

## Analyzing microeconomic determinants of non-performing loans in Saudi Arabian banks: Implications for banking sector health and risk management

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### ABSTRACT

This research aims to study the smaller economic factors that influence the percentage of loans that banks in Saudi Arabia have given out but are not getting repaid. It uses data from 10 Saudi Arabian banks, covering 130 instances from the years 2009 to 2021, to figure out which economic factors at the bank level matter most. These factors are taken from the banks' yearly financial statements. The study looks at five specific factors suggested by earlier research, which are believed to impact the percentage of these non-repaying loans in the banking sector. These factors are the ratio of loans to deposits, the capital adequacy ratio (CAR), the return on assets (ROA), the net interest margin (NIM), and the size of the bank. The findings reveal that the size of the bank, its CAR, its ROA, its ratio of loans to deposits (which has a reverse effect), and its NIM (which has a direct effect) all play significant roles in determining the percentage of non-repaying loans in Saudi Arabian banks. Understanding these factors is crucial for getting insights into the health of the banking system. Monitoring and evaluating the ratio of non-repaying loans is important for keeping the financial system healthy and supporting steady economic growth. The study suggests that to manage the risks of loans not being repaid and to keep the banking system stable, effective policies and risk management practices are needed. It advises that banks improve their lending processes to manage non-repaying loans better and ensure profits for their shareholders.

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### 1. Introduction

Over the past twenty years, the global economy has experienced multiple crises, such as the 2008 financial crisis and the COVID-19 pandemic. Each crisis presents unique challenges, prompting institutions to implement various measures. These events have financial consequences impacting governments, corporations, and the financial sector. Following a crisis, some loans may become non-performing, requiring banks to take steps to monitor and manage these harmful loans to ensure their survival and maintain the stability of the banking system. When the level of non-performing loans (NPLs) rises, banking authorities need to act to strengthen the financial sector (Thakor, 2015).

The banking system is crucial for fund accumulation and is fundamental to Saudi Arabia's economic development. By the end of 2022, retail loans provided by Saudi Arabian banks exceeded one trillion riyals for the first time, reaching 1.02 trillion riyals, a 15% increase from 2021. The banking system also plays a key role in monetary policy by converting savings into investments, thus boosting economic growth. Currently, thirty-five banks operate in Saudi Arabia, including twelve domestic commercial banks, twenty-one foreign commercial banks, and three digital banks.

NPLs are a critical metric in bank management. The size of NPLs significantly affects the health of a country's banking system. To explore the factors influencing NPLs in Saudi Arabian banks, we must first understand the definition and dimensions of NPLs in a corporate context. The International Monetary Fund (Ari et al., 2019) defines NPLs as loans where interest or principal remains unpaid for 90 days or more. NPLs are often divided into non-specialized and specialized loans. Non-specialized NPLs are further categorized into bad loans (defaulted for 90-180 days), questionable loans

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(defaulted for 180-360 days), and lost loans (defaulted for more than 360 days).

By 2020, the level of NPLs in Saudi Arabia had decreased, while the level of credits had increased. This was due to government support programs, particularly those acting as guarantors for some private-sector loans. One significant support program was the loan payment postponement, which helped companies and households during the COVID-19 crisis. At the end of 2022, the ratio of NPLs in Saudi Arabia remained at 1.8%, the same as the previous year. From 2009 to 2021, the average NPL ratio in Saudi Arabia's banking system was 1.89%, with a low of 1.08% in 2014 and a high of 3.29% in 2009. Comparatively, the global NPL ratio across 113 countries was 6.5% at the end of 2021 (Bruce et al., 2022).

Although the overall NPL size in Saudi Arabia has been stable for several years, variations in NPL levels across different years and banks are concerning for banking supervisory authorities. It is essential to monitor NPL levels to ensure the banking sector's stability, especially since loans are concentrated in sectors such as construction, real estate, and households. Recent statistics show that construction and real estate loans accounted for 14% of total loans in 2021, while personal loans made up more than 50%.

