
The Crucial Macroeconomic and Microeconomic Determinants of Retail and Corporate Credit Risks

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Abstract:

Purpose: In early 2018, the corporate non-performing loan ratio began to climb steadily, showing some threats to the financial health of the Egyptian banking system. Therefore, the determinants of corporate and retail credit risks in the banking sector of Egypt during 2013-2020 were studied in the present work to provide better insight into how the macroeconomic and microeconomic determinants affect the level of credit risks.

Design/Methodology/Approach: The present research utilized the Dickey-Fuller test to assess the stationarity of the panel data and then employed the generalized method of moments (GMM) for data analysis.

Findings: It was found that asset size, loans-to-deposits, inflation, gross domestic product (GDP), and lending interest rate were negatively associated with the corporate credit risk, while the capital adequacy ratio, foreign direct investment (FDI), and public debt were positively related. Moreover, the loans-to-deposits ratio was negatively associated with retail credit risk, while the capital adequacy ratio was positively related.

Originality/Value: In this context, classifying the credit risk into corporate and retail credit risk was very crucial as it illustrated that the corporate credit risk was more sensitive to the determinants than the retail ones.

Keywords: Nonperforming loans, Macroeconomic, Microeconomic.

JEL Classification: G20, G21, G28.

Paper Type: Research study.

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1. Introduction

Credit risk is one of the risks that severely threaten banks' solvency and profitability and deteriorates the quality of their portfolios. Credit risk is the risk of a borrower's failure to meet his obligations to the creditors (Kjosevski *et al.*, 2019). Loans that passed the due date by 90 days without paying the installments are classified as nonperforming loans (NPL), dividing the total NPLs by the total loans is the NPL ratio, which is used as a proxy for the credit risk. Increases in the NPL ratios over time lead to deterioration in the financial health of the banks and threaten their survival and growth and consequently lower the growth of the economies (Naili and Lahrichi, 2022). Rises in NPLs reduce capital and threaten banks' solvency. In other words, the capital absorbs any losses arising from the loans; subsequently, the bank will become insolvent if the loan losses surpass the capital.

Previous studies on credit risk determinants have shown that the majority of studies did not categorize credit risks. Although very few trials did, there are discrepancies in the results of these investigations. Isaev and Masih (2017), for example, divided credit risk into mortgage, business, and retail categories. They have found that the determinants affect them differently. Additionally, Kjosevski *et al.* (2019) separated credit risk into two categories: retail and corporate, and their findings also have shown that the determinants have distinct effects on each. This demonstrates the significance of categorizing credit risk to prevent the creation of any deceptive estimated models that have a detrimental impact on credit decisions and increase the number of NPLs (Thalassinou *et al.*, 2015).

Our research has found that the banks of Egypt are facing a corporate credit risk, which may threaten banks' role in supporting the growth of the economy and weakens the financial health of the banking system. Furthermore, to the best of our knowledge, after a comprehensive literature review, no previous work on credit risk determinants was found examining or discussing the impact of the macroeconomic and microeconomic variables on corporate and retail credit risk in Egypt.

Therefore, the current work aims to investigate the determinants of retail and corporate NPLs, demonstrating our contribution to expanding the body of literature and providing better insights to credit risk officers for better prediction of corporate and retail credit risk exposures.

2. Materials and Methods

2.1 Data and Sample Size

A sample of 23 conventional commercial banks out of 37 banks operating in Egypt was selected after excluding the Islamic and specialized banks. The study included 184 observations and spanned the years 2013 to 2020. The bank data were collected from the financial statements and footnotes of the annual reports of the conventional

banks of Egypt, while the economic data from the official site of the central bank of Egypt (CBE) from the statistics of the economic research section as well as the annual reports. The symbols, definitions and expected signs of the studied variables are given in Table 1.

Table 1. *Descriptive of variables*

Variables (Symbols)	Definition	Expected sign
Corporate credit risk (CNPL)	Corporate nonperforming loans/Total Corporate loans	
Retail credit risk (RNPL)	Retail nonperforming loans/Total Retail loans	
<i>Microeconomic</i>		Negative
Profitability (ROA)	Return on Assets (ROA) = Net profit/total assets	Negative/Positive
Solvency (CAR)	Capital adequacy ratio (CAR) = Core + supplementary capitals/risk-weighted assets	Negative
Bank size (SIZE)		Negative/Positive
Operating inefficiency (OPEFF)	The log of the total assets Total costs/total income	Negative Negative/Positive
Income diversification (DIV)	Non-interest income/total income	Positive
Liquidity (LTD)	Total loans/total deposits	Positive
<i>Macroeconomic</i>		Negative/Positive
Public debt (IDEBT)	The log of internal debt in EGP	
External debt (EDEBT)	The external debt in USD	
Inflation (INF)	Annual percentage change in the consumer price index (CPI)	Positive
Exchange rate (EXR)	Annual percentage change in exchange rate of EGP/USD	Negative
Economic growth (GDP)	Annual percentage change in GDP	Negative/Positive
Interest rate (INT)	Annual weighted average lending interest rate	Negative
Foreign Direct Investment (FDI)	FDI percentage of the GDP	

Source: Own study.

