
**THE IMPACT OF MACROECONOMIC AND
MICROECONOMIC VARIABLES ON CREDIT RISK: A
COMPARATIVE STUDY BETWEEN RETAIL AND
CORPORATE CREDIT RISKS IN THE BANKS OF EGYPT**

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Abstract: In 2018, corporate credit risk had notably increased in the Egyptian banking industry because its nonperforming loan (NPL) ratios had reversed the downward sloping curve shaping upward ones while the retail NPL ratio struggled the reverse, shaping a flat curve. In the present work, the paper aims to study the macroeconomic and microeconomic factors of corporate and retail credit risk to develop customized models that better predict the future value of the credit risk in the banks of Egypt to provide better insight to the credit officers and regulators to help in enhancing their credit decisions and regulations.

The paper has utilized the Fixed-Random effects regression models for data analysis using panel data from 2013 to 2020. The findings showed that the macroeconomic and bank-specific variables affect the corporate and retail credit risks differently showing the importance of dividing the credit risk into categories to avoid generating misleading results and to create more robust and accurate predictive models of credit risk. The results also revealed that asset size, income diversification, loan-to-deposit ratio, interest rate, and external debt significantly affect corporate credit risk. In contrast, retail credit risk is affected only by macroeconomic variables such as external debt, GDP, interest rate, and foreign direct investment.

Keywords: *Macroeconomic, Microeconomic, Nonperforming loans, and credit risk*

JEL Codes: *G20, G21, G28*

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Introduction

Credit risk is a term used to describe the potential loss that a bank or financial institution may face due to the failure of a borrower to repay their debt. Banks face one of the most significant risks, and it can significantly affect their financial stability and profitability. (Farooq et al., 2019) Credit risk arises when borrowers fail to meet their obligations, such as failing to make timely payments or repaying the principal amount borrowed this can result in losses for banks which can lead to a decrease in their capital and liquidity levels. In this respect, credit risk management is critical for banks to ensure that they are adequately protected against potential losses and maintain their financial stability (Abid et al., 2014). Kjosevski et al. (2019) also argued that nonperforming loans (NPLs) are a major concern for both corporate and retail banking sectors. Castro (2013) contends that these loans are considered nonperforming when the borrower fails to make timely payments or defaults on the loan. Moreover, Haniifah (2015) stated that the NPL ratio is an important indicator of a bank's loan portfolio's health and ability to manage credit risk. In this context, nonperforming loan ratios play a crucial role in assessing a bank's overall performance and are used by most researchers as a proxy for credit risk. The corporate NPL ratio reflects the percentage of nonperforming loans in a bank's corporate loan portfolio, while the retail NPL ratio measures the percentage of nonperforming loans in its retail loan portfolio.

The paper reviewed the literature and found that several bank-specific and macroeconomic variables can affect the nonperforming loans (NPLs) in banks. The quality of a bank's loan portfolio is a key determinant of its NPLs. ElGaliy (2022) contends that banks with higher-quality loans are less likely to experience defaults and delinquencies, which can lead to NPLs while Kjosevski et al. (2019) argued that banks with higher levels of capital are better able to absorb losses from NPLs, reducing the impact on their financial health. Banks with strong risk management practices are better equipped to identify and mitigate potential credit risks, reducing the likelihood of NPLs. Banks with lax underwriting standards may be more likely to issue loans to borrowers at higher risk of default, leading to higher NPLs. Additionally, a strong economy can lead to lower NPLs as borrowers are more likely to be able to repay their loans. High unemployment rates can lead to higher NPLs as borrowers may struggle to make loan payments. Changes in interest rates can affect borrowers' ability to repay their loans, potentially leading to higher NPLs. High inflation

can erode borrowers' ability to repay their loans, leading to higher NPLs (Mirolim & Mansur, 2017). However, most of the reviewed papers in the literature have examined the bank-specific and macroeconomic variables on credit risk without classifying the credit risk such as retail and corporate even though some of the articles in the literature such as Isaev & Masih (2017) and Kjosevski, et al. (2019) have categorized the credit risk and found that the bank-specific and macroeconomic variables affect them differently.

In this respect, the paper has collected data on the retail and corporate NPL ratios of the banks of Egypt during 2013-2020 and found that the corporate and retail NPL ratios are not moving in a similar shape as depicted in Figures 1 and 2. In addition, the corporate NPL ratio has reversed the downward line while the curve of the retail NPL ratio has struggled to the downward line shaping flat ones which shows that both NPL ratios are reacting differently over the years which might be an indicator that the Corporate and retail NPL ratios are affected differently by the bank-specific and macroeconomic variables. Moreover, Figure 1 shows that the corporate credit risk in Egypt has increased noticeably compared to the previous years. Consequently, it threatens banks' profitability and net worth because increases in the level of credit risk deteriorate bank capital and minimize the level of the profit margin.