This study aims to provide valuable information to policymakers and regulators to help control NPL levels by examining the factors influencing NPLs in ten Saudi Arabian banks. Using panel data analysis, the study investigates the relationship between bank-specific variables and NPLs in Saudi Arabia.

## 2. Literature review

Several scholars have studied the variables that affect NPL in many countries because they play a crucial role in the banking sector's stability and reflect its strength and health. The following studies give us a clear picture of the principal macroeconomic variables influencing NPLs.

Le and Le (2023) investigated the influence of macroeconomic variables (inflation, money supply, economic growth, and actual interest rates) on NPLs in the Vietnamese banking sector. Ordinary least squares and quantile regression methods were used from 2000 to 2020 to achieve the study's objective. The results of ordinary least squares show no significant impact of economic growth on NPLs; on the other hand, the results of quantile regression estimation show that economic growth hurts NPLs. In addition, the study results show that inflation and actual interest rates negatively impact NPLs, while the money supply negatively impacts NPLs. Based on the study results, there are several recommendations for managing NPLs in the Vietnamese banking sector.

According to Ferreira (2022), who conducted a study based on data from eighty countries between 1999 and 2019, using panel estimates generalized method of moment with data from the World Bank's

Global Financial Development Database, the research aimed to explain the development of the ratio of NPLs to banks' total loans. The study found that banks that make high profits benefit from market stability and do not expect high values of the ratio of NPLs to total loans. On the other hand, the high rate of this ratio is associated with an increase in market concentration, bank cost-to-income ratio, and bank regulation. Interestingly, the results showed little difference between high-income and non-high-income countries and between institutions for organization for economic co-operation and development (OECD) and non-OECD countries. Anita et al. (2022) examined macroeconomic variables affecting NPLs of 8 South Asian countries (Afghanistan, Bangladesh, Bhutan, India, Nepal, Maldives, Pakistan, and Sri Lanka) for the period 2008–2019. The fixed effects (FE) model was used in the study to solve the problem of heteroscedasticity. The empirical results are consistent with the previous results and show a significant negative relationship with gross domestic product (GDP), inflation rate, and money supply. To keep NPL levels under control in South Asian economies, regulators should identify the financial system's weaknesses and promote economic growth by ensuring a balanced money supply level and inflation rate.

Memdani (2017) tested the determinants of the Indian banking system concerning non-performing assets (NPAs) for three types of ownership structures: Private banks, government banks, and foreign banks. Banks' data collected for the period 2005–2014. Panel data techniques used. Results demonstrated that individual income and inflation variables affected NPA in government banks. For private banks, variables such as GDP were statistically significant, while loans to total loans and size were statistically significant at a 10% level. There was no statistical significance for any variable for foreign banks.

Touny and Shehab (2015) tested the variables influencing loan defaults in Arab countries' banks over 2000–2012 using fixed effect models. Results showed that the emergence of the financial crisis in 2007, financial conditions, and changes in macroeconomics affected loan defaults negatively. Household consumption variables have a negative effect in non-oil-exporting countries and a positive effect in oil countries. According to government expenditure variables, there is a reverse relationship between government expenditure and loan defaults in non-oil-exporting and oil countries. Moreover, increasing the debt level has a positive effect on loan defaults. An accommodative monetary policy and trade development in petroleum countries significantly negatively influence loan defaults.

Ekanayake and Azeez (2015) confirmed that NPL was the primary variable that affected the ex-post default risk in Sri Lanka's banking system, based on nine commercial banks from 1999 to 2012. Their study results showed that NPLs are influenced by variables at the macro and micro levels, with an inverse relationship between NPLs and banks'

efficiency. Results further showed a positive influence of the ratio of the loan-asset variable on NPLs. Banks with growth in the loan portfolio had a decreased level of NPLs. The banks' size and GDP growth correlated positively with NPLs, while inflation affected NPLs negatively, and the lending rate was affected positively.