2.2 Method

The generalized method of moments (GMM) was utilized in the present research. GMM is based on moment conditions, which are equations that relate the sample moments of the data to the model parameters, and it avoids the assumptions of traditional regressions. Arellano and Bond (1991) have reported that GMM addresses the endogeneity dilemma and the bank-specific effect with the error term. Furthermore, most of the researchers such as Gosh (2015), Koju *et al.* (2018), Gulati *et al.* (2019), Farooq *et al.* (2019), Naili and Lahrichi (2022), and Zampeta and Chondrokoukis (2022; 2023) used the GMM in data analysis because it is a more

accurate estimator than the other models.

Accordingly, the present work employed GMM to examine the determinants of corporate and retail credit risks in the banking sector of Egypt. Before applying the GMM, the research utilized the unit-root test to test the stationarity of the panel data and found that some of the data are non-stationary. Therefore, the data have been lagged to the first difference to guarantee that all the data became stationary before being applied to the GMM. In this respect, two equations were created as shown below:

$$\Delta \text{CNPL}_{it} = \alpha_i + \sum \beta_{jt} \text{MICRO} + \sum \beta_{kt} \text{MACRO} + e_{it} \quad (1)$$

$$\Delta \text{RNPL}_{it} = \alpha_i + \sum \beta_{jt} \text{MICRO} + \sum \beta_{kt} \text{MACRO} + e_{it} \quad (2)$$

Where:

CNPL denotes the model's dependent variable for the corporate credit risk

RNPL denotes the model's dependent variable for the retail credit risk

MICRO denotes the microeconomic variables

MACRO denotes the macroeconomic variables

j denotes the number of microeconomic variables ($J = 1, \dots, 6$)

t denotes the years from 2013 to 2020

i denotes cross-section dimension

k denotes the number of macroeconomic variables ($K = 1, \dots, 7$)

α_i denotes the model's constant value

β denotes the beta coefficient of the independent variables

e denotes the error term

$$\Delta \text{CNPL}_{it} = \alpha_i + \sum \beta_1 \text{ROA} + \sum \beta_2 \text{CAR} + \sum \beta_3 \text{SIZE} + \sum \beta_4 \text{OPEFF} + \sum \beta_5 \text{DIV} + \sum \beta_6 \text{LTD} + \sum \beta_7 \text{IDEBT} + \sum \beta_8 \text{EDEBT} + \sum \beta_9 \text{INF} + \sum \beta_{10} \text{EXR} + \sum \beta_{11} \text{GDP} + \sum \beta_{12} \text{INT} + \sum \beta_{13} \text{FDI} + e_{it} \quad (1.1)$$

$$\Delta \text{RNPL}_{it} = \alpha_i + \sum \beta_1 \text{ROA} + \sum \beta_2 \text{CAR} + \sum \beta_3 \text{SIZE} + \sum \beta_4 \text{OPEFF} + \sum \beta_5 \text{DIV} + \sum \beta_6 \text{LTD} + \sum \beta_7 \text{IDEBT} + \sum \beta_8 \text{EDEBT} + \sum \beta_9 \text{INF} + \sum \beta_{10} \text{EXR} + \sum \beta_{11} \text{GDP} + \sum \beta_{12} \text{INT} + \sum \beta_{13} \text{FDI} + e_{it} \quad (2.1)$$

Where:

α_i denotes the model's constant value

β denotes the beta coefficient of the dependent variables

e denotes the error term

3. Results

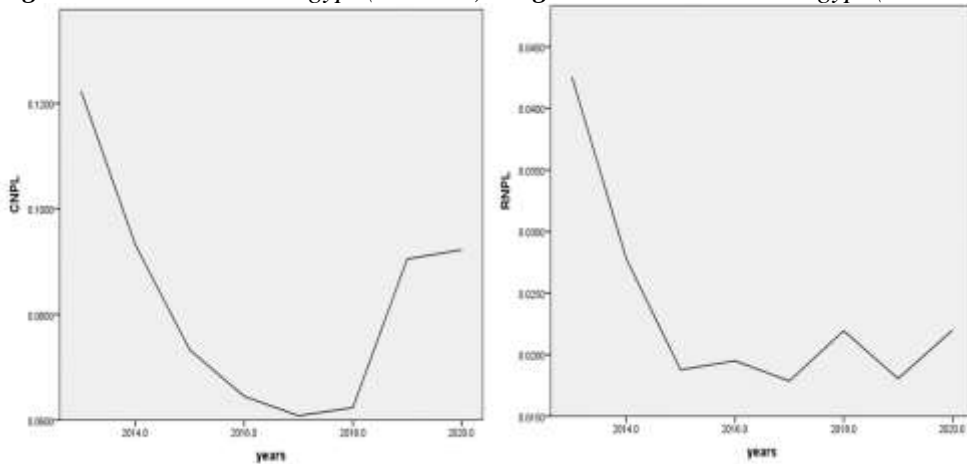
3.1 RNPL and CNPL Ratios in Banks of Egypt during 2013-2020

The research graphically compares the corporate and retail credit risks during 2013-2020 by collecting the corporate and retail NPL ratios from the annual reports of the

banks of Egypt. It can be observed that the CNPL ratio started to increase from 2018 to 2020 as shown in Figure 1. However, as depicted in Figure 2, the RNPL ratio struggled with the declining trend. Accordingly, we argue that the determinants of the CNPL and RNPL may be different because they do not track a synchronized form.

Therefore, studying CNPL and RNPL separately will provide better insights to the academics and professionals about the determinants, which significantly affect retail and corporate credit risks to generate a better customized estimated model for each department in credit risk management. This will improve the performance of the CNPL and RNPL predictions, and consequently, lower the spikes of the CNPL, enhancing the financial health of the banking system.

Figure 1. CNPL ratio in Egypt (2013-20) **Figure 2. RNPL ratio in Egypt (2013-20)**



Source: Annual Reports of the Banks of Egypt.

3.2 Descriptive Statistics

Table 2 illustrates the descriptive analysis of the collected data. The data contains 184 observations, and the CNPL mean is .082408, while the RNPL mean is .023563, indicating that the corporate credit risk makes up a larger share of the overall credit risk than the retail credit risk.

Additionally, the CNPL has a standard variation of .0851911 whereas the RNPL has a standard deviation of .0261205, indicating that the CNPL is more volatile over time than the RNPL. The maximum is .6464 and .1997 for the CNPL and RNPL, respectively.

As a result, we come to the conclusion that corporate clients in banks pose a greater risk than do retail customers, and that they require more monitoring efforts to effectively control their risk exposure.

The ROA has a mean of .017140 and a standard deviation of .0127600, which implies that Egypt's banks have produced poor profit margins over the years. The mean value of CAR is .170888, which exceeds the minimal capital 0.125 requirement that was imposed by the CBE in their regulations. Additionally, the standard deviation for bank size is very high, reaching .5972810, which indicates that Egypt's banks have a wide range of asset sizes and few peers.

Moreover, the banks of Egypt have on average a cost-to-income ratio of .540652, which means that the total expenses account for 54% of the total income. However, the fees-to-income ratio on average reaches .087410, implying that the banks of Egypt don't heavily depend on non-traditional services to generate more non-interest income to total income. Furthermore, the mean of the loan-to-deposit (LTD) ratio is .490434, demonstrating that the banks of Egypt use on average 50% of their deposits to issue loans to their clients.

The external debt has increased and fluctuated significantly, reaching 123.5 billion dollars in 2020 against 34.9 billion in 2011, which shows the huge burden of debt that Egypt bears nowadays. Additionally, the inflation rate reaches a maximum of 0.29500 compared to its mean of .12750. This shows that Egypt faces high inflationary pressures. The standard deviation of the exchange rate is 4.6947717, which signifies that Egypt's currency faces high fluctuations over time, with a maximum exchange rate of 17.8 (EGP/USD) in 2017 and a minimum rate of 6.9 in 2011.

The GDP in Egypt has fallen from 5.6% in 2019 to 3.6% in 2020 due to the global challenges that hit the world's economy. Finally, the FDI accounts for 2.3% of the total GDP of Egypt, which shows a very low percentage of capital flights to Egypt.