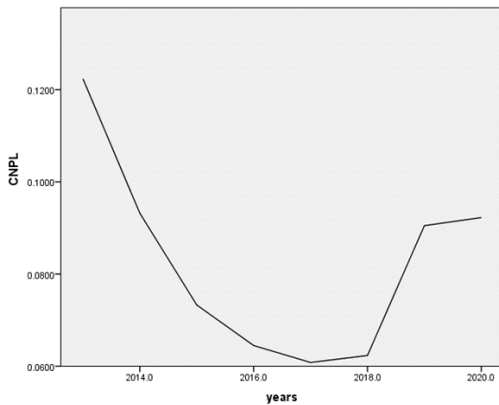


Figure 1

Corporate NPL ratio in Egypt (2013-2020)

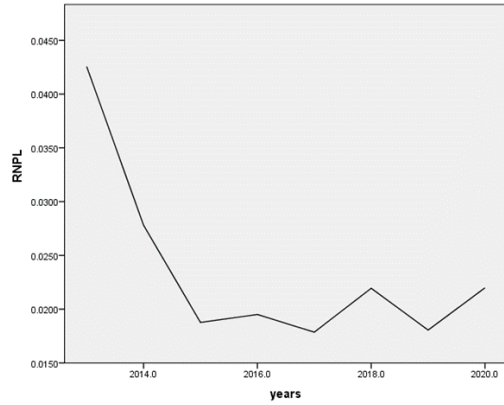


Figure 2

Retail NPL ratio in Egypt (2013-2020)

Source: Annual Reports of the Banks of Egypt

Furthermore, the literature found few studies conducted in Egypt investigating the factors that affect credit risk. To the researchers' knowledge, no paper was found exploring the factors that affect the corporate and retail credit risk in the banks of Egypt.

Therefore, studying separately the impact of bank-specific and macroeconomic factors on corporate and retail credit risks will provide better insight and generate more accurate estimated models that are suitable and customized to the retail and corporate credit officers for better credit risk prediction and decisions that enhance the financial health of the banking systems.

Materials and Methods

The paper used a sample of 26 banks out of 37 operating in Egypt after excluding the specialized banks from the study because the specialized banks are focusing on the corporate clients with minimal attention to the retail clients while the Islamic banks haven't been excluded because most of the conventional banks now have divisions offer Islamic financial products to avoid losing their market share. The paper has selected the period of study of 2013-2020 with 208 observations because it considers this period as an economic transition to Egypt after the revolution of 25 Jan. The paper has collected two types of data; bank-specific and macroeconomic data. The bank-specific data have been collected from the annual reports of the banks from their official sites while the macroeconomic data were collected from the official site of the Central Bank of Egypt (CBE).

Table 1: Variables Definition

Variables (Symbols)	Definition
Corporate credit risk (CNPL)	Corporate nonperforming loans/Total Corporate loans
Retail credit risk (RNPL)	Retail nonperforming loans/Total Retail loans
Profitability (ROA)	Return on Assets (ROA) = Net profit/total assets
Bank capital (CAR)	Capital adequacy ratio (CAR) = Core + supplemental capitals/risk-weighted assets
Asset size (SIZE)	The log of the total assets
Operating inefficiency (OPEFF)	Total costs/total income
Income diversification (DIV)	Non-interest income/total income
Liquidity (LTD)	Total loans/total deposits
Internal debt (IDEBT)	The log of internal debt in EGP
Foreign debt (EDEBT)	The external debt in USD
Exchange rate (EXR)	Annual percentage change in the exchange rate of EGP/USD
Economic growth (GDP)	Annual percentage change in the real GDP
Interest rate (INT)	Annual average lending interest rate
Foreign Direct Investment (FDI)	FDI Percentage of the GDP

In the present work, the paper has utilized the Fixed-Random

effect regression method for data analysis because in statistical modeling such a method can help to improve the accuracy and reliability of data analysis by controlling for confounding variables, accounting for variability, and improving precision (Sahai & Ageel, 2012). It is important to carefully consider which variables should be included as fixed or random effects in a given analysis, as this can have a significant impact on the results (Cheung, 2008). Before employing the fixed-random, the paper first tested the stationarity of the data by using the augmented Dickey-Fuller test to ensure that the data were stationary, then the paper utilized the Hausman test to show the results of the random and fixed effect and which results were appropriate for the data analysis.

