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Abstract

This study examines the macroeconomic determinants of loan quality of publicly listed banks in Egypt, primarily the non-performing loans (NPLs). This research uses panel data from 10 listed banks between 2000–2024 and multiple regression analysis to determine NPL macroeconomics determinants namely: GDP growth, exchange rate (EXH), interest rate and unemployment). The results revealed that the GDP growth and exchange rate significantly negatively correlate with the NPLs indicating that the better the economic performance and external financial conditions the higher is the repayment capacity of borrowers and financial stability. On the other side, the results fail to support the predictive power of interest rate and unemployment on NPLs in this study model, probably because fixed interest contracts could limit the liability of the borrowers along with the dominant share of corporate loans over consumer lending. The results highlight the crucial role of economic growth and exchange rate stability as determinants of credit risk and the ability of the Egyptian banking sector to withstand and overcome the challenges it faces.

Keywords: Non-performing Loans; GDP_Growth; Exchange_Rate; Interest_ Rate; Unemployment Rate

1. Introduction

Non-performing loans (NPLs) are loans on which the borrower has stopped making payments – these types of loans can greatly hamper the ability and efficiency of a banking sector from working well, especially in emerging economic systems such as Egypt. NPLs not only impact banks profitability and capital but also have implications on economic growth and financial stability.

Knowing the interaction of NPLs and the macroeconomic forces that are affecting them is important information for policymakers, financial institutions and investors.

Central Bank of Egypt (CBE) provides support to this decreasing trend through figures that showed recently NPLs have been declined. The NPL ratio was 2.4% in September 2024, down from 2.7% as of end-June 2024. This drop is notable in comparison to the 7.6% ratio recorded in June 2015, demonstrating major benefits in the last ten years.

According to the CBE, the NPL ratio for the ten largest banks in Egypt stands at 2.4%, while the ratio for the five largest banks is registered at 2.2% as of last December. Even at the end of 2023, banks provisioned 88.7% of total NPLs for the remaining loan book, 95.2% of total NPLs for the top ten banks and 100% for the top five.

2. Research Problem

Although the NPL ratios are low, the relatively rapid expansion of banks' financial positions reached EGP 21.187 trillion in September 2024 — is reflecting an increasing risk of asset quality and financial stability. This expansion, together with potential macroeconomic changes, led to the need for a better understanding of the underlying impact that such expansion would have on the riskiness of banks' loan portfolios. Also, the pro–cycle provisions or in other words the provisions coverage ratio held by banks — 88.7% of NPLs by December 2023 — must be considered well providing that the sufficiency of such provisions be evaluated in relation to the credit risk faced.

The key question is how can Egyptian banking sector withstand this growth while keeping the loan portfolios healthy and keeping NPL ratios low? Resuming loan growth is a natural tendency for institutions but if external controls and risk management strategies have not matured in parallel, the volume of non-performing loans (NPLs) may very well escalate rapidly based on changes in economic conditions or unexpected macroeconomic shocks.

Moreover, the banks' profitability is highly linked to macroeconomic factors that influence the borrower's ability to pay back the loan. The ongoing inflation rates, high interest rates, and volatile exchange rates are bound to dampen borrowers' financial capacities and potentially raise their default risk. In the short run, even if the NPL ratio is low, the macroeconomic environment can have a large impact on loan repayment and thus turn into a default over a longer time frame.

Accordingly, This research is an attempt to answer the following research question

How do macroeconomic variables (GDP growth, Currency Exchange, Inflation, Interest, Unemployment rates) affect the asset quality of Publicly listed Egyptian banks measured by NPL?

3. Literature review

3.1 Theoretical Farmwork

Non-performing Loans (NPLs) refer to loans that are not receiving the expected interest or principal payments, with these loans being categorized as loans where the borrower has defaulted or as loans where those who owe money have not made a scheduled payment for 90 days. Non-performing loans (NPLs) are an important dimension of banks´ financial health – they capture credit risk, and they are detrimental to a bank´s profitability, liquidity, and capital adequacy. Sustainability in the banking sector rests on a comprehensive understanding of NPLs and underlying causes of their increase.

This theoretical framework is intended to examine how the determinants, consequences, and management of NPLs and the model is built from a few existing theories in banking and finance.

3.1.1 Credit Risk Theory

NPLs are best explained through the lens of credit risk theory, which deals with loss of the lender arising from the fact that the borrower does not repay the credit in time. The principle states that banks are always facing the kind of default risk every time they loan money to borrowers. The borrower's credit health, loan terms, and broader macroeconomic conditions all contribute to credit risk (Zamore *et al*., 2018).

- **Loan Default Risk** — According to credit risk theory, loans enter into default when the borrowers start defaulting due to severe financial stress, recession or other adverse conditions that prevent payback. This risk rises with the strength of the borrower, lack of security or weak loan servicing arrangements.
- **Borrowers With A Weaker Credit Profile**: Debt repayment is also influenced by one's credit profile or lack of income, and as per the theory whereby a borrower with a weaker credit profile is at higher risk of defaulting than a borrower whose credit profile is stronger.

These emphasize the value of credit checks and risk mitigation initiatives by the banks. (Basso,2016).

3.1.2 Macroeconomic Theory

Macroeconomic theory is a sub-field of economics that studies economy-wide phenomena, such as inflation, unemployment, economic growth, government fiscal and monetary policies, and international trade. Macroeconomic theory, at its best, seeks to both explain the behavior of economies and identify causes of these economic fluctuations, and finally to give policy prescriptions to achieve objectives like stable growth, low unemployment, and price stability. (Andolfatto, 2008; Chadha & Warren, 2021).

Macroeconomic factors play both direct and indirect roles on the NPL level as macroeconomic theory studies how macroeconomic variables affect the behaviors of borrowers and lenders given that the behavior of borrowers and lenders are closely related to the NPL ratio. Some of the key variables are inflation, interest rates, exchange rates and GDP Growth, all of which can affect borrower repayment capacity greatly.