Makri et al. (2014) studied the impact of various factors on NPLs in the banking sector of Eurozone countries from 2000 to 2008, before the financial crisis. The research included 14 out of 17 banks operating in the Eurozone. The study examined factors such as GDP growth, budget deficit, government debt, unemployment rate, loan-to-deposit (LTD) ratio, return on shareholder equity, return on assets (ROA), and capital adequacy ratio (CAR). The data were analyzed using the Generalized Method of Moments technique. The results showed that ROA, GDP growth, and return on equity (ROE) negatively affected NPLs, while unemployment, lending, and inflation rates had a positive effect. However, the LTD ratio, inflation, and budget deficit did not have a significant impact on NPLs.

Akinlo and Emmanuel (2014) investigated the factors affecting NPL in Nigeria from 1981–2011. They found that economic growth negatively affected NPLs in the long term, while unemployment, debts to the private sector, and exchange rate positively affected NPLs. Results demonstrated that debts to the private sector, exchange rate, borrowing rate, and market index are important variables vis-a-vis NPLs.

Abid et al. (2014) tested the variables influencing NPLs in the Tunisian banking sector from 2003 to 2012. A study of 16 banks showed that NPLs are affected by macroeconomic variables like inflation rates, interest rates, and the quality of the management as bank-specific factors.

Shingjergji (2013) focused on the effect of the macroeconomic factors on the performance of the credit share in the Albanian banking system. Quarterly data was collected for 2005–2012, and a simple regression model was used. The results revealed a positive correlation between the GDP and the NPL ratio. The inflation variable influenced the NPL ratio, while interest and exchange rate variables showed a positive effect.

Klein (2013) examined the impact of GDP growth, unemployment, and inflation as macroeconomic variables, along with bank-level variables such as the equity-to-assets ratio and the assets-to-loans ratio, on NPLs from 1998 to 2011. The study involved 10 banks from 16 countries in Central and Eastern Europe and used vector autoregression methodology. The findings indicated that GDP growth, unemployment, and inflation were the most critical factors influencing loan defaults. Additionally, the equity-to-asset ratio and the asset-to-loan ratio at the bank level also affected NPLs. Škarica (2014) explored the factors influencing bad loans in six Central and Eastern European countries. Using the Fixed Effect Model, the study analyzed data from 2007 to 2012 and found that borrowing

growth, GDP, interest rates, unemployment rates, and purchasing power influenced NPLs. Specifically, GDP and unemployment rates had a negative impact on NPLs, with NPLs increasing during economic recessions and decreasing during economic recoveries and growth. This indicates that economic conditions significantly affect financial stability. Additionally, the results showed that the rate of inflation had a positive impact on NPLs.

Curak et al. (2013) investigated the determinants (macro and microeconomic factors) of bad loans in the Southeast European banking system, with a sample of 69 banks from 10 countries during the 2003–2010 period. Study results revealed that inflation and interest rates increased as economic growth decreased, leading to higher NPLs. Additionally, bad loans are influenced by variables at the bank level, such as the size of the bank and profitability ROA.

Swamy (2012) studied the effect of factors at the macro and bank levels on credit risk in Indian banks, using a panel data technique from 1997 to 2009. The variables included purchasing power, average per-person income, savings, GDP, bank size (SIZE), LTD ratio, borrowing rate, ratio of operating expense, and profitability. Results showed no relationship between GDP growth, purchasing power, capital adequacy, borrowing rate, saving, and credit risk, while the ratio of LTD and profitability had a positive influence; however, the SIZE negatively influenced the credit risk. The research concluded that the privatization of the banking system reduces loan defaults. Saba et al. (2012) studied the variables influence of NPLs in US banks to see the influence of GDP growth, Inflation, and Total credit variables on default risk from 1985 to 2010 using regression tests and the correlation between NPLs and GDP growth, Inflation, and total credit variables. The study found the impact of all independent variables on default risk and suggested that GNP should be considered when issuing loans.