There are two equations were created for the CNPL and RNPL as shown below:

$$\Delta \text{CNPL}_{it} = \alpha_i + \sum \beta_1 \text{ROA} + \sum \beta_2 \text{CAR} + \sum \beta_3 \text{SIZE} + \sum \beta_4 \text{OPEFF} + \sum \beta_5 \text{DIV} + \sum \beta_6 \text{LTD} + \sum \beta_7 \text{IDEBT} + \sum \beta_8 \text{EDEBT} + \sum \beta_9 \text{EXR} + \sum \beta_{10} \text{GDP} + \sum \beta_{11} \text{INT} + \sum \beta_{12} \text{FDI} + e_{it} \quad (1)$$

$$\Delta \text{RNPL}_{it} = \alpha_i + \sum \beta_1 \text{ROA} + \sum \beta_2 \text{CAR} + \sum \beta_3 \text{SIZE} + \sum \beta_4 \text{OPEFF} + \sum \beta_5 \text{DIV} + \sum \beta_6 \text{LTD} + \sum \beta_7 \text{IDEBT} + \sum \beta_8 \text{EDEBT} + \sum \beta_9 \text{EXR} + \sum \beta_{10} \text{GDP} + \sum \beta_{11} \text{INT} + \sum \beta_{12} \text{FDI} + e_{it} \quad (2)$$

Results

The data has been described in terms of observations, mean, standard deviation, minimum, and maximum to illustrate how the data is clear and free from any anomalies. As shown in Table 2 the CNPL has a mean of 8.6% which means that the banks of Egypt on average have a corporate credit risk exposure of 8.6% while the mean of the RNPL is 2.9%. Accordingly, corporate credit risk accounts for a large portion of the total credit risk in the banks of Egypt compared to the retail credit risk. Moreover, the standard deviation of the CNPL and RNPL is 8.4% and 4.1% respectively, which implies that the corporate credit risk is more volatile over the years than the retail credit risk. The banks on average have a mean of 1.7% of ROA which means that the profitability is very low in the banking industry of Egypt. Furthermore, the CAR has a mean of 17% indicating that the banks meet the capital requirements of the central bank (12.5%). The mean of the operating efficiency is 54.3% which indicates that the banks on average have 54.3% of expenses from the total income and such a percentage shows inefficiency in bank management.

Additionally, the income diversification ratio is 8.4% which

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shows that the fees (Non-interest) income is 8.4% of the total income, and such a percentage represents a low level of diversification by the banks of Egypt. The LTD is 48% which implies that the banks of Egypt have on average 48% loan-to-deposit ratio. The EXR and GDP have the highest standard deviation compared to the other variables which implies that the exchange rate and the GDP are highly fluctuated over the years which indicates that Egypt faces unstable economic conditions. Moreover, the maximum exchange rate reached 17.8/USD during 2013-2020 while the economic growth of Egypt has a maximum of 5.6% and a minimum of 2.2%. In addition, the external debt has a minimum of USD 43.2 billion while the maximum is 123.5 Billion dollars which shows that Egypt's external debt burden has notably increased over the years during 2013-2020. In this respect, the results of the descriptive statistics have detected no anomalies or illogical numbers which shows that the collected data are clear and informative.

Table 2: Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
CNPL	208	.0861979	.0846203	.0000806	.6464095
RNPL	208	.0294205	.0410488	.0000378	.3009789
ROA	208	.0169758	.0122357	-.011054	.089889
CAR	208	.1691727	.0470488	.0776	.35
SIZE	208	10.62499	.5678792	9.497381	12.35702
OPEFF	208	.5426405	.1297613	.190713	.8842827
DIV	208	.0839319	.0361775	.0132167	.1960739
LTD	208	.4779385	.1512293	.1208442	.8300353
EDEBT	208	74.625	29.1202	43.2	123.5
IDEBT	208	3.44527	.1676947	3.183953	3.675971
EXR	208	12.4875	4.693292	6.9	17.8
GDP	208	4.0625	1.07021	2.2	5.6
INT	208	.141125	.032845	.097	.198
FDI	208	2.310235	.7062826	1.453434	3.260263

The paper has tested the stationarity of the data by employing the Augmented Dickey-Fuller test as shown in Table 3 which indicates that the CNPL, RNPL, ROA, OPEFF, and GDP are stationary at lag 0 while CAR, SIZE, DIV, LTD, EDEBT, IDEBT, EXR, INT, and FDI are non-stationary. Therefore, the data lagged at the first difference and then retested as shown in Table 3 showing that all the data became stationary.

