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Measuring the Impact of the Macroeconomic and Bank-specific Variables on Capital Risk: A Comparative Study between the Listed and Non-listed Banks

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Abstract

Banks have a sensitive impact on the economic performance of the countries through their intermediate role inside the financial system. To guarantee the effectiveness of their role in supporting the growth of the economies, they need to monitor their risks continuously. Capital risk is one of the threats that banks should carefully measure and manage to survive and grow. After reviewing the literature on capital risk determinants, we found no paper classifying capital risk into listed and non-listed banks. However, we found that the listed and non-listed capital risks have not been synchronized over the years and have a weak correlation. In this respect, the paper aimed to examine the impact of the macroeconomic and bank-specific variables on the categorized capital risk to enhance the prediction performance of the capital risk in the banks. The results found that the capital risk of the listed banks is more susceptible to bank-specific and macroeconomic variables. In contrast, the non-listed banks are unaffected by the macroeconomic variables, confirming the importance of classifying capital risk before the examination to better manage and control the capital risk.

Keywords: Macroeconomic, Bank-specific, Capital risk, Listed and non-listed banks

Introduction

Banks are integral to the global financial system, providing borrowers with indirect financing to help their businesses grow. Nonetheless, banks are confronted with several dangers that jeopardize their ability to survive and expand in the credit markets and potentially hinder their delicate role in stimulating economic growth (Naoaj, 2023). For banks, capital risk is the most dreadful type of risk because of its high likelihood of occurring and its significant effect on bank performance. One risk associated with capital risk is that the bank might not have enough capital to cover its asset losses, making it insolvent and one step away from filing for bankruptcy (Abiodun et al., 2020). Obeid (2023) argued that capital risk is always sensitive to changes in credit risk levels. When banks face a higher level of credit risk, it indicates that they expect to incur larger losses on assets that should be covered by capital. In this regard, Balili and Tola (2023) stated that banks should carefully manage their credit risk exposure and capital size to minimize any future insolvency risk that could jeopardize their survival in the near future. Further, capital risk is measured by the capital adequacy ratio (CAR), which divides equity capital by total risk-weighted assets to

determine how much equity capital is relative to risky assets and how sufficient capital is to cover any losses that may occur in bank assets.

According to Farag et al. (2023), Egyptian banks face significant levels of corporate credit risk, with 8.2% compared to 2.4% for retail credit risk, indicating a high credit risk that may threaten Egyptian banks' insolvency if they do not have sufficient reserves to cover any credit risk-related losses. Furthermore, based on the Central Bank of Egypt's (CBE) foresight into future credit risk exposure and other risks it established a minimum capital ratio requirement of 12.5%, requiring all Egyptian banks to keep such a proportion in their CAR to avoid unanticipated insolvency risk. In this regard, the paper collected historical CAR data for Egypt's listed and non-listed banks from 2011 to 2023 and plotted them into two graphs, as shown in Figures 1 and 2. The paper observed that the CARs of the listed and non-listed banks are not moving in parallel and used the correlation to determine the strength and direction of the relationship between the two classified CARs. The results revealed a correlation of 0.217731, which shows a weak correlation between the CAR of listed and non-listed banks. Additionally, both CARs increased noticeably during 2016-2021. Then they started to struggle with growth, the CARs far exceeding the required regulated capital of 12.5%. This shows that the banks might take precautions to avoid an expected increase in the insolvency risk driven by the high instability of Egypt's economy. Moreover, the average CAR of the non-listed banks is higher than the CAR of the non-listed ones. In this respect, the paper assumes that the determinants of the CAR could be different between the listed and non-listed banks and that they need examination to provide more accurate customized models to the bankers of the listed and non-listed to have better control on the solvency levels for better survival and growth in the credit markets and to have better support to the development of the economies.

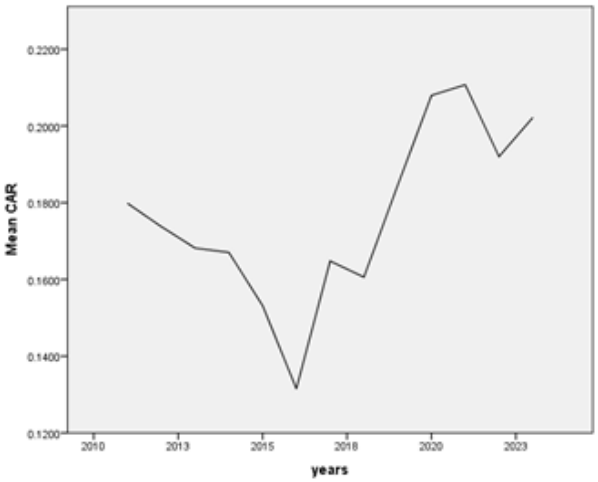

Figure (1)