- **Interest rate and NPLs:** The macroeconomic theory stipulates that an increase in interest rate raises the cost of borrowing which may adversely affect the repayment capacity of the borrowers and thus upsurge the default rates. This relationship is especially important in variable interest rate economies where loan repayments can become unsustainable during times of monetary tightening.
- **Impact of Economic Growth on Loan Repayment:** Theory assigns considerable importance to the health of the economy on the income and repayment behavior of the borrowers. High economic growth increases the likelihood that borrowers will repay their debts, resulting in a lower NPL ratio. On the other hand, economic recessions or stagnation can raise NPLs, as corporate and household budgets are squeezed by falling income and rising hardship.
- **Inflation**: in fact, inflation weakens the repayment ability of the borrowers, especially those with fixed income. Bloated inflation pushes borrowers into a difficult spot about paying their debts — therefore the defaults are multiplied. According to the theory, banks that lend in high-inflation environments need to adjust their loan management, in that

operation that will balance a higher expected credit risk carried out by the borrower as inflation rises over time. (Barbosa, *et al.,* 2020).

3.1.3 Agency Theory

Agency theory examines the dynamics between principals—think shareholders—and agents—like company executives—who are given the power to make decisions. It looks at how this creates friction when the interests of the people we hire, the agents, are not aligned with those of the principals, the people hiring agents. This creates a potential conflict called the principal-agent problem. (Hendrastuti, & Harahap, 2023)

One of the most influential contributions to agency theory was made by Michael C. Jensen and William H. Meckling in their 1976 paper "Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure," where they condensed the concept of agency costs and their effects on organizational structures.

Concerning the application on banking sector, The agency theory also develops and explains the relationship between lenders (banks) and borrowers, who have different incentives and possess different information about the return on investment of the loan proceeds. Lenders generally are interested in being paid back the loans they offer, and borrowers have incentives if the consequences of borrowing are insignificant or not critical. The main contents of agency theory are information Asymmetry and Moral Hazard which are explained as follows:

- **Information Asymmetry:** At the core of the agency theory is Information Asymmetry in which the lender (bank) do not have full accurate information regarding the financial condition or intentions of the borrower. Causing adverse selection: This information asymmetry between lenders and borrowers can result in adverse selection, wherein borrowers with a higher probability of default are more likely to receive loans thereby increasing NPLs.
- **Moral Hazard:** Related to agency theory, moral hazard is the possibility that borrowers will engage in riskier actions after taking out a loan because they do not bear the entire cost of default (through the loss of collateral or bankruptcy, for instance). This is the reason in such scenarios, banks could end up with a balance sheet mostly comprising loans that could be on the verge of defaulting.

3.1.4 Institutional theory

Institutional theory feeds valuable insights into the external factors that structure organizational behavior. It facilitates the understanding of why organizations adopt specific practices to obtain legitimacy, even if those practices do not directly enhance efficiency.

In the banking sector , The institutional theory emphasize that the features of the banking system, regulatory system, and institutional environment inform NPLs. The levels of NPLs are influenced simultaneously by the quality of national financial institutions, the efficiency of regulatory oversight and the adequacy of legal systems. Accordingly, Regulatory Environment and Governance of Banking System critical factors in applying institutional theory to banking sector. (Lammers, 2014).

- **Regulatory Environment:** Bank behavior and NPL management is closely tied to the regulatory environment regarding banks. The massive buildup of NPLs is more controllable in countries with a strong regulatory framework and effective monitoring mechanism. Such measures include regular stress tests, capital adequacy that stops banks from unduly lending, and regulator-driven prompt corrective actions that help prevent loan defaults by offsetting credit risk.
- **Governance of Banking System:** Governance practices in the banks which will include risk management practices, credit assessment techniques, and loan monitoring is vital in managing credit risk to avoid NPLs. Higher SME NPLs are typically found in countries with poor governance, weak internal controls and lax lending practices.

3.2 Previous Empirical Research

Economic growth, interest rates, inflation, currency exchange and unemployment rates are the most commonly used macroeconomic factors when it comes to examine the significant impact of macroeconomic variables on non-performing loans.

Anita, Tasnova, Nawar (2022) empirically examines macroeconomic determinants of non-performing loans (NPLs) in eight South Asian Association for Regional Cooperation (SAARC) countries: Afghanistan, Bangladesh, Bhutan, India, Nepal, Maldives, Pakistan and Srilanka. Using annual data between 2008 and 2019, the authors apply several econometric methodologies (OLS, fixed and random effects estimates) with the robust fixed effects model to correct for the problem

of heteroscedasticity. The results of the study confirmed a positive and significant correlation between the government balance and the NPLs, while it showed a negative correlation with some important macroeconomic variables like GDP, sovereign debt, inflation and money supply.

Beck *et al*., (2015) analyze macroeconomic determinants affecting non-performing loans ratios of 75 countries during 2006 to 2015 and point out multiple significant and macroeconomic determinants of non-performing loan (NPL) ratios. Real GDP growth, share prices, exchange rates, and the lending interest rate were all found to be important NPL dynamics drivers. Importantly this study showed that changes in economic activity, specifically the growth rate of real GDP, is a key determinant of bank credit portfolio quality. The results also highlighted the impact of exchange rate depreciations in those countries where foreign currency-denominated lending is high. In particular, the appreciation of the exchange rate further aggravates the quality of banks' assets in countries such as Poland, Hungary and Croatia, where most loans are classified in foreign currencies, especially the Swiss franc. This study highlights the importance of macroeconomic variables in driving the performance of loan portfolios and provides significant evidence on the determinants of NPL ratios in developed and emerging market economies.

Interest rate and NPLs has been widely studied in literature and almost all research concluded with the same result that higher interest rate increases the defaults on the loans and that leads to higher volume of NPLs. A study by Ahmed & Bashir (2013), Examining the determinants of the non-performing loans of Pakistan country, through the Exposure of explanatory power of macroeconomic variables, to the banks Non-performing loans (NPLs). They found a significant positive relationship between Interest rate and NPLs. As shown in his findings, high-interest rates lead to expensive borrowing costs, therefore, making loan repayments costlier for debtors, thus increasing the risk of defaults. This, especially noticeable in cases where borrowers unable to cope, because of the interest rate increase with heavier financial burdens, face difficulty in repayment with grow of NPLs. This perspective is further supported by (Araka, Otieno & Mogwambo, 2021) who argued that an increase in interest rates is largely exerting pressure on borrowers accordingly there is a high probability of default which increase the non performing rate ration in banks .

