. Beyond their traditional roles, public banks in Egypt also serve as catalysts for development, a role accentuated by recent governmental drives toward sustainable growth and finance. Spearheading this charge is the Central Bank of Egypt (CBE), which has taken the lead in promoting sustainable finance by subsidizing loans across various sectors, including SMEs, industry, agriculture, housing, and eco-friendly ventures aimed at curbing carbon emissions. The CBE's sustainable finance directives provide a framework for Egyptian banks to align with sustainable development goals (SDGs) through six core principles emphasizing environmental preservation, social responsibility, sound governance, and transparent reporting (CBE, 2021).

Moreover, under the watchful eye of the CBE, public banks actively partake in corporate social responsibility (CSR) initiatives that address critical societal needs such as education, healthcare, housing, and empowerment programs for women and individuals with disabilities. While primarily humanitarian in nature, these endeavors indirectly foster development. Egypt's major national banks, including the National Bank of Egypt, Banque Misr, and Banque du Caire, adhere closely to the Central Bank's guidelines concerning lending rates and national strategies. Prioritizing financial inclusion and fostering entrepreneurship, a substantial portion of their lending activities is directed towards SMEs, particularly in response to the COVID-19 pandemic, which has propelled the adoption of digital banking services (CBE, 2021).

In Egypt, alongside its commercial banking sector, there exist public development institutions, albeit with narrower scopes compared to their commercial counterparts. These include entities such as the National Investment Bank, Egyptian Agricultural Bank, Nasser Social Bank, Housing and Development Bank, Industrial Development Bank, and Export Development Bank of Egypt. However, when it comes to spearheading development-oriented initiatives, it is primarily the commercial banks, especially those government-owned, that assume the forefront. This analysis zooms in on the three foremost commercial banks, wielding significant influence over the Egyptian market, along with those commercial banks included in the EGX 30, which references the Egyptian market index.

The EGX30 index, denominated in local currency and priced in U.S. dollars since 1998, encompasses the 30 most liquid and actively traded companies, both financial and non-financial. Calculated based on market capitalization and adjusted for free float, the index derives the adjusted market value of a listed company from its listed shares, closing price, and percentage of floating shares. Monthly returns are computed using the monthly closing values of the EGX30 index. Among these banks are eight notable institutions: Commercial International Bank, Egyptian Gulf Bank, QNB Alahli Bank, Housing & Development Bank, Al Baraka Bank Egypt, Credit Agricole Egypt, Faisal Islamic Bank, and Abu Dhabi Islamic Bank.

The study delves into the intricacies of credit risk determinants within Egypt's commercial banking sphere, both systematic and unsystematic, employing the Non-Performing Loan (NPL) ratio as a pivotal metric. This ratio, derived by dividing the gross value of nonperforming loans (as recorded on the balance sheet) by the total value of the loan portfolio (inclusive of

nonperforming loans prior to loan loss provisions deduction), serves as a barometer for bank health and efficiency, spotlighting issues pertaining to asset quality within the loan portfolio. According to international standards, loans are designated as nonperforming when principal and interest payments are delinquent by 90 days or more, or when full receipt of future payments is not anticipated (IMF, 2006).

Spanning from 2010 to 2022, the research sources yearly data from the financial statements of three prominent commercial banks and the other eight banks of EGX30, with the data source acknowledged as Thomson Reuters. Independent variables, mirroring this timeframe, are categorized into systematic (macro-economic) and unsystematic (bank-specific) determinants. The latter, extracted from the financial statements of the aforementioned banks, encompass various facets (Kharabsheh 2019): Bank Size, gauged by total assets; Annual Loan Growth, quantified by the ratio of current-year loans to previous-year loans; Profitability, assessed through Return on Equity (ROE), computed as net profit divided by total equity; Operational Efficiency, measured by the ratio of operating expenses to operating income; and Capital Adequacy, determined by dividing total equity by total assets.

On the flip side, systematic determinants, as outlined by Kharabsheh (2019), encompass broader economic indicators: Gross Domestic Product, reflected in the annual country GDP rate (source: www.worldometers.info); Inflation Rate, denoting the annual inflation rate (source: www.cbe.org.eg); Interest Rate, signifying the annual central bank of Egypt (CBE) interest rate (source: www.cbe.org.eg); and Foreign Exchange Rate (FOREX), derived from the annual central bank of Egypt (CBE) foreign exchange rate (source: www.cbe.org.eg).