The CAR of the Listed Banks

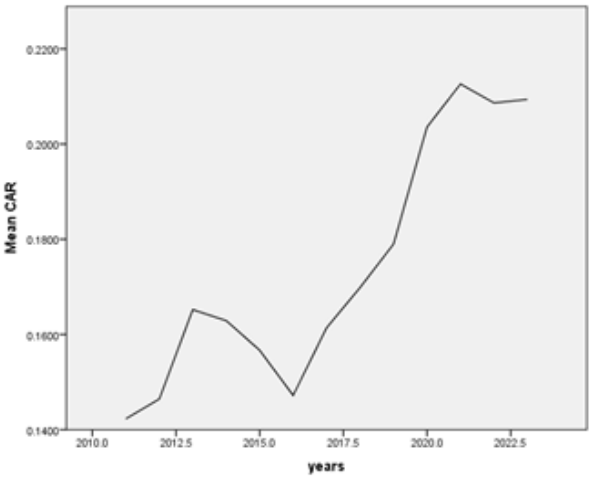

Figure (2)

The CAR of the Non-Listed Banks

- **Literature review**

In this section, the paper reviews the literature on capital risk determinants to identify the common factors that significantly affect capital risk and determine the literature gap the article will address in its results and analysis. The literature review is split into three sections: (1) *Previous studies in Egypt*, (2) *Previous studies in the rest of the world*, and (3) *Literature gap*.

Previous studies in Egypt

El-Ansary and Hafez (2015) employed the regression model to investigate the impact of the bank-specific variables on capital adequacy in the banks of Egypt using a sample of 33 banks and panel data from 2004 to 2013. The results found that asset size, liquidity, credit risk, profitability, and asset management quality significantly affect the level of CAR. Further, Liquidity is measured by dividing securities by total assets and was found to be positively correlated

with the CAR, implying that when banks allocate more reserves to securities that are less risky than loans, earnings increase, resulting in a higher level of capital reserves in the banks. Moreover, the loan-to-deposit ratio was also employed as a proxy for liquidity and shown to be positively associated with CAR, suggesting that more loans issued relative to deposits increase the possibility for losses, pushing banks to inject additional capital as a buffer against insolvency threats and thus raising the CAR. Additionally, the credit risk was negatively associated with the CAR, indicating that more exposure to credit risk increases bad debt expenses, which immediately deteriorates capital and hence decreases the CAR. Moreover, Eldomiaty et al. (2016) explored the determinants of CAR by using a sample from the Egyptian banks covering the period of 2010-2014 the findings showed that profitability, credit risk, and liquidity have significant effects on capital adequacy. Further, Hafez (2018) explored the relationship between bank efficiency and capital adequacy using a sample of 40 banks operating in Egypt with panel data from 2002 to 2015. The findings found that capital adequacy has a positive effect on bank efficiency, arguing that increases in bank efficiency indicate that the banks can control expenses relative to income by enhancing the profitability level and thus raising the level of CAR. Furthermore, Dawood (2020) studied the effect of market power, cost efficiency, and risk-taking on capital adequacy by using a sample from the listed banks of EGX covering panel data from 2013 to 2017. The results found that market power and cost efficiency have a positive effect on capital adequacy. Further, in Egypt, Farag et al. (2023) utilized the GMM and Fixed effect using panel data from 2011 to 2020 to explore the determinants of credit risk by classifying the credit risk into retail and corporate, the results revealed that the determinants are different between the two classified credit risks which illustrate the importance of classifying the credit risk when we also need to examine its impact on the CAR to provide better insights and more accurate and robust estimated models. Additionally, Obiedallah and Abdelaziz (2024) employed the linear mixed model to investigate the moderating role of the CAR between financial inclusion and bank performance by using a sample of 10 listed banks in the Egyptian stock exchange (EGX) covering the period of 2013-2021. The results revealed that the CAR strengthens the relationship between financial inclusion and bank performance measured by ROA.