Louzis et al. (2012) analyzed the factors affecting NPLs in the Greek banking system from 2003 to 2009. They focused on three types of loans: consumer, business, and real estate loans, using the dynamic panel data method. The study was based on the hypothesis that loan quality is influenced by both macroeconomic and microeconomic factors, and these effects differ by loan type. The results showed that gross domestic product, unemployment rate, and lending rate significantly impacted NPLs, as well as the efficiency and effectiveness of bank administration. These effects were consistent across all loan types. A review of previous studies identified significant gaps in understanding the determinants of NPLs in the Saudi Arabian banking system. Therefore, this study aims to address these gaps by examining the variables influencing NPLs in Saudi Arabian banks. The hypotheses of this study are:

**H01:** LTD does not influence NPLs in Saudi Arabian banks.

**H02:** CAR does not influence NPLs in Saudi Arabian banks.

**H03:** ROA does not influence NPLs in Saudi Arabian banks.

**H04:** Net interest margin (NIM) does not influence NPLs in Saudi Arabian banks.

**H05:** SIZE does not influence NPLs in Saudi Arabian banks.

### 3. Research methodology

#### 3.1. Population and sample

The population for this study consists of fourteen Saudi Arabian banks. The selected banks must have their annual financial reports from 2009 to 2021. The sample selection was ten banks in Saudi Arabia from 2009 to 2021.

#### 3.2. Data

The study gathered data from 10 banks in Saudi Arabia from 2009 to 2021. The study is based on secondary data extracted from the Annual Financial Reports of Saudi Arabian banks. To explore the variables affecting NPLs in Saudi Arabian banks. We used a panel data approach. Panel data merge both time series and cross-section data, which is appropriate for our study. We used panel data models, FE, and Random Effects (RE) (Table 1).

#### 3.3. Estimation model

To investigate the variables affecting NPLs in Saudi Arabian banks. We will use FE and RE models. The FE model considers the uniqueness between the cross-sectional units, resulting in a coefficient for each cross-section. These differences are incorporated into the economic model through cross-sectional and time dummies so that each variable has its cross-sectional value that controls for the difference between the variables (Gujarati and Porter, 2009). On the other hand, RE assume

that an unobserved individual is unrelated to the explanatory factors. The review of previous studies examining the determinants of NPLs in different environments shows that NPLs are explained by both macroeconomic and microeconomic variables. This study focuses on bank-specific variables that influence NPLs.

#### 3.4. The FE model

The specific model for the FE model is:

$$NPL_{i,t} = \beta_0 + \beta_1 CAR_{i,t} + \beta_2 LTD_{i,t} + \beta_3 NIM_{i,t} + \beta_4 ROA_{i,t} + \beta_5 \log(SIZE_{i,t}) + v_{i,t} \tag{1}$$

where,  $NPL_{i,t}$  represents NPLs to total loans ratio for bank  $i$  in year  $t$ .  $CAR_{i,t}$  represents the CAR at time  $t$ .  $LTD_{i,t}$  represents LTD at time  $t$ .  $NIM_{i,t}$  represents NIM at time  $t$ .  $ROA_{i,t}$  represents ROA at time  $t$ .  $\log(SIZE_{i,t})$  represents the bank's total asset log at time  $t$ .  $v_{i,t}$  is the error term.  $\beta_0$  is intercept term of the regression and the others are coefficients representing the impact of each independent variable.

#### 3.5. The RE model

The specific model for the Random-effects regression model is:

$$NPL_{i,t} = \beta_0 + \beta_1 CAR_{i,t} + \beta_2 LTD_{i,t} + \beta_3 NIM_{i,t} + \beta_4 ROA_{i,t} + \beta_5 \log(SIZE_{i,t}) + \mu_{i,t} + v_{i,t} \tag{2}$$

where,  $NPL_{i,t}$  represents NPLs to total loans ratio for bank  $i$  in year  $t$ .  $CAR_{i,t}$  represents the CAR at time  $t$ .  $LTD_{i,t}$  represents LTD at time  $t$ .  $NIM_{i,t}$  represents NIM at time  $t$ .  $ROA_{i,t}$  represents ROA at time  $t$ .  $\log(SIZE_{i,t})$  represents the bank's total asset log at time  $t$ .  $v_{i,t}$  is the error term.  $\mu_{i,t}$  is the RE intercept that captures heterogeneities across banks and times.