8. RESULTS AND DISCUSSION

8.1 Descriptive Analysis

Starting with the summarized descriptive statistics in Panel A of Table 1, the credit risk dependent variable reveals a maximum value of 1.97, a minimum of 0, an average (mean) of 0.33, a median of 0.19, and a standard deviation of 0.50. Concerning the independent variables, the Gross Domestic Product (GDP), as a macroeconomic (systematic) determinant, ranges from 0.02 to 0.07, with a mean of 0.04, a median of 0.04, and a standard deviation of 0.01. Additionally, the measure for capital adequacy, representing a bank-specific (unsystematic) determinant, shows a maximum of 0.17, a minimum of 0, a mean of 0.07, a median of 0.07, and a standard deviation of 0.04.

Panel B of Table 1 illustrates the contemporaneous bivariate correlations between the variables included in the analysis. Importantly, the correlations between each independent variable and the dependent variable are all below 0.80, suggesting that multicollinearity is not a concern among the variables (Gujarati, 2003). The correlations display varying signs, some of which may agree with or contradict existing theories and literature. However, it is crucial to recognize that correlation merely indicates a linear association between two variables, not a causal relationship (Ratner, 2009). Thus, our attention turns to the regression coefficients within the regression model employed, which will reveal the correct directional impacts of the results.

Table 1: Describing Research Variables

Panel A: Descriptive Statistics

Descriptive Statistics/ Variables	*Credit Risk_Y*	Macroeconomic (Systematic) Determinants				Bank-Specific (Unsystematic) Determinants				
		Gross Domestic Product_X1	*Annual Inflation Rate_X2*	*Interest Rate_X3*	*Foreign Exchange Rate (FOREX)_X4*	*Bank Size_X5*	*Annual Loan Growth_X6*	*Management Efficiency_X7*	*Profitability (ROE)_X8*	*Capital Adequacy_X9*
Mean	0.33	0.04	0.12	0.13	12.82	234742.57	1.06	1.77	0.11	0.07
Median	0.19	0.04	0.10	0.12	15.78	43247.18	1.20	1.81	0.14	0.07
Standard Deviation	0.50	0.01	0.06	0.03	6.12	391638.66	0.35	2.23	0.10	0.04
Minimum	0	0.02	0.05	0.10	5.81	0	0	0	-0.36	0
Maximum	1.97	0.07	0.23	0.20	24.79	1929926.62	1.48	26.09	0.25	0.17

(**Source:** Excel 2019)

Panel B: Correlations Matrix

Variables		*Credit Risk_Y*	*Macroeconomic (Systematic) Determinants*				*Bank-Specific (Unsystematic) Determinants*				
			Gross Domestic Product_X1	*Annual Inflation Rate_X2*	*Interest Rate_X3*	*Foreign Exchange Rate (FOREX)_X4*	*Bank Size_X5*	*Annual Loan Growth_X6*	*Management Efficiency_X7*	*Profitability (ROE)_X8*	*Capital Adequacy_X9*
Credit risk_Y		1									
Macroeconomic (Systematic) Determinants	**Gross Domestic Product_X1**	0.015772	1								
	Annual inflation rate_X2	0.018943	0.431464	1							
	Interest Rate_X3	0.02441	0.350503	0.690951	1						
	Foreign Exchange Rate (FOREX)_X4	0.046376	0.679225	0.544316	0.473421	1					
Bank-Specific (Unsystematic) Determinants	**Bank Size_X5**	-0.08389	0.202106	0.046472	-0.01441	0.313327	1				
	Annual Loan Growth_X6	0.192959	0.099513	0.054691	0.043079	0.105179	0.226702	1			
	Management Efficiency_X7	0.095322	-0.17885	-0.06133	-0.04434	-0.12353	-0.07274	0.162748	1		
	Profitability (ROE)_X8	0.019607	0.154393	0.078256	0.07645	0.174706	0.425567	0.447816	-0.1822	1	
	Capital Adequacy_X9	0.506135	-0.00684	-0.006	-0.00383	-0.00907	0.122248	0.548962	0.217671	0.485124	1

(**Source:** Excel 2019)