Table 2. Descriptive statistics

Variables	Observation	Mean	Stand. deviation	Minimum	Maximum
CNPL	184	.082408	.0851911	.0001	.6464
RNPL	184	.023563	.0261205	.0000	.1997
ROA	184	.017140	.0127600	-.0111	.0899
CAR	184	.170888	.0469664	.0776	.3500
SIZE	184	10.618529	.5972810	9.4974	12.3570
OPEFF	184	.540652	.1348217	.1907	.8843
DIV	184	.087410	.0350457	.0132	.1961
LTD	184	.490434	.1335318	.1309	.8300
IDEBT	184	3.44527	.1677475	3.1840	3.6760
EDEBT	184	74.6250	29.1293821	43.2000	123.5000
INF	184	.12750	6.9153745	.05000	0.29500
EXR	184	12.4875	4.6947717	6.9000	17.8000
GDP	184	.04063	1.0705	.022	.056
INT	184	.141125	.0328554	.0970	.1980
FDI	184	.023102	.7065053	.014534	.032603

Source: Own study.

3.3 The Results of GMM and Discussion

Table 3 shows the empirical results of the GMM, revealing that the microeconomic determinants significantly affect the CNPL. The SIZE of the bank has a negative significant impact on CNPL as increases in the SIZE will reduce the CNPL by $-.0250292$. These results are supported by Chaibi and Ftiti (2015), Al-Khazali and Mirzaei (2017), Karadima and Louri (2020) and Naili and Lahrichi (2022), where they have argued that large banks in size have more ability to diversify their investments in different types of loans, which consequently reduces the overall risk of the bank.

Moreover, the LTD has a negative association with the CNPL as increasing the LTD will reduce the CNPL by $-.1941245$. This result is contradicted by the results obtained by Gosh (2015), Al-Khazali and Mirzaei (2017), Mpofu and Nikolaidou (2018) and Ozili (2019). These authors argue that increases in loans to deposits will raise the probability of default on loans and consequently raises the NPL.

However, the negative association is supported by the argument that some of these rises in LTD were caused by bank mergers and acquisitions in Egypt, which started to occur in the previous decade, and ultimately improved their financial situations and decreased their CNPLs. The ROA was found insignificant, which implies that increases in ROA won't affect the value of the CNPL.

This finding is contradicted by Abid *et al.* (2014), Gosh (2015), Chaibi and Ftiti (2015), Wood and Skinner (2018), Kjosevski *et al.* (2019), Gulati *et al.* (2019), Karadima and Louri (2020) and Naili and Lahrichi (2022) as they found a negative relationship with the NPL, arguing that banks with high ROAs would be less likely to make riskier loans, hence, lowering the NPLs.

The CAR is statistically significant and has a positive relationship with the CNPL as increases in the CAR will raise the CNPL by $.2703422$. These results are consistent with the findings of Wood and Skinner (2018) and Saif-Alyousfi and Saha, (2021), stating that increases in CAR will increase the buffer against the insolvency risk, which encourages banks to engage in more risky loans leading to more CNPL.

The findings of the GMM also indicate that the macroeconomic determinants significantly affect the CNPL. Increases in the INF will reduce the CNPL by $-.0051317$. These results are in agreement with the results obtained by Naili & Lahrichi (2022), where they argue that increases in the INF, particularly in emerging nations, would enforce governments to noticeably raise their interest rates in order to reduce the demand on loans and consequently reduces the CNPL.

Additionally, the GDP is negatively related to the CNPL as increases in the GDP will lower the CNPL by $-.2190678$. These results are supported by Castro (2013), Gosh (2015), Chaibi and Ftiti, (2015), Mpofu and Nikolaidou (2018), Naili and Lahrichi (2022) and ElGaliy (2022), where they have found that rises in GDP will

increase the national income, which eventually strengthens the financial positions of the borrowers and lowers the CNPL.

Furthermore, the INT was found negatively associated with the CNPL, indicating that increases in the INT will reduce the CNPL by -3.772807, in agreement with the results of Wood & Skinner (2018) and Shehata (2019), arguing that rises in the INT will reduce the demand for loans lowering the CNPL. Additionally, the exchange rate is insignificant. The fact that Egypt used multiple foreign exchange (FX) systems during the studied period of 2013–2020, which justified the insignificance as it first applied the pegged FX before adopting the free-float system. The claim that the exchange rate is insignificant is supported by Love and Ariss (2014) and Haniifah (2015).

The IDEBT has a positive significant impact on the CNPL increases in the IDEBT will raise the CNPL by 1.015764 and it is supported by the findings of Ali and Daly (2010), Reinhart and Rogoff (2011), Louzis *et al.* (2012), Amit Gosh, (2015) and Naili and Lahrichi (2022), arguing that increases in the public debt will place more pressure on the government to reduce their spending on public projects, which subsequently lowers the level of national income, deteriorating borrowers' capacity to repay their debts, and increasing the amount of CNPL.