**Table 1:** Study variables

Variables	Notation	Measurement
<b>Dependent variable</b>		
Non-performing loans	NPL	$\frac{NPL}{Total\ loans}$
<b>Bank-specific independent variables</b>		
Capital ratio	CAR	$\left(\frac{Tier\ 1\ capital + Tier\ 2\ capital}{Risk - weighted\ assets}\right) \times 100$
Loan-to-deposit	LTD	$\left(\frac{Total\ loans}{Total\ deposits}\right) \times 100$
Return on assets	ROA	$\left(\frac{Net\ income}{Total\ assets}\right) \times 100$
Net interest margin	NIM	$\left(\frac{Interest\ income - interest\ paid}{Total\ assets}\right) \times 100$
Bank size	SIZE	Log of the total assets of the bank

### 4. Data analysis and interpretation

#### 4.1. Descriptive statistics

Table 2 shows the descriptive statistics of the dependent and independent factors, NPLs, capital

adequacy, LTD ratio, NIM, ROA, and SIZE from 2009–2021. The number of observations was 130. Table 2 shows that the values of the mean of NPL, CAR, LTD ratio, NIM, ROA, and SIZE are 0.0189, 0.1576, 0.6239, 0.0803, 0.0660, and 8.1419 respectively. The standard deviation for NPL was 0.0164, with lower

value of 0.0910 and higher value of 0.1796. The lower value for the CAR was 0.0529, with a higher value of 0.9017 and a standard deviation of 0.0865. The standard deviation for loan to deposit ratio was 0.0779, with lower and higher values of 0.0642 and 0.8246 in sequence. The lower and higher values for NIM were 0.0246 and 0.1148, respectively, with a standard deviation of 0.0133. The lower and higher values for ROA were 0.0346 and 0.0904, respectively, with a standard deviation of 0.0105. The lower and higher values for SIZE were 7.2382 and 8.9610, respectively, with a standard deviation of 0.3410.

#### 4.2. Correlation matrix

Table 3 demonstrates the correlation between dependent and independent factors. Because the correlation between all the factors was lower than 0.80, there was no collinearity problem between the study variables.

#### 4.3. Unit root test

To ascertain whether the variables are stationary, a unit root test of variables is required to prevent biased results. We used Im-Pesaran-Shin Test (Im et al., 2003). Table 4 shows that all variables are integrated at the first difference. Since the p-value is lower than 5%, we refuse the zero hypothesis of unit root that the panel integrated order.

#### 4.4. Regression Results

As mentioned, we will use fixed-effect and random-effect models. Choosing the model that explains the variables affecting NPLs in Saudi Arabian banks is essential. Table 5 demonstrates the estimation results. We performed Hausman's test (Hausman, 1978) to choose the suitable model between two models, fixed and random-effect models (Table 6). Table 6 shows that the p-value is significant. Therefore, we should select the fixed model. The study aims to explore the variables

affecting NPLs in Saudi Arabian banks using panel data regression, specifically the fixed effect model. As shown in Table 7, the R-squared value is 0.7303, which means that the explanatory variables determine 73.03 percent of the variation in NPLs.

The CAR coefficient value negatively and statistically significantly impacts NPLs in Saudi Arabian banks. When the CAR increases by 1%, NPLs decrease by a certain amount (number\_1), assuming that other factors outside the model are constant. This negative relationship implies that NPLs decrease by the same amount when the bank increases its equity ratio. The results indicate that well-capitalized banks are less prone to loan defaults. A high equity ratio leads banks to make less risky decisions. Therefore, many banks try to conduct rational and innovative financing to minimize the level of NPLs. These findings are consistent with the study conducted by Jabbouri and Naili (2019), who found a negative correlation between the CAR and NPLs. They also agree with the studies conducted by Abid et al. (2014), Makri et al. (2014), and Berger and DeYoung (1997) and disagree with Swamy (2012) and Louzis et al. (2012), who found a significant correlation between Capital Adequacy and NPLs.