8.2 Panel Data Unit-Root (Stationarity) Tests

Table 2: Unit Root Tests

Variables/ Tests		Levin, Lin & Chu t	Im, Pesaran and Shin W-stat	ADF – Fisher Chi-square	PP – Fisher Chi-square
Significance/ Probability Level (Before Differencing)					
Credit risk (Y)		0.0025	0.4532	0.8132	0.4839
Macroeconomic (Systematic) Determinants	**GDP (X1)**	0.0930	0.1947	0.4716	0.0001
	Annual Inflation Rate (X2)	0.0156	0.0026	0.0096	0.0013
	Interest Rate (X3)	0.0000	0.0000	0.0000	0.9165
	Foreign Exchange Rate (X4)	0.9478	0.9940	1.0000	0.3786
Bank-Specific (Unsystematic) Determinants	**Bank Size (X5)**	0.0000	0.0000	0.0000	0.0000
	Annual Loan Growth (X6)	0.0000	0.0000	0.0000	0.0000
	Management Efficiency (X7)	0.9999	1.0000	1.0000	1.0000
	Profitability_ ROE (X8)	0.0000	0.0015	0.0058	0.3249
	Capital Adequacy (X9)	1.0000	0.3376	0.6904	1.0000
Significance/ Probability Level (After Differencing (1st. Difference))					
Credit risk (Y)		0.0000	0.0014	0.0050	0.0000
Macroeconomic (Systematic) Determinants	**GDP (X1)**	0.9951	0.0047	0.0155	0.0001
	Foreign Exchange Rate (X4)	0.8015	0.0054	0.0175	0.0000
Bank-Specific (Unsystematic) Determinants	**Management Efficiency (X7)**	0.0000	0.9934	0.0000	0.0000
	Capital Adequacy (X9)	0.0000	0.0157	0.0483	0.0028

(**Source:** EViews 13)

Table 2 reveals that several variables, including Credit risk, Gross Domestic Product (GDP), Foreign Exchange Rate, Management Efficiency, and Capital Adequacy, display significance levels exceeding 5% across multiple tests or in all of them. In contrast, other variables show significance levels below 5% in only one test or across the four tests performed. However, when the first differences are taken for the variables with significance levels above 5% in all tests, their significance levels shift from insignificant to significant in at least three tests. This indicates the robustness of the final panel data used for both independent and dependent variables, as confirmed by the majority of the tests.

8.3 Panel Data Regression Analysis

Shifting to the Panel Data Regression Analysis models presented in Table 3, which cover the entire period from 2010 to 2022, it is clear that the random effects model is the appropriate choice. The explanatory variables utilized by the researchers significantly impact the credit risk dependent variable, except for the interest rate. Key findings include:

1. Gross Domestic Product (GDP) shows a negative effect on credit risk with a significance level below 1%.
2. The annual inflation rate demonstrates a negative effect on credit risk at a significance level below 1%, contradicting prevailing theory and aligning with some literature (Makri et al., 2014; Nkusu, 2011). These studies argue that higher inflation reduces the real value of outstanding debt, thereby enhancing the repayment ability of households and businesses (Nkusu, 2011). Similarly, Khemraj and Pasha (2009) examined the banking sector in Guyana, finding a negative relationship between inflation and NPLs, attributing their results to increased wages accompanying inflation, which sustain repayment capabilities. Recent

evidence from the Indian banking sector also suggests that the risk of bank failure decreases during inflationary periods (Gulati et al., 2019).

3. The foreign exchange rate has a positive impact on financial distress at a significance level below 1%.
4. Bank size negatively affects credit risk at a significance level below 1%, contradicting prevailing theory and aligning with some literature (Alhassan, Kyereboah-Coleman, & Andoh, 2014; Hu, Li, & Chiu, 2004; Salas & Saurina, 2002). Larger banks are argued to be better equipped to conduct thorough credit screening, assess borrower creditworthiness, and manage defaulters due to advanced risk management systems and procedures (Louzis et al., 2012; Salas & Saurina, 2002; Solttila & Vihriâlâ, 1994). Larger banks also allocate more resources to loan evaluation and analysis, thereby avoiding lending to low-quality borrowers (Hu et al., 2004). In contrast, smaller banks with limited risk management tools may struggle to handle defaulters, leading to higher NPLs. The diversification hypothesis also suggests that larger banks have lower NPLs due to greater diversification compared to smaller banks (Louzis et al., 2012).
5. Annual loan growth negatively impacts credit risk at a significance level below 1%, contradicting prevailing theory and partially agreeing with some literature, such as Jabbouri & Naili (2019a), who found a negative but statistically insignificant correlation between credit growth and NPLs across a sample of 98 banks in 10 MENA countries from 2003 to 2016. They attributed this negative sign to the crowding-out effect in the MENA region during the study period, which restricted access to loans for risky firms and individuals, consequently reducing the accumulation of NPLs. However, other studies argue that the impact of credit growth on banks' bad loans is dynamic rather than static (Klein, 2013; Makri et al., 2014; Vithessonthi, 2016).
6. Management efficiency shows a negative impact on credit risk at a significance level below 1%.
7. Profitability (ROE) has a negative effect on credit risk at a significance level below 1%.
8. Capital adequacy demonstrates a negative impact on credit risk at a significance level below 1%.