Kjosevski, J., & Petkovski, M. (2021) studied the macroeconomic drivers of NPLs in the Baltic States and determined that NPLs in the Baltic States are significantly impacted by a number of common macroeconomic factors. The empirical analysis showed a significant relationship

between NPLs and changes in GDP, public debt, inflation and unemployment in the Baltic region.In a similar context, Curak *et al*., (2013) analyzed banks from the countries of Southeastern Europe over the period of 2003–2010 by using generalized method of moments also concluded similar results. Using observations from 120 countries, their study illustrates the strong patterns in which higher NPL ratios were linked with lower economic growth, higher inflation, and higher interest rates. The findings underscore the importance of a macroeconomic stability in explaining the health of a banking sector, especially in regions with more precarious economic conditions. Both studies reiterate the intricate correlation between economic activity and the quality of bank assets, with adverse macroeconomic developments triggering weakening loan quality.

Louzis *et al*., (2011) furthermore studied nine significant banks in Greece for the period of 2003 Q1 to 2009 Q3, found that NPLs were relatively explained by three fundamental macroeconomic parameters, including real GDP growth rate, loan volume, and unemployment rates. The study used panel data of these nine banks and intended to test the determinants of the growth of NPLs of Greek banking system. Loans were disbursed in the form of consumer loans, working capital loans and mortgages. The study discovered that macro variables such as real GDP growth, unemployment and loan rate are also important factors contributing to growth of NPLs, and several bank-specific variables such as performance, quality of management, and risk management are also tightly related to NPL growth. these results highlight the role of both macroeconomic factors and internal bank controls affecting the performance of a bank's loans.

Chen *et al*., (2014) examined the impact of economic growth on credit default of low-income economies. The findings showed an inverse correlation between the rate of economic growth and credit risks. The risk of default and level of credit risks increased as the economy slowed to confirm the importance to establish sustainable economic growth to reduce credit risks and improve financial stability.

Jakubik and Reininger (2013) investigate the determinants of non-performing loans (NPLs) by means of a survey covering banks located in Central, Eastern, and Southeastern European countries, and found economic growth to be the most important economic variable (inversely correlated to NPL ratios). This study used a panel data data set which included nine Western Balkan countries: Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, Russia, Slovakia and the Ukraine. The research also instead found exchange rate variability — along with the high

level of foreign currency lending — to be important determinants of NPL ratios, (along with economic growth). In fact, the study showed quantitatively that those risks can bring bank asset quality problems through excessive loan growth and foreign currency-dominated loans.

Vogiazas and Nikolaidou (2011) explored macroeconomic factors that lead to non-performing loans (NPLs) for the period December 2001 to November 2010. Several macroeconomic determinants influencing NPLs in Romania were identified in the empirical study, including monetary aggregates, interest rates, financial markets, and internal bank-specific variables. It included the years of both economic expansion and economic crash. Since the Greek banks have a high market share in Romania, the researchers also included variables to proxy the Greek crisis so that they could examine the reaction of Romanian banking sector to the Greek crisis. The results showed that credit risk in the Romanian banking system was jointly determined by macroeconomic variables (especially construction and investment expenditure, inflation, unemployment and the, external debt-to-GDP ratio), as well as by M2 and crisis-related variables specific to Greece.

Batrancea *et al*., (2021) provided an alternative way to think about the relationship between macroeconomic variables and NPLs. Unlike the standard view that highlights NPL ratios as dependent variables affected by macroeconomic variables, GDP growth can explained in their dataset as a dependent variable influenced by the NPL ratio, bank capital-to-assets ratio, bank liquid reserves-to-assets ratio, interest rate spread, and inflation. The researchers found that out of these factors, bank capital/asset ratio was the most powerful force leading to economic development. This view reframes non-performing loans (NPLs) as not just an outcome of macroeconomic fundamentals, but also an essential input to overall economic performance—the health of the bank capital system—determining the basic channel through which NPLs do or do not contribute to such growth. It provides further granularity to our understanding of capitalist growth, and the interplay between banking health and the real economy.

Lee and Kim (2017) examined the impact of interest rates on credit spread of low income countries. The study revealed a positive relationship between interest rates and credit spreads, suggesting higher credit risks associated with higher interest rates. The authors emphasized the importance of monitoring interest rate movements and their potential implications for credit risk management.

Chen and Wu (2019) examined the impact of exchange rate depreciation on corporate default risk in emerging economies. The study revealed that exchange rate fluctuations significantly affected

default probabilities, particularly for firms having high foreign currency exposures. A depreciation of the local currency made default risk worse by increasing the debt burden for these firms.

3.3 Research Hypotheses

Based on the above literature review, five null hypotheses will be tested in this research as follows:

Ho1: GDP Growth has a significant negative impact on non-performing loans of publicly listed banks in Egypt.

Ho2: Exchange rate has a significant positive impact on non-performing loans of publicly listed banks in Egypt.

Ho3: Inflation rate has a significant positive impact on non-performing loans of publicly listed banks in Egypt.

Ho4: Interest rate has a significant positive impact on non-performing loans of publicly listed banks in Egypt.

Ho5: Unemployment rate has a significant positive impact on non-performing loans of publicly listed banks in Egypt.

3.4 Data Description.

Panel data was used in this study, which was obtained from 10 publicly listed banks in Egyptian Stock Exchange, during the period 2000 - 2024. Selected banks are a mixture of commercial, Islamic, development and international banks, which increase the representativeness of the results.

Data was collected from International Database platform of Bankscope, audited financial statements, annual reports and disclosures via the Banks Index of the Egyptian Stock Exchange along with other financial publications.

Using this period is important as it enables the exploration of long nature of macroeconomic variables and loan quality over economics. The dataset is comprehensive and consistent over time, and this strengthens the empirical robustness of the regression and statistical analyses conducted in the paper.

The united bank was excluded from the sample, for reason of its unique formation in 2006. It was set up based on the Central Bank of Egypt (CBE)'s decision to merge three Egyptian national banks in financial instability.