Table 3: Augmented Dickey-Fuller Test

Variable	Inverse chi-squared lag (0)		Inverse chi-squared lag (1)	
	Statistic	p-value	Statistic	p-value
s				
CNPL	171.110	0.0000*	88.6902	0.0011*
RNPL	2	0.0000*	81.0112	0.0061*
ROA	306.467	0.0059**	83.8994	0.0033*
CAR	8	*	74.2710	0.0230*
SIZE	81.2385	0.9883	672.832	*
OPEFF	31.6734	0.2677	5	0.0000*
DIV	57.8649	0.0669**	185.401	0.0000*
LTD	68.0424	*	4	0.0170*
EDEBT	24.6714	0.9995	75.8817	*
IDEBT	35.2638	0.9635	102.735	0.0000*
EXR	0.1552	1.0000	5	0.0151*
GDP	47.6066	0.6472	76.5016	*
INT	15.3401	1.0000	109.486	0.0000*
FDI	77.0184	0.0137**	7	0.0000*
	13.6670	1.0000	17.6476	0.0000*
	24.6555	0.9995	10.2577	0.0000*
			112.252	0.0000*
			3	
			115.783	
			0	

*Imply p-value < 0.01. ** p-value < 0.05. *** p-value < 0.1.

The results of the Hausman test for the CNPL found that the Prob>chi2 is 0.6792, which means that it is statistically insignificant, indicating that the fixed effect results should be ignored and consider the results of the Random. On the other side, the results of the Hausman test for the RNPL found that Prob>chi2 is 0.0743, which is statistically significant signifying that the random results should be ignored and accept the fixed effect results.

Table 4 shows the results of the Random model which revealed that the CNPL model is statistically significant. The SIZE, DIV, and LTD are statistically significant and have a negative relationship with the CNPL, while the EDEBT and INT positively impact the CNPL. In other words, one unit increase in SIZE, DIV, and LTD will reduce the CNPL by -.0416888, -.4886669, and -.1167377 respectively. Additionally, one unit increase in EDEBT and INT will raise the CNPL

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by .0058724 and 2.62718 respectively. The results of the Random model revealed that asset size, income diversification, loan-to-deposit ratio, interest rate, and external debt significantly affect corporate credit risk. In contrast, the results of the fixed model showed that the retail credit risk is affected only by external debt, GDP, interest rate, and foreign direct investment. In other words, the corporate credit risk is significantly affected by the macroeconomic and bank-specific variables while the retail credit risk is affected only by the macroeconomic variables since all the bank-specific variables were found statistically insignificant.

In the present work, asset size (SIZE) was found statistically significant and negatively associated with the CNPL which is supported by Al-Khazali & Mirzaei (2017), Karadima & Louri (2020), and Naili & Lahrichi (2022) advocating the theory of “diversification” which argues that increases in the size of bank assets show more diversification in bank loans and consequently it diversifies bank portfolio by having different risk-specific loans leading to a lower level of credit risk. Moreover, income diversification (DIV) was found to be statistically significant and is negatively related to the CNPL and supported by Al-Khazali & Mirzaei (2017) and Ozili (2019) arguing that increases in income diversification indicate that the bank generates more income through offering non-interest and interest-bearing banking services which consequently diversified more bank investments and thus lower credit risk exposure to the banks. Furthermore, the loan-to-deposit ratio (LTD) has a negative significant impact on the CNPL, and the results are contradicted by the findings of Gosh (2015); Al-Khazali & Mirzaei (2017); Mpofo & Nikolaidou (2018), and Ozili (2019) as they found that the relationship between LTD and credit risk is positive, arguing that increases in the loan-to-deposit ratio indicate more loans outstanding relative to the deposits which means more probability of loan failure will occur since there is an increase in loans over the years. However, these results could be explained by the fact that Egypt recently had a series of mergers and acquisitions that boosted bank synergies and strengthened their financial position, which led to holding more high-quality loans relative to deposits that have decreased the credit risk exposure to banks. Additionally, the EDEBT was found significant and has a positive relationship with the CNPL is supported by Kauko (2012); Maltritz & Molchanov (2014), and Nikolaidou & Vogiazas (2017) stating that increases in the EDEBT will deteriorate the value of the home currency leading to more pressure on borrowers’ repayment

capacity. As a result, more exposure to corporate credit risk. Last but not least, the paper also found that the INT has a positive relationship with the CNPL, the results consistent with Castro (2013); Mirolim & Mansur (2017), and ElGaliy (2022) contending that increased interest rates will raise firms' costs, lowering their revenue to expenses and thus weakening their capacity to repay outstanding loans, leading to a rise in corporate credit risk.