The R-square and adjusted R-square values of 0.987096 and 0.986223, respectively, indicate that the independent variables explain 98.7% and 98.6% of the variation in credit risk. The remaining percentage is attributed to factors or variables beyond the scope of this study.

Table 3: Panel Data Regression Analysis Models (2010: 2022)

Variables/ Tests		Random Effects			Fixed Effects			Pooled Effects		
		Coefficient	T	Sig. T	Coefficient	T	Sig. T	Coefficient	T	Sig. T
C		2.584135	49.27293	0.0000	2.584135	49.27293	0.0000	2.584135	175.6448	0.0000
Macroeconomic (Systematic) Determinants	GDP (X1)	-0.256282	-3.00616	0.0032	-0.256282	-3.00616	0.0032	-0.256282	-10.71615	0.0000
	Annual Inflation Rate (X2)	-0.208938	-9.43706	0.0000	-0.208938	-9.43706	0.0000	-0.208938	-33.64059	0.0000
	Interest Rate (X3)	0.049775	0.824363	0.4112	0.049775	0.824363	0.4113	0.049775	2.938633	0.0033
	Foreign Exchange Rate (X4)	0.005770	8.239103	0.0000	0.005770	8.239103	0.0000	0.005770	29.37020	0.0000
Bank-Specific (Unsystematic) Determinants	Bank Size (X5)	-1.83E-07	-3.3668	0.0010	-1.83E-07	-3.3668	0.0010	-1.83E-07	-12.00174	0.0000
	Annual Loan Growth (X6)	-0.258604	-20.80249	0.0000	-0.258604	-20.8025	0.0000	-0.258604	-74.15531	0.0000
	Management Efficiency (X7)	-0.402633	-51.7038	0.0000	-0.402633	-51.7038	0.0000	-0.402633	-184.3101	0.0000
	Profitability_ ROE (X8)	-6.184755	-49.7309	0.0000	-6.184755	-49.7309	0.0000	-6.184755	-177.2772	0.0000
	Capital Adequacy (X9)	-10.65584	-37.0644	0.0000	-10.65584	-37.0644	0.0000	-10.65584	-132.1247	0.0000
R^2		0.987096			0.987096			0.987096		
Adjusted R^2		0.986223			0.985103			0.987022		
F		1130.451			495.2152			13284.92		
Sig. F		0.000000			0.000000			0.000000		
Sig. Hausman test		1.0000								
Appr. Model		Random Effects Model								

(**Source:** EViews 13)

9. CONCLUSION & SUGGESTIONS

9.1 Conclusion

This study offers valuable insights into the complex relationship between various macroeconomic (systematic) and bank-specific (unsystematic) determinants and credit risk within the Egyptian commercial banking sector. The analysis highlights the significant role of the foreign exchange rate in amplifying credit risk, particularly in the context of the Egyptian pound's floatation. The depreciation of currency, which diminishes its value relative to foreign currencies, introduces considerable risk and uncertainty. Banks, being among the most vulnerable financial institutions to exchange rate fluctuations, are particularly impacted by these movements. Beck et al. (2015) emphasize that currency depreciation has a substantial negative effect on banks' credit quality, especially in countries with widespread currency mismatches. This effect is further compounded when banks in such nations have a significant proportion of private sector debt denominated in foreign currencies, leading to greater susceptibility to non-performing loans (NPLs) due to the increased debt servicing costs faced by unhedged borrowers.

Moreover, the study finds that GDP and annual inflation rates have negative effects on credit risk, highlighting their mitigating roles. This is consistent with the broader understanding that favorable macroeconomic conditions reduce the likelihood of credit defaults. On the bank-specific side, all unsystematic determinants were found to negatively impact credit risk, underscoring the need for careful management within the Egyptian commercial banking sector to minimize these risks.

The relationship between cost efficiency and bad loans has been a subject of extensive research, though results remain inconclusive. Notably, Berger and Deyoung's (1997) exploration of this connection introduced the "skimping hypothesis," which posits that banks achieving short-term cost efficiency by allocating limited resources to credit underwriting and monitoring may, in fact, experience a growing pool of NPLs in the long term. This hypothesis, alongside the broader literature, underscores the importance of comprehensive risk management practices.