Previous studies in the rest of the world

Masood and Ansari (2016) studied the CAR determinants by employing the Random effect model using a sample from 14 listed banks in the Karachi Stock Exchange (KSE) in Pakistan from 2008 to 2014. The findings found that the loan-to-asset ratio and ownership concentration have a negative impact on CAR. In contrast, the deposit-to-asset ratio and loan loss reserves are positively associated with the CAR. Additionally, in Vietnam, Pham and Nguyen (2017) found that profitability measured by the Net Interest Margin (NIM) is positively associated with CAR, while the loan-to-asset ratio has a negative effect on CAR which is consistent with the results of El-Ansary and Hafez (2015). Further, Usman et al. (2019) used a sample from listed banks in the Indonesia Stock Exchange (IDX) using panel data from 2007 to 2018, they found that the asset size, loan loss reserve, and loan-to-total assets negatively affect the CAR while, the leverage and net interest margin have a positive relationship with the CAR. Talumantak (2021) also studied the CAR determinants in Indonesia by covering the period from 2015 to 2020 and he found that bank size, operating efficiency, and liquidity negatively affect the CAR. In addition, Ali (2019) employed the regression and used a sample of Islamic banks from the Gulf Cooperation Council countries from 2013 to 2018 to identify CAR factors, he found that operating efficiency and financing-to-deposit ratio significantly affect the CAR demonstrating the importance of enhancing the efficiency of management to avoid unexpected drops in CAR that might threaten bank solvency levels. El-Ansary et al. (2019) employed the generalized method of moments (GMM) to investigate the determinants of capital risk in the MENA region conducting a comparative study between the Islamic band Conventional banks using panel data covering the period of 2009-2013. They found that bank efficiency, bank size, and GDP significantly affect the CAR in Islamic and Conventional banks. Ahmed and Albaity (2019) studied the CAR by using a sample from banks operating in East Asian countries covering the period from 2004 to 2014 and they found that liquidity, leverage, and bank size significantly affect the CAR which is consistent with the literature. Moreover, in Nigeria, Abiodun et al. (2020) discovered that credit risk has a negative impact on the CAR, claiming that more non-performing loans increase bad debt expenses, deteriorating capital reserves and

thus lowering the CAR. In contrast, the profitability measured by the ROA has a positive influence on the CAR, arguing that banks with high-profit margins have more retained earnings, leading to a higher level of CAR. Additionally, Dao (2020) used a sample of 16 Vietnamese banks covering the period from 2010 to 2017 to find the macroeconomic and bank-specific determinants of CAR and his findings revealed that operating efficiency, credit growth, and GDP growth significantly affect the CAR confirming the importance of regularly monitoring the economic growth of Vietnamese economy to maintain a suitable amount of CAR protect banks stability and growth. Further, in another study in Vietnam, Vu and Dang (2020) found that loan loss reserve and leverage negatively affect the CAR demonstrating that more leverage indicates that the banks rely more on debt sources than equity increasing risk-weighted assets and consequently lowering the CAR. Additionally, they found that profitability measured by ROA is positively related. In Ethiopia, Bogale (2020) found that bank size and loan-to-asset ratio negatively affect the CAR while ROA and loan loss provision are positively related which is consistent with the findings of the literature. Furthermore, Kablay and Gumbo (2021) employed regression to study the CAR factors covering the period of 2015-2019 using a sample of nine banks operating in Botswana and they showed that the asset-to-equity ratio has a significant impact on CAR illustrating that more leverage used in debt relative to equity will deteriorate the level of the CAR in the banks. Additionally, EHIEDU (2022) examined the effect of the bank-specific variables on the CAR in Nigeria by using regression, covering the period from 1990 to 2021. He found that liquidity has a negative effect on CAR and the bank size is negatively associated, illustrating that large banks have more diversification power and are installed with more advanced credit screening tools that can lower the overall bank risk and raise the CAR. Hadi et al. (2022) investigated the effect of the exchange rate on the CAR during the COVID-19 by using a sample from commercial banks in Iran and they found that the exchange rate significantly affected the CAR during the COVID-19 arguing that banks with foreign assets along with devaluation in their home currency led to losses lowers the CAR and threaten bank solvency level. In addition, Naoaj (2023) used the Fixed-Random effect and Pooled Ordinary Least Square models to study the determinants of CAR utilizing a sample of 28 Bangladeshi banks from 2013 to 2019. According to the results, liquidity has a positive impact on the CAR, while leverage, size, and inflation have a negative effect. Additionally, Gharaibeh (2023) utilized the autoregressive distributed lag (ARDL) model to explore the effect of the CAR determinants in the short-term and long-term in the commercial banks of Jordan covering the period of 2003-2021. In the long run, he found that leverage and liquidity have a positive relationship with the CAR supported by the results of Ansary and Hafez (2015). Further, Balili and Tola (2023) used a sample of commercial banks in Albania to investigate the factors that affect the CAR using panel data from 2016 to 2022, they found that asset size and loan loss reserve are negatively significant with the CAR. Moreover, Kishibayeva et al. (2023) employed the dynamic ordinary least square to study the determinants of bank regulatory capital by using a sample from the G7 countries from 1999 to 2017. The findings showed that CAR, Z-score, and real GDP have a positive effect, demonstrating the importance of these variables in formulating capital regulations around the world. In addition, Benilles (2023) utilized the regression to investigate the CAR factors by using a sample from banks in Algeria covering the period from 2011 to 2020 and he found that bank size, liquidity, loan loss reserve, deposit, and ownership negatively affect the CAR, while leverage and ROA have a positive effect claiming that the bank-specific variables play a crucial role in shaping the level of the CAR in the banks.