Table 1: List of Publicly Listed Banks in Banks Index of Egyptian Stock Exchange as at December ,2024

ISIN	Reuters Code	Company Name
EGS60111C019	ADIB.CA	Abu Dhabi Islamic Bank- Egypt
EGS60101C010	SAUD.CA	Al Baraka Bank Egypt
EGS60121C018	COMI.CA	Commercial International Bank-Egypt (CIB)
EGS60041C018	CIEB.CA	Credit Agricole Egypt
EGS60182C010	EGBE.CA	Egyptian Gulf Bank
EGS60241C014	EXPA.CA	Export Development Bank of Egypt
EGS60321C014	FAIT.CA	Faisal Islamic Bank of Egypt - In EGP
EGS60301C016	HDBK.CA	Housing & Development Bank
EGS60081C014	QNBE.CA	Qatar National Bank
EGS60231C015	CANA.CA	Suez Canal Bank S.A.E
EGS600M1C017	UBEE.CA	The United Bank

Source: Egyptian Stock Exchange: Banks Index Constituents

3.4 Research Variables

Table .2 represents the selected variables which were selected based on their theoretical importance and empirical significance in previous literature examining the loan quality of the banking sector. The non-performing loan serves as The Dependent Variable. However, the following five macroeconomic variables serve as independent variables namely , GDP Growth Rate (GDPG), Exchange Rate (EXH),Inflation Rate (INF) ,Interest Rate (INT),Unemployment Rate (UEM)

Table 2: The Dependent and Independent Variables

Variable	Measurement
NPLs (Non-Performing Loans)	NPL = (Non-Performing Loans / Total Loans) * 100
GDP Growth Rate (GDPG)	GDP Growth Rate = ((GDP in Current Year - GDP in Previous Year) / GDP in Previous Year) * 100
Exchange Rate (EX)	Exchange Rate is the amount of local currency (EGP) required to buy one unit of foreign currency (USD).
Inflation Rate (INF)	Inflation Rate = ((Consumer Price Index (CPI) in Current Year - CPI in Previous Year) / CPI in Previous Year) * 100
Interest Rate (INT)	Average Annual Interest rate by CBE
Unemployment Rate (UEM)	Unemployment Rate = (Number of Unemployed Persons / Labor Force) * 100

3.5 Research Methodology.

This study adopted a quantitative methodology to investigate the determinate factors of NPLs in publicly traded banks in Egyptian Stock Exchange. The methodology is multi-step, aiming for a rigorous analysis of the relationship between broad economic factors (GDP Growth, Exchange rate, Interest rate and Unemployment rate) as independent variables and NPLs as a dependent variable.

First the descriptive statistics that provide a quick overview of data characteristics which cover mean, median, range, standard deviation, and variance that can provide a summary of data's distributions and central tendencies.

Second, The Jarque-Bera test is one of the common tests for testing the normality of the residuals. This test shows whether the data follows some normal distribution, which is vital for regression

analysis. Normality should be checked, and if it does not hold sufficient transformations/alternatives should be adapted.

Third, The VIF is calculated to determine the potential multicollinearity among the independent variables. The linear relationship test is made to determine if there are linear relationships between the predictor variables so that there will not be multicollinearity, which can distort the outcomes of the regression analysis.

Finaly, the primary analytical approach utilized in this study is multiple regression analysis, enabling the estimation of the relationships between macroeconomic factors and NPLs. The regression model is set to analyze the direct effect of GDP growth, exchange rate, interest rate, and unemployment rate on the level of Egyptian banking NPLs.

3.5.1 Descriptive Statistics

Table.1 shows the descriptive statistics for six variables of Egyptian economic indicators during 2000–2024 from mean, standard deviation, and range for each variable. Further down an interpretation line by line for each of these indicators:

Table .3 : Descriptive Statistics

Indicator	Mean	Median	Max	Min	Range	Std. Dev.	Variance
GDP Growth Rate (GDPG)	4.3792	4.25	7.2	1.8	5.4	1.6149	2.6036
Exchange Rate (EXH)	20	19	30.89	5	25.89	8.75	76.5625
Inflation Rate (INF)	10.7708	10.1	29.5	2.4	27.1	6.6495	44.17
Interest Rate (INT)	15.75	15	27.25	8.25	19	6.9	47.61
Unemployment Rate (UEM)	10.2375	10.25	13.4	7.3	6.1	1.8872	3.5619
Non-Performing Loans (NPL)	6.8	6.5	11.2	2.4	8.8	3.5	12.25

The average of the GDP growth rate for this period is 4.38% which suggests the Egyptian economics have a moderate growing trend. The mean comes out to around that same median value of 4.25%, indicating a symmetrical distribution around that central ballpark. By the same token, the growth rate that reaches up to 7.2% at the highest and 1.8% at the lowest, reflects the ups and downs of the economy, which are influenced by the domestic and global economy. With a standard deviation of 1.6149, which seems to be not absolute indicating the deviation from mean is visible,

yet not extreme, suggesting that while growth spurts have occurred, the economy has stable growth in-ranged. The variance of 2.6036 serves as additional evidence that the change is somewhat stable.

The exchange rate (EGP/USD) demonstrates a high level of variation since the average is about 20.0000 EGP/USD. The range is 25.89, represents a huge fluctuation in the EGP exchange rate that is affected by many factors such as inflationary pressures, monetary policy changes, and global economic factors. The high value of standard deviation of 8.75 indicates an extreme variation in value of the Egyptian pound against the dollar with high risk.

The inflation rate fluctuated between 29.5% at its peak and 2.4% at its lowest. The average of 10.77% indicates a moderate rate of inflation overall, but the standard deviation (6.65%) indicates a fair amount of variation in inflation. This volatility in Egypt's inflation movement during the period has resulted in a wide difference of the maximum and minimum values that ranges from 27.1 percent.

The interest rate has varied from 8.25% to 27.25% with a mean of 15.75%. The Central Bank has shown significantly variation on interest rates that the of range 19.0% and standard deviation 6.9%, indicating strong volatilities in interest rate determination that attempting to control the inflation, controlling liquidity, and promoting the economy. Egypt Unemployment Rate fluctuated moderately reaching its lowest value of 7.3% and highest of 13.4%. With a level of 10.24%, this unemployment is relatively low and moderate, and with a standard deviation of 1.89% it reflects stable unemployment level with some variation caused by economic and policy changes.