A considerable body of literature also attempts to clarify the relationship between banks' performance and NPLs, particularly exploring whether lagging profitability affects NPL levels. Louzis et al. (2012) introduce the "poor management hypothesis," suggesting that low profitability may indicate inadequate management skills and credit strategies, leading to higher NPLs. This view is supported by Ghosh (2015), who finds that higher profitability is associated with lower NPLs, as profitable banks are less likely to engage in excessive risk-taking.

Finally, the study touches upon the capital adequacy ratio (CAR) and its inverse relationship with NPLs. Shrieves and Dahl (1992) argue that undercapitalized banks tend to increase their capital in response to heightened risk exposure, whereas banks with substantial risk capital lend more cautiously, reducing the likelihood of NPLs. This finding is echoed by Barth, Caprio, and Levine (2004), who contend that banks with low CARs often adopt riskier lending practices to

boost profits, leading to higher NPL levels. The moral hazard hypothesis, proposed by Keeton and Morris (1987), further explains this relationship, suggesting that managers of thinly capitalized banks engage in riskier activities because they face limited losses in case of failure.

Overall, this study underscores the importance of both systematic and unsystematic factors in shaping credit risk within the Egyptian commercial banking sector. Policymakers, bank managers, and regulators should pay close attention to these determinants, especially in times of economic volatility, to ensure the stability and resilience of the banking sector.

9.2 Suggestions

1. Explore Alternative Models: Future research should consider exploring alternative models of credit risk determinants, as different models may yield varying results. By expanding the study to include additional time periods and a broader range of commercial banks, researchers can enhance the representativeness of their findings. Furthermore, applying this study to other banking sectors beyond commercial banking could provide a more comprehensive understanding of the underlying dynamics of credit risk across different financial institutions.

2. Incorporate Significant Political and Market Events: An empirical study could benefit from a segmented analysis that takes into account significant political and market events in the Egyptian stock market. Incorporating events such as the 2011 and 2013 revolutions, the 2016 Egyptian pound floatation, the global COVID-19 pandemic in 2020, and the ongoing Russian-Ukrainian and Israeli-Palestinian conflicts could offer deeper insights into the impact of these events on credit risk within the commercial banking sector. This approach would allow for a more nuanced understanding of how external shocks influence the financial stability of banks.

3. Investigate Bidirectional Effects: Future research could also delve into the bidirectional effects between pairs of research variables by employing Granger causality tests in the short term or the Toda and Yamamoto (1995) approach in the long term. This methodology could uncover interrelationships and causal links among the variables, providing a clearer picture of the directional influences at play. Such an analysis would be instrumental in understanding the dynamic interactions between systematic and unsystematic factors and their collective impact on credit risk in the Egyptian commercial banking sector.

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المستخلص:

تستكشف هذه الدراسة محددات مخاطر الائتمان المنتظمة وغير المنتظمة في قطاع البنوك التجارية المصري، وذلك باستخدام دراسة تطبيقية. استخدم البحث منهجاً تطبيقياً من خلال جمع البيانات الثانوية بين 2010 و2022. لتحقيق ذلك، صاغت الدراسة تسع فرضيات واستخدمت نموذج انحدار البيانات المقطعية العشوائي التطبيقي. أثبتت النتائج التحقيق صحة خمس فرضيات مع النظرية .ثلاث فرضيات تتناقض مع النظرية السائدة وتتفق جزئيا مع بعض الدراسات السابقة. تم رفض الفرضية المتبقية. يجب أن تستكشف البحوث المستقبلية نماذج بديلة لمحددات مخاطر الائتمان للحصول على منظور أوسع من خلال تضمين فترات زمنية وقطاعات مصرفية متنوعة خارج البنوك التجارية .بالإضافة إلى ذلك، فإن دمج الأحداث السياسية والسوقية الهامة، مثل الثورات المصرية، وتعويم الجنيه في عام 2016، وجائحة الكورونا 2019، والصراعات المستمرة، يمكن أن يوفر رؤى أعمق حول تأثيرها على مخاطر الائتمان .وأخيرا، فإن التحقيق في التأثيرات ثنائية الاتجاه بين متغيرات البحث باستخدام اختبارات جرانجر للسببية أو منهج تودا وياماموتو يمكن أن يوضح العلاقات السببية والتفاعلات بين العوامل المنتظمة وغير المنتظمة التي تؤثر على مخاطر الائتمان في قطاع البنوك التجارية المصري.

الكلمات المفتاحية: *مخاطر الائتمان، المحددات المنتظمة، المحددات غير المنتظمة، قطاع البنوك التجارية، نموذج انحدار البيانات المقطعية العشوائي، مصر.*