The coefficient value of the LTD variable had a negative statistical impact on NPLs in Saudi Arabian banks. This result indicates that an increase in bank loans correlates with a decrease in NPLs. A higher LTD ratio indicates that deposits create income and increase profits. Profitability encourages exposure to less risky areas with high credit standards. This activity prevents loan defaults. Similarly, a decline in the LTD ratio means inefficiency in allocating money and low returns. According to the empirical studies by Jameel (2014), the LTD ratio is negatively related to NPLs. The result of this study is consistent with Dao et al. (2020), Rachman et al. (2018), and Long et al. (2020) but not with that of Kartikasary et al. (2020) and Khafid et al. (2020), who showed a significant effect while Morakinyo and Sibanda (2016) found no effect of LTD on NPLs.

Table 2: Descriptive statistics

Variables	NPL	CAR	LTD	NIM	ROA	SIZE
Mean	0.0189	0.1576	0.6239	0.0803	0.0660	8.1419
Median	0.02221	0.1434	0.6354	0.0814	0.0658	8.2242
Maximum	0.0329	0.9017	0.8246	0.1148	0.0904	8.9610
Minimum	0.0108	0.0529	0.0642	0.0246	0.0346	7.2382
Std. dev.	0.0164	0.0865	0.0779	0.0133	0.0105	0.3410

Table 3: Correlation analysis

Variables	NPL	CAR	LTD	NIM	ROA	SIZE
NPL	1					
CAR	-0.1399	1				
LTD	-0.2386	-0.4420	1			
NIM	0.2066	0.0694	-0.2881	1		
ROA	-0.0166	-0.1581	-0.1902	-0.04290	1	
SIZE	-0.2304	-0.3188	0.1031	0.01442	0.1196	1

The result of the variable NIM, which is calculated as the ratio of NIM to earning assets, shows a positive impact and is statistically significant on NPLs in Saudi Arabian banks at the 5% level, which

means that an increase in bank profit leads to an increase in NPL. The NIM illustrates that the NPL ratio increases when the net interest income increases by the banks' productive assets. This

relationship seems strange. The explanation for the positive relationship between NPLs and net market interest rates could be that the weak financial position of borrowers leads to an increase in NPLs; perhaps borrowers also have the opportunity to borrow at higher interest rates, which leads to an

increase in net market interest rates. This result is consistent with the findings of [Salas and Saurina \(2002\)](#), which referred to Spain and India, respectively, but contradicts ([De Lis et al., 2001](#)) in Spain.

**Table 4:** Results of the Im-Pesaran Shin ([Im et al., 2003](#)) unit root test

Variables	Level		First difference	
	Statistic	Probability	Statistic	Probability
NPL	-1.71430	0.0432	-6.11692	0.0000*
CAR	0.03426	0.5137	-5.93903	0.0000*
LTD	-0.88232	0.1888	-6.52133	0.0000*
NIM	-1.49475	0.0675	-2.96124	0.0015*
ROA	-1.89701	0.0289	-3.07117	0.0011*
SIZE	1.12220	0.8691	-2.58433	0.0266**

\* and \*\*: Indicate significance at the 1% and 5% levels, respectively

**Table 5:** Regression results of panel data models

Independent variables	Dependent variable: NPL	
	FE	RE
	Coefficient	Coefficient
CAR	0.503450*	0.306212*
LTD	-0.072948**	-0.083730*
NIM	-0.044803**	-0.081775***
ROA	0.329450*	0.163021***
SIZE	-1.033422*	-0.216118*

\*, \*\*, and \*\*\*: Indicate significance at the 1, 5, and 10% levels, respectively

**Table 6:** Hausman test

Test summary	Chi-squared statistic	Chi-squared degrees of freedom	Probability
Cross-section random	29.507943	5	0.0000