The quality of loans in the banking system is reflected in the non-performing loan (NPL) ratio. The range of 8.8% (2.4% to 11.2%) suggests a change in economic conditions and loan provision behavior across the period. The NPLs is considered as a critical measure for banking stability, as long as there is a decline in NPLs ratios between 2000 and 2023 , this indicates that there is an efficient credit risk management in the Egyptian Banking sector which support the financial stability of banking sector.

3.5.2 Normality Test – Jarque-Bera Test

In order to examine whether the dependent and independent variables data follow a normal distribution that Jaraque-Bera test (JB test) is used, and this test provides statistic that is compared

against a critical value of 0.05 to determine whether the data follow a normal distribution or not .The null hypothesis (Ho) for the JB test is that , the data set is normally distributed while the alternative hypothesis(H1) stated that the data does not follow a normal distribution. Table 2. Revealed the JB statistics for all data set in this research

Table 4: Jarque-Bera Test Results for Normality

Indicator	JB Test Statistic	P-Value
GDP Growth Rate (GDPG)	1.1557	0.5611
Exchange Rate (EXH)	0.4722	0.7579
Inflation Rate (INF)	5.2137	0.0738
Interest Rate (INT)	0.5704	0.7546
Unemployment Rate (UEM)	1.441	0.4865
Non-Performing Loans (NPL)	2.3892	0.3012

The JB statistics for GDP growth rate as shown in table 2 is 1.1557 with P value of 0.5611 which is significantly higher than 0.05. Accordingly, the researcher failed to reject the null hypothesis and based on this result the GDP growth rate data is normally distributed

Concerning the exchange rate, the GB statistics for exchange rate is 1.7047 and the P value is 0.4264, which is higher than 0.05. Accordingly, the researcher failed to reject the null hypothesis, and the results suggest that the exchange rate data follows a normal distribution

With regard to inflation rate, the results shows that the JB statistic is 5.2137 with P value 0.0738 which is slightly higher than 0.05 it could suggest that a potential marginal deviation from normality could be appeared and this result is normal as inflation in Egypt was highly volatile in recent years driven by several factors such as global economic conditions and high cost of supply chain and policy changes although the inflation data might not perfectly follow a normal distribution and also it does not also deviate too much. Accordingly, there is no normality concerns.

The JB Statistics for the interest rate in Table.2 choose that the P value is 0.5612 which is significantly higher than 0.05, this result leads to failure to reject the null hypothesis and suggests that the interest rate data is normally distributed.

Concerning the unemployment rate, the above result shows JB statistics 1.44 with p-value 0.4865 which is significantly higher than 0.05 according to the unemployment rate data following a normal distribution. Also, the data of NPL ratio is following the normal distribution as JB statistics is 2.398 and P-Value is significantly higher than 0.05.

Based on the above-mentioned results and analysis, it's obvious that there is no concerns about the normal distribution of all dependent and independent variables.

3.5.3 Test for multipolarity

One of the core assumptions to test multicollinearity is that the explanatory variable or what so-called predictors are not significantly correlated with one another as when predictors are significantly correlated this will lead to a problem of high multicollinearity accordingly misleading interpretation of the results. In order to examine the existence of multicollinearity the variant inflation factor (VIF) will be used in this research as a indicative tool for multicollinearity .

Table 5 : VIF test for multicollinearity

Variable	VIF
GDP Growth Rate (GDPG)	2.8
Exchange Rate (EXH)	4.5
Inflation Rate (INF)	16.2
Interest Rate (INT)	8.6
Unemployment Rate (UEM)	3.7

The VIF value for GDP Growth Rate, Exchange rate Unemployment rate are 2.8,4.5 and 3.7 respectively which is below 5 , Accordingly, these explanatory variables are fairly independent and do not show a critical multicollinearity problem.

The VIF values for Inflation Rate and Interest rate are 16.2 and 8.6 which means that there is a significant level of multicollinearity, suggesting the Inflation Rate and Interest rate are strongly correlated with other variables. Accordingly, the inflation rate will be removed and the VIF test will be run again without the highest VIF value of the Interest rate.

Table 6: VIF test for Multicollinearity after removing the Inflation rate

Variable	VIF
GDP Growth Rate (GDPG)	2.2
Exchange Rate (EXH)	4.1
Interest Rate (INT)	4.6
Unemployment Rate (UEM)	2.9

Based on the results revealed in Table 4 there is no problem of multicollinearity as all VIF values are below 5, Accordingly the selected independent variables (GDP Growth Rate, Exchange Rate, Interest Rate and Unemployment) fit as explanatory (predictable) variables.

3.5.4 Regression Model

In this study we utilize a multiple regression model to analyze the relationship between the non-performing loans (NPLs) in the Egyptian banking sector and other macroeconomic indicators. The dependent variable of the regression model is level out of non-mature loans (NPL) whereas the independent variables are GDP growth (GDPG), exchange rate (EXH), interest rate (INT) and unemployment rate (UEM). The overall goal of this regression is to demonstrate the effect of macroeconomic variables on the loan quality of publicly listed Egyptian banks. ANOVA table evaluates how well the model as a whole fits, highlighting the key relationships between independent variables and the dependent variable, as well as how significant each predictor is in accounting for the variations in NPL levels.

The regression function was developed as follows:

$$\boldsymbol{Y}=\beta 0+\beta 1X1+\beta 2X2+\beta 3X3+\beta 4X4+\epsilon$$

Where:

- Y: Dependent variable (**NPL**)
- X1: GDP Growth Rate (**GDPG**)
- X2: Exchange Rate (**EXH**)
- X3: Interest Rate (**INT**)
- X4: Unemployment Rate (**UEM**)
- β0: Intercept
- β1,β2,β3,β4: Coefficients for the independent variables
- ϵ: Error term.

3.5.5 Regression Model Result

The results of the regression analysis below attempt to analyze the relationship between NPL as a dependent variable and the four independent variables, namely GDP growth (GDPG), Exchange Rate (EXH), Interest Rate (INT), and Unemployment Rate (UEM). The results from ANOVA table reveal very important information regarding the overall fit of the model as well as the significance of the predictors to NPL.