On the other side, Table 4 shows also the results of the fixed effect regression for the RNPL model which revealed that the model is statistically significant. The FDI is statistically significant and has a negative relationship with the RNPL while the EDEBT, GDP, and INT positively affect the CNPL. In other words, one unit increase in FDI will reduce the RNPL by $-.126719$ while one unit increase in EDEBT, GDP, and INT will raise the RNPL by $.0029195$, $.0575854$, and 2.071365 respectively. Furthermore, the GDP has a positive relationship with the RNPL and it is contradicted by Gosh (2015); Chaibi & Ftiti, (2015); Mpofo & Nikolaidou (2018); Naili & Lahrichi (2022), and ElGaliy (2022) stating that the GDP is negatively related to the credit risk because increases in the GDP growth rate will increase the national income which eventually strengthens the repayment capacity of the borrowers and reduces the NPL ratio. However, the positive relationship could be justified by arguing that an increase in the GDP growth rate in Egypt could result in encouraging the banks to relax their credit terms for issuing more loans during the stable economic periods which consequently raised the retail credit risk exposure to banks. Moreover, the lending interest rate (INT) has a positive relationship with the RNPL which is supported by the results of Castro (2013); Mirolim & Mansur (2017), and ElGaliy (2022) arguing that increased interest rates will raise firms' expenses, lowering their profits and thus deteriorating their ability to repay, leading to spikes in retail credit risk. Finally, the FDI has a negative relationship with the RNPL supported by Konstantakis et al. (2016) contend that increases in foreign direct investment will skyrocket the cash inflow to the host country enhancing the financial positions of the firms and lead to better repayment to the debt obligations.

Table 4: Random-Fixed effects results

Variables	Random (CNPL)		Fixed (RNPL)	
	Coef.	P-value	Coef.	P-value
ROA	-.0979515	0.851	.0650925	0.797
CAR	.1076688	0.457	-.0329519	0.654
SIZE	-.0416888	0.001*	.0031671	0.665
OPEFF	.0435399	0.535	-.0093565	0.794
DIV	-.4886669	0.062**	-.1932071	0.152
LTD	-.1167377	0.011**	-.0221501	0.360
EDEBT	.0058724	0.022**	.0029195	0.014**
IDEBT	-1.155655	0.604	-1.060047	0.296
EXR	-.0151694	0.272	-.0012091	0.849
GDP	.0495854	0.256	.0575854	0.006*
INT	2.62718	0.080***	2.071365	0.003*
FDI	-.0999263	0.301	-.126719	0.006*
Cons	3.556673	0.491	2.680902	0.255

*Imply p-value < 0.01. ** p-value < 0.05. *** p-value < 0.1.

Conclusions

The paper studied the macro- and microeconomic factors on the retail and corporate NPL ratios during 2013-2020 and the results revealed that the corporate NPL is affected by the macro- and microeconomic variables while the retail NPL is affected only by the macroeconomic variables. Accordingly, the results of both models are different, confirming the importance of dividing the credit risk into retail and corporate to provide better insights about the factors that significantly affect the credit risk in the retail and corporate divisions of the banks. Moreover, the results succeeded in adding to the body of the literature as to the researchers' knowledge few papers were conducted in Egypt. In this respect, the developed models will be helpful to the retail and corporate credit risk officers and managers to better predict the future value of the NPLs. Last but not least, the paper concluded that classifying the NPLs is very important to avoid developing confusing results or misleading estimated models that would affect negatively the decisions of the professionals and regulators.

Recommendations

The results provide a group of recommendations to academics, professionals, and regulators. The paper recommends that academics break down credit risk into categories before studying the factors that

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affect credit risk to avoid developing confusing and vague results that could mislead professionals and regulators. Additionally, it recommends that academics in their future work examine the impact of other microeconomic variables than the ones studied in the paper because the findings found that the microeconomic variables have an insignificant effect on the retail NPL. Moreover, it recommends that credit officers use the developed models to have better predictions of retail and corporate credit risk. In other words, corporate credit officers could predict the future movement of the credit risk exposure by watching the future movement of asset size, income diversification, and loan to deposit ratio, external debt, and lending interest rate, while retail credit officers could predict the future movement of the credit risk exposure by watching the future movement of external debt, GDP, lending interest rate, and FDI. Finally, the paper urges the regulators of the CBE to force the banks of Egypt to disclose the gross loans and NPLs under different industries to help academics in their future work to study the determinants of credit risk under different industries which will consequently help in developing more robust and accurate estimated models help in enhancing the credit risk management.

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