Finally, the FDI is positively related to the CNPL rises in the FDI will increase the CNPL by .4821061. This is supported by Giammanco *et al.* (2022), arguing that increases in FDI encourage banks to relax their credit terms to issue more loans to foreign businesses, which consequently raises the CNPL. On the other side, the RNPL results have revealed that the CAR is statistically significant and positively associated with the RNPL, while LTD is negatively related to it.

In other words, increases in the CAR will raise the RNPL by .0950418, whereas increases in LTD will decrease the RNPL by -.026364. Finally, the remaining variables were found insignificant, which illustrates that the RNPL is not affected by the macroeconomic determinants and is less sensitive to the microeconomic determinants than the CNPL.

Table 3. Results with GMM estimations

Regressors	CNPL		RNPL	
	Coefficients	P-value	Coefficients	P-value
<i>Microeconomic</i>				
ROA	.3996615	0.410	.0443838	0.772
CAR	.2703422**	0.050	.0950418**	0.029
SIZE	-.0250292**	0.011	.002111	0.480
OPEFF	.0871418	0.174	.0066636	0.742
DIV	.3726554	0.166	.0267548	0.756
LTD	-.1941245*	0.000	-.026364***	0.065
<i>Macroeconomic</i>				
IDEBT	1.015764**	0.039	.1471639	0.346

EDEBT	-.0023985	0.445	-.0012007	0.227
INF	-.0051317***	0.072	-.0012266	0.171
EXR	-.0232383	0.142	.0036604	0.465
GDP	-.2190678**	0.019	-.009144	0.756
INT	-3.772807**	0.029	-.095638	0.860
FDI	.4821061**	0.017	.0057889	0.927

Source: Own study.

4. Conclusions and Future Work

The current findings point out the importance of studying the determinants of retail and corporate credit risks separately, disclosing that macroeconomic and microeconomic determinants have distinct effects on retail and corporate credit risks. As a result, it is of great importance to classify the NPL into retail and corporate before the evaluation of them to provide better and more accurate estimated models, which would enhance the performance of prediction to the credit risk exposure.

Moreover, the empirical findings would advance the corpus of knowledge on credit risk determinants and offer greater understanding to researchers, professionals, and regulators. Future research should focus on studying additional RNPL determinants, as only two of the thirteen variables identified in the current study were found to be significant.

5. Recommendations

The present empirical results successfully developed customized estimated models to the retail and corporate credit risk that can be used by the credit officers to better predict the future movement of the CNPL and RNPL. Accordingly, they should make precautions to minimize their retail and corporate credit risk exposures and avoid deteriorating the quality of banks' assets and their solvency levels.

The banks should be concerned about the microeconomic determinants to estimate the future CNPL because the size of the capital is positively related to the CNPL, so increases in the CAR (holding the other factors constant) will make the banks expect more CNPL. Furthermore, banks with more assets anticipate lower CNPL due to the diversification advantage. In addition, increases in the loans-to-deposits ratio due to the merger and acquisitions will lower the CNPL.

The current empirical results also confirmed the importance of monitoring the macroeconomic determinants to predict the future CNPL. In other words, credit officers should be concerned about the size of the public debt as it is found positively associated with the CNPL. So, any increase in the public debt can raise the CNPL because more debts reduce the government's expenditures and deteriorate the national income, which consequently raises the CNPL.

Furthermore, rises in inflation rates can reduce the CNPL, especially, when the central bank raises significantly the interest rates to curb the inflationary pressures and consequently reduces the loans and the CNPL. Moreover, increases in the GDP will reduce the CNPL because it indicates better financial positions for the borrowers, leading to better debt servicing.

Additionally, increases in interest rates lower the CNPL because rises in interest rates will discourage borrowers to demand more loans, which consequently reduce the CNPL. Finally, the FDI is positively related to the CNPL, indicating that increases in FDI will encourage the banks to relax their credit terms to issue more loans to foreign businesses, leading to more CNPL.

On the other side, the retail credit officers should be concerned about the microeconomic determinants to predict the future RNPL as it is found that increases in bank capital will raise the RNPL, while increases in the loans-to-deposits ratio will reduce the RNPL.

The research recommends regulators to enforce banks to make further disclosures about the industry-specific NPLs. In other words, the research suggests banks to classify the NPLs under industrial, commercial, real estate, and consumer to make it easier for the researchers to study the determinants of NPLs under different categories to generate more accurate and customized estimated models for better prediction to the NPLs.

Moreover, according to Cui et al. (2018), the regulators are recommended to enforce banks to make further disclosures for green and non-green loans and NPLs to help academics study the determinants of green credit risk to generate estimated models that support the growth of environmental sustainability.

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