Table 7: Analysis of variation (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	120.542	5	24.108	154.53	.000[c]
	Residual	38.086	244	.156		
	Total	158.628	249			

a. Dependent Variable: Non-Performing Loans (NPL)

c. Predictors: (Constant), GDPG ,EXH,INT,UEM

The total sum of squares (SST) of 158.628 represents the total variation in Non-Performing Loans. This variance can be divided into two parts called the regression sum of squares (SSR) and sum of squared errors (SSE). The total sum of the variance that is explained by the regression model (the regression sum of squares) equals 120.542, with an unexplained variance (SSE) of 38.086. The ratio of the explained variance to the total variance suggests that a significant portion of the variance in NPL is explained by the selected predictors.The associated p-value of the F-statistics is equal to $0.000 < 0.05$ (conventional level of significance). This means that regression model is significant at $p < 0.001$ level which indicates that independent variables which are GDP growth, exchange rate, interest rate, and unemployment rate have statistically significance overall effect on the Non-Performing Loans.

Table 8: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.870[b]	.759	.756	.403	2.00

b. Predictors: (Constant), GDPG, EXH,INT,UEM

c. Dependent Variable: Non-Performing Loans

A high value (R = 0.870) indicates a strong positive linear relationship between dependent variables (Non-Performing Loans or NPL) and independent variables (GDP growth, exchange rate, interest rate and unemployment rates). This means that the model describes a good explanation of the variance in NPL. Also, since R of 0.870 is a value closer to 1, this suggests a strong fit of the model.

Table 9: Unstandardized Coefficient and Standardized Coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	13.214	1.697		2.529	.000
	GDP	-1.164	.215	-1.039	-1.648	.000
	EXH	1.487	.327	1.184	2.314	.038
	INT	.395	.486	.364	.259	.032
	UEM	-.496	.415	-.119	-1.718	.341

Regarding R Square (Coefficient of Determination) Table.6 revealed that R^2 is 0.759 which indicates that the dependent variables can explain about 75.9% of the variation in non-performing loan. This is a kind of high value which means that this model can explain most of the variance in NPL. Also , high R^2 indicates a strong model fit, meaning that the predictors are highly effective in explaining the dependent variable (NPL).

The above-mentioned table revealed the results of multiple regression analysis and provides insights about the determinants of non-performing loans of publicly listed banks in Egypt. By investigating the relationship between selected macroeconomic variables namely, growth, Exchange Rate, Interest Rate and Unemployment indicators and non-performing loans (NPLs), The interpretations about the variables that influence the quality of loans are as follows :

Impact of GDP growth on NPLs

The analysis revealed that there is a significant negative relationship between GDP growth and non-performing loans with coefficient of -1.64 which suggests that if there is an increase in GDP growth, the level of NPL tends to decrease. A strong GDP often leads to improvement in the borrower's income levels and financial stability which enhances the capacity of the borrowers to pay off their loans and decreases the probability of bad debts. This result is consistent with finding of (Anastasiou et al. 2016; Bofondi and Ropele 2011; Espinoza and Prasad 2010) who confirmed that there is a negative relationship between GDP growth and non-performing loans .

This finding suggests that NPLs of listed banks in Egypt decline with the increase of GDP growth. The value and sign of the coefficient (-1.64) supports that the macroeconomic performance is the most important fact on shaping the credit risk in the banking industry. In particular, the negative coefficient indicates that while GDP growth increases, NPL decreases, indicating that borrowers' being stronger in finance and consecutive credibility overall during the period of economic boom.

The economics underlying this relationship is related to fundamentally to the connection between macroeconomic activity (business conditions) and the creditworthiness of borrowers. During times of economic booms, companies usually enjoy higher income as demand is higher for goods and services and households have better employment prospects and income. This is benign for debt-servicing capacities of corporate as well as individual borrowers.

This result is not only economically appealing, but is also consistent with several studies of empirical evidence stated by Anastasiou *et al*., (2016), Goda and Hommes (2016), Bofondi and Ropele (2011) and Espinoza and Prasad (2010) who have verified that negative relationship between GDP growth and NPLs for different banking systems, with the focus on emerging and developed economies. The findings indicate that macroeconomic growth contributes to the

stabilization of credit markets and limits systemic risk while enhancing the overall soundness of banking institutions.

The theoretical underpinning for this relationship could be explained by the financial accelerator model and the procyclical character of lending. In expansions, borrowers' financial position have been strengthen and therefore their risk perceived by banks have been reduced . Accordingly, bank lending has increased, and repayments have been regularly paid. On the other hand, during recessions and downturns, lower incomes and profitability raise the risk of loan delinquency and consequently increase the NPLs. The coefficient of -1.64 in the current model confirms this above theoretical explanation, providing measurable evidence of the effect of macroeconomic behavior on loan quality within the Egyptian publicly listed banks.

Based on this result, the researcher failed to reject the null hypothesis Ho1 that the GDP growth has a negative significant impact on NPL.

Influence of Exchange Rate (EXH) on NPLs

The exchange rate also reveals a significant negative relationship with non-performing loans as the coefficient equal to 1.487 which suggests that a favorable exchange rate could reduce the cost of imported raw material and reduce the overall cost of production of the borrowers and lead to enhancing the capacity to repay banks' debts. Also, a favorable Interest rate will boost the economy accordingly increasing the growth of companies' financial position and their ability to pay off their loans.

As the exchange rate falls, firms that import raw materials or capital goods find themselves paying more for those inputs as the prices of those imported goods rise. This is especially the case in countries like Egypt, which relies on imports to drive production in many of its industries. Higher priced imports raise the cost structure for businesses pushing down profit margins and potentially creating cash flow problems. During periods of fiscal distress, firms may find difficulty in honoring their debt payments; this leads to default and subsequently a higher number of NMPLs in the banking system.

The negative sign of -1.487 also indicates that there is a strong relationship between exchange rate depreciation and NPLs. A deteriorating currency, which raises the cost of producing goods for companies, can have an extremely damaging effect on their ability to pay back loans. The

economic impact could, in turn, drive higher-end defaults by these over-burdened companies, as they struggle to support themselves with revenue to pay off the debts. The exchange rate has a significant bearing on the cost of production and is therefore a key variable in the financial health of borrowers and the quality of loans.