Correlated RE-Hausman test; Dependent variable: NPL; Test cross-section RE

The coefficient value of the ROA variable, measured by net profit to total assets, shows a negative statistical impact on NPLs in Saudi Arabian banks of 1%. This means that as banks' profits increase, NPLs decrease. This result is consistent with the findings of [Jolevski \(2017\)](#) and [Berger and DeYoung \(1997\)](#), who found that highly profitable banks are less likely to be involved in risky lending activities that may lead to credit losses. [Godlewski \(2008\)](#) examined the correlation between NPLs and ROA and found that the value of NPLs decreases as the value of ROA increases and vice versa. In contrast, [Boudriga et al. \(2010\)](#) found a negative relationship between ROA and NPLs. They explained that when the value of ROA decreases, the bank's management decides to invest in risky projects, and consequently, NPLs increase. This result is consistent with the findings of [Makri et al. \(2014\)](#), who found a negative relationship between ROA and NPLs, and [Ahmad \(2013\)](#), who showed a positive relationship between ROA and NPLs. This result is consistent with the findings of [Jolevski \(2017\)](#). [Berger and DeYoung \(1997\)](#) found that highly profitable banks are less likely to engage in risky lending activities that can lead to loan losses.

The estimated coefficient of SIZE has a negative and statistically significant impact on NPLs in Saudi Arabian banks at a 1% level, which means that NPLs decrease by 0.038224 when SIZE increases by 1%. The result shows that SIZE is a significant determinant of NPLs in the Saudi Arabian banking system. SIZE reflects the power and capabilities of the bank to deal with information asymmetry problems. Large banks have professional staff and

robust technological infrastructure. [Salas and Saurina \(2002\)](#) showed a negative relationship between SIZE and NPL. According to their study, large banks constantly monitor their loans and have good risk management and high diversification of loans. Therefore, these findings are consistent with the assumption that large banks have professional staff and specialized technical capabilities to professionally manage debt defaults and maintain the quality of loan portfolios. This result is consistent with the findings of [Swamy \(2012\)](#) and [Salas and Saurina \(2002\)](#), who found a negative correlation between SIZE and NPLs, suggesting that large banks have good policies and the necessary capabilities to deal effectively with debt defaults. However, this result does not align with [Abid et al. \(2014\)](#), who found a positive correlation between SIZE and NPLs.

## 5. Conclusion

This study investigated the factors contributing to NPLs in Saudi Arabian banks from 2009 to 2021. The study utilized FE to analyze the data. The results indicate that the CAR, ROA, and SIZE have a negative impact on NPLs at a 1% significance level. In contrast, the LTD ratio has a negative impact on NPLs at a 5% significance level. Finally, the NIM is positively associated with NPLs at a 5% significance level.

These findings have significant implications for both regulators and bank management. Firstly, performance ratios can be used to predict potential loan defaults, which could help Saudi Arabian banks identify banks that are at risk of NPL increases.

Secondly, regulators should focus on ensuring that banks adopt effective risk management policies and procedures to prevent financial instability. Thirdly, lending policies should be revised to focus on

customers with good credit ratings, which could help reduce NPLs. Lastly, accurate methods should be employed to determine creditworthiness and reduce the risk of NPLs.

**Table 7:** FE model results

Variable	Coefficient	t-statistic	Prob.
C	0.503450	6.711285	0.0000
CAR	-0.072948	-3.054350	0.0028*
LTD	-0.044803	-2.077550	0.0462**
NIM	0.329450	2.055091	0.0421**
ROA	-1.033422	-4.817198	0.0000*
SIZE	-0.038224	-4.520353	0.0000*
<b>Cross-section FE</b>			
Observations		130	
R-squared		0.730358	
Adjusted R-squared		0.661011	
F-statistic		6.205810	
Prob(F-statistic)		0.000000	
Durbin-Watson stat		1.331882	

Dependent variable: NPL; Method: Panel least squares; Sample: 2009-2021; Periods included: 13; Cross-sections included: 10; Total panel (balanced) observations: 130

The limitation of this study is that the data for Saudi Arabian banks is only available from 2009. Future studies could include data from other countries, such as the GCC and Arab countries. Furthermore, future studies could consider additional variables at both the bank and macro levels, such as liquidity, ROE, loan type, money supply, unemployment rate, budget deficit, GDP, inflation, and interest rates, to identify additional determinants of NPLs.

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## Compliance with ethical standards

## Conflict of interest

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