This finding is in line with well-established economic theory stating that exchange rate volatility and depreciation can increase financial risks for the firms that depend too much on importing. Relatively poor countries like Egypt, where the importance of imported goods and raw materials is undeniable as part of industrial production, could see a serious impact on the health of banking from rate movements. With imported inputs becoming more expensive, businesses' costs of production have surged, which will in turn eat into margins, and over time, bankruptcies and failure to make repayment of loans. Policymakers and financial regulators should pay close attention to exchange rate movements, as depreciation can amplify financial risks by increasing the cost structure for businesses, particularly in import-dependent industries.

According to the above-mentioned results , the researcher Fail to accept the null hypothesis H0:2 accordingly H0:2 that the exchange has a significant positive impact on non-performing loans of publicly listed banks in Egypt is rejected.

Concerning the null hypothesis Ho3 : This hypothesis has not been tested as inflation rate shows high multicollinearity in VIF test, accordingly it has been removed from the data to avoid misleading results from the regression model .

Impact of Interest rate On NPLs Unemployment rate on NPL

Contrarily, Interest Rate has no significant impact on non-performing loans as the coefficients are relatively small and their p value are not Signiant at .05 confidence level, which suggest that theses macroeconomic factors don't have explanatory and predictivity power on non-performing loan. This result is inconsistent with (Anastasiou *et al*., 2016; Bofondi and Ropele 2011; Kjosevski *et al.*, 2019; Rinaldi and Sanchis-Arellano 2006) ,who stated that the unemployment has a positive impact on NPLs. The general idea is that an increase of unemployment rate curtail the purchasing power of households, i.e., they are unable to meet their debt obligations

Concerning the insignificant relationship between interest rates and non-performing loans, one probable explanation is that the borrowers with fixed interest rate contracts may not be affected by

an increase in interest rates accordingly the cost of their loans may not rise immediately. However, if there is an immediate impact on some borrowers and the banks are using a restructuring strategy like grace period and long-term repayment schedule, such strategies could critically reduce the significant effect of increasing loans interest. Additionally, the prevalence of a fixed interest rate lending contract could have another effect of delaying the pass-through effect of high interest rates which also ease the expected significant effect.

Furthermore, interest rate sensitivity varies significantly by borrower type. Large corporate borrowers may have diversified funding sources, including international lines of credit, and are thus less rate-sensitive. By contrast, small and medium enterprises (SMEs) and retail borrowers, though more sensitive, represent a smaller share of total loan volumes. This may explain the weak statistical correlation despite theoretical expectations.

From the perspective of risk and regulation, immunity from high interest rates is not significant. With ongoing banking sector liberalization, and further improvements to international assessment practices, the monetary policy transmission mechanism in Egypt is expected to tighten further. Banks will need to prepare for this transition by taking interest rate stress tests and repricing risk to higher levels. Instead, they should avoid excessively relying on rate-based instruments with an aim to tame credit growth and complement them with loan-to-value (LTV) and debt service-to-income (DSTI) ratios which are more closely associated with borrower solvency.

Accordingly, the null hypothesis Ho4 which stated that Inflation rate has a significant positive impact on non-performing loas of publicly listed banks in Egypt is rejected .

The effect of Unemployment rate on NPL:

Regarding the unemployment rate, as revealed in the above-mentioned regression analysis results, confirmed that there is no significant effect of unemployment rate on non-performing loans of publicly listed banks. this result is inconsistent with (Turan 2016; Kurumi and Bushpupa 2017) who finds that NPLs have a negative correlation with the unemployment rate.

The explanation of insignificant relationships could be due to the portion of retail loans or consumer loans to the overall loans in the banking sector, is not significant as the corporate loans are significantly higher than the consumer loans. Accordingly, any delay or past dues of retail loans may not significantly affect the overall non-performing loans.

On the banking side, corporate loans comprise a large share of the formal credit market, especially loans to public sector firms, infrastructure projects, and medium-to-large firms, and there the default risk is more closely linked to sectoral output or fiscal policy than to national unemployment rates. This suggests that the disconnecting of unemployment and NPLs may be owing to a misalignment between the sectors that underpin loan portfolios versus those captured by the labor force data.

Also, household in Egypt are frequently financed by social networks, remittances, (Rotated Saving Groups (ROSCAs), or informal credit. These adaptive strategies lower the probability of defaulting on formal debts, and particularly for those at risk of being cut out from future access to credit. Furthermore, in community-based lending relationships, cultural norms have historically prioritized reputation and repayment over legal enforcement.

In addition, Egypt also benefits from large remittances from its diaspora (about $30 billion per year in recent years) that can provide an income buffer that is often counter-cyclical. In times of crisis or high unemployment, remittances can rise and ensure that families are able to meet loan payments despite a drop in income.

Another explanation is that Egyptian banks — and particularly the large state-owned and leading private-sector banks — have used selective retail lending as a so-called implicit hedge against the macroeconomic variability that labor markets have historically generated.

This selectivity is based upon a very conservative credit underwriting philosophy made the Retail lending in Egypt is not an easy open access. Bankers tend to focus on the formally employed, salaried employees (more often in the public sector, quasi-government sector or Multinational Companies, National companies with stable income and less income variability), as jobs and therefore their practically non-cyclical Employment income streams are expected to be a settled flow hence protected from temporary shocks of cyclical unemployment. This segment of the population has relatively predictable repayment ability, and the inclusion of this population segment in the lending portfolios of banks greatly reduces the exposure of banks to a credit deterioration caused by the rise in unemployment.

The centralized payroll deduction model prevalent in consumer lending further strengthens this approach. This model facilitates loan repayments that are directly debited from salaries before

being disbursed to borrowers. In particular, such mechanisms structurally sever repayment behavior from near-term employment shocks, especially, of course, where employers guarantee loan obligations as well as maintain continuity of salaries in periods of economic stress. Basically, the instant of payment certainly is institutionalized because in essence, the credit risk of losing a job or having your income disrupted does not exist.

Furthermore, banks in Egypt have always had a preference for secured as opposed to unsecured retail lending, as much of the credit that is disbursed is for durable goods, real estate or auto loans backed with assets or collateral. That orientation adds additional insulation from unemployment shocks since default behavior is tied more closely to asset depreciation and liquidity stress rather than labor market volatility as such. Unsecured personal loans are also generally underwritten with conservative debt-to-income hurdles, which appear to align with expected risk appetite, tempered by historical experiences with inflationary as well as structural/renewal fiscal environments.

Based on the revealed results the null hypothesis Ho5: which stated that unemployment rate has a significant positive impact on non-performing loans of publicly listed banks in Egypt.

is rejected

5. Conclusion & Recommendations.

This research is an attempt to provide useful insights to discover the main factors that have a significant impact on the loan quality of publicly listed banks in Egypt. The policymakers and financial institutions have to pay substantial attention to economic growth represented by GDP growth and enhancing external economic factors (such as exports or trade openness, represented by exchange rate) to reduce NPL levels in the Egyptian Banking sector. This, in turn, can lead to better economic conditions as borrowers are able to meet their obligations, resulting in fewer defaults and increased financial stability for lending institutions. Conversely, while interest rates and unemployment might conceptually drive behavior relating to loan repayments, their statistical insignificance in this model indicates that these drivers may not be as relevant in predicting NPL on our current sample. Future research can test the extent to which the relevance of these factors depends on the details of the economic environment and the characteristics of the data set used.

In conclusion, the result of this research reveals that the regression identifies GDP and EXH as the two most significant predictors of non-performing loans, both having strong negative statistically

significant associations. The results highlighted the need for supporting economic growth and external economic resilience to counter risks in NPLs. Understanding these underlying factors can allow stakeholders to implement specific measures to mitigate non-performing loans, ensuring a more resilient banking sector.

The most significant negative relationship between EXH and NPLs indicates that the external strength is an essential factor affecting the quality of loans in the Egyptian banking sector. It follows, then, that policymakers must prioritize the tightening of trade, the bolstering of exports, and the stabilizing of the national currency. Improving external economic linkages and maintaining stable exchange rates help reduce the vulnerabilities that make the banking system more exposed to increasing likelihood of non-performance.

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Given the results of this study, Egyptian financial institutions are encouraged to incorporate these macroeconomic indicators in their risk management systems. Banks could take away being learned from the associations between GDP growth, exchange rate stability, and NPLs, in their lending decisions and be ahead of the prospective risks. In addition, institutions can implement dynamic models that change with the economy to withstand macroeconomic fluctuations.

Regulators should also take these findings into account in shaping regulations and policies for the banking sector. By emphasizing sound rules that support stability, financial regulators can establish a climate that is suitable for reducing systemic risk in the financial system. This proactive effort will help to reduce the level of NPLs and consequently contribute to increased stability in the banking system.

6.Further Research Directions.

While this study provides valuable insight into the macroeconomic determinants of NPLs of publicly listed banks in Egypt, many relevant avenues remain for future research. One way to

mitigate this risk in future research is a sectoral disaggregation of loan portfolios: separating exposure to corporate and retail lending and sector-specific exposures. This approach would enable much finer disaggregated analysis of the way particular parts of the economy react to macro-economic shocks in terms of creditworthiness.

Second, consideration of bank-specific characteristics, such as capital adequacy ratios, liquidity buffers, credit risk management strategies and ownership structure may lead to the development of a more comprehensive NPL dynamics model. It would enable the separation of systemic macro-level impacts from institution-level risk governance activities.

Third, future research can use dynamic panel methods (e.g., System GMM) to mitigate potential endogeneity issues and unobserved bank specific heterogeneity. They also help retain the long-run memory of NPLs and the slow-moving character of the impacts from macroeconomic variables on credit quality over the horizon.

Fourth, Considering the institutional and regulatory environments such as the effectiveness of legal enforcement mechanisms, central bank policies, and the profile of credit information systems—as possible moderators or mediators. These structural dimensions are especially relevant in emerging markets, where the quality of institutional environments can determine success or failure in terms of credit risk.

Fifth, while the lack of recent studies can provide more currency to adoption of this appeal, future studies may distinguish conditional effect of source of external shocks [global financial volatility, pandemics, commodity prices swings] on their amplifying or dampening effect on the relationship between domestic macroeconomic variables and NPLs, particularly relevant in the context of global economic uncertainty.

Lastly, few studies in the MENA context, or more generally, within emerging markets contextualize their analysis through comparative studies. Providing cross-country studies would widen the scope through which the findings are analyzable, as it would allow us to compare between countries and explain general trends affecting finance. These kinds of comparative frameworks would also help with benchmarking, as well as with the transferability of policies between similar economic systems.

Altogether, these extensions would contribute to empirical rigor in future research in addition to providing inputs to more focused and robust form of credit risk policies in the financial system.

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القروض المتعثرة للبنوك المصرية المدرجة في البورصة وتفاعلها مع المتغيرات الاقتصادية الكلية

المستخلص

تبحث هذه الدراسة في العوامل الاقتصادية الكلية المُحددة لجودة قروض البنوك المُدرجة في بورصة مصر، وبالأخص القروض المتعثرة. يستخدم هذا البحث بياناتٍ من عشرة بنوك مُدرجة بين عامي 2000 و2024، بالإضافة إلى تحليل الانحدار المُتعدد، لتحديد العوامل الاقتصادية الكلية المُحددة للقروض المتعثرة، وهي: نمو الناتج المحلي الإجمالي، وسعر الصرف، وسعر الفائدة، والبطالة. وقد أظهرت النتائج أن نمو الناتج المحلي الإجمالي وسعر الصرف يرتبطان سلبًا بشكل كبير بالقروض المتعثرة، مما يُشير إلى أنه كلما كان الأداء الاقتصادي والظروف المالية الخارجية أفضل، زادت قدرة المُقترضين على السداد، وزاد الاستقرار المالي. من ناحية أخرى، لا تدعم النتائج القدرة التنبؤية لسعر الفائدة والبطالة على القروض المتعثرة في نموذج الدراسة هذا، ويرجع ذلك على الأرجح إلى أن عقود الفائدة الثابتة قد تُحد من مسؤولية المُقترضين، إلى جانب هيمنة قروض الشركات على قروض المستهلكين(الأفراد). وكذلك تُسلّط النتائج الضوء على الدور المحوري للنمو الاقتصادي واستقرار سعر الصرف كمُحدّدين لمخاطر الائتمان، وقدرة القطاع المصرفي المصري على الصمود والتغلب على التحديات التي يواجهها.

الكلمات المفتاحية: القروض المتعثرة؛ نمو الناتج المحلي الإجمالي؛ سعر الصرف؛ سعر الفائدة؛ معدل البطالة.