Literature gap

To the best of the researchers' knowledge, a comprehensive literature review revealed that no paper compares the variables affecting listed versus non-listed banks' solvency. Furthermore, we found limited papers investigating the factors that influence capital risk in Egypt and few papers examine the effect of macroeconomic variables on the CAR. In addition, no study has classified credit risk into corporate and retail before analyzing the CAR. Thus, by comparing listed and non-listed banks to develop two tailored estimated models and classifying the credit risk into retail and corporate that will improve insights into bank solvency determinants, this research validates the study's novelty and significance in filling gaps in the literature database. Furthermore, it contributes by providing a roadmap that defines banking strategies that should be formulated to meet Basel III requirements for CAR. In this respect, the paper formulated the following questions.

Q_1. *Is the solvency of listed and non-listed banks impacted differentially by macroeconomic factors?*
Q_2. *Is the solvency of listed and non-listed banks impacted differentially by bank-specific factors?*

According to the previously raised questions, the paper formulates the following hypotheses:
H_1: *The solvency of listed and non-listed banks is impacted differentially by macroeconomic factors*
H_2: *The solvency of listed and non-listed banks is impacted differentially by bank-specific factors*

- **Methodology**

The paper aims to investigate the impact of the macroeconomic and bank-specific variables on the capital adequacy of the listed and non-listed banks by using panel data from 2011-2023 using a sample of 27 banks operating in Egypt out of 36 banks, 13 listed and 14 non-listed as shown in Table (1). Listed banks are the banks that are registered in the Egyptian Exchange (EGX) while the non-listed banks are the non-registered ones. In addition, the macroeconomic data are gathered from the annual reports of the Central Bank of Egypt (CBE) while the bank-specific data is collected from the published annual reports of the listed and non-listed banks from their financial statements. Additionally, based on what is reviewed in the literature, the article found that the selected variables are commonly used and found significant. Accordingly, bank solvency is the dependent variable, measured by the Capital Adequacy Ratio (CAR), and the independent variables are classified as macroeconomic and bank-specific as shown in Table (2). Further, the article divides credit risk into retail and corporate categories based on the findings of Farag et al. (2023) and Farag (2024) to use them as independent variables to investigate their effects on the classified CARs. Moreover, the paper employed the Generalized Method of Moments (GMM) and Fixed-Effect regression models to test the hypotheses and to find answers to the questions raised earlier. Further, the paper used the GMM to address the endogeneity problems and reduce the biased beta coefficient, and the fixed effect model was used to check the robustness of the results. In this regard, the paper formulated the following two econometric models for each classified CAR.

$$\Delta\text{Listed-CAR}_{it} = \alpha i + \sum \beta_1 \text{ ROA} + \sum \beta_2 \text{ SIZE} + \sum \beta_3 \text{ BEFF} + \sum \beta_4 \text{ DIV} + \sum \beta_5 \text{ LTD} + \sum \beta_6 \text{ CNPL} + \sum \beta_7 \text{ RNPL} + \sum \beta_8 \text{ EDEBT} \sum \beta_9 \text{ INF} + \sum \beta_{10} \text{ EXR} + \sum \beta_{11} \text{ GDP} + \sum \beta_{12} \text{ IDEBT} + \sum \beta_{13} \text{ INT} + \sum \beta_{14} \text{ FDI} + e_{it} \quad (1)$$

$$\Delta\text{NonListed-CAR}_{it} = \alpha i + \sum \beta_1 \text{ ROA} + \sum \beta_2 \text{ SIZE} + \sum \beta_3 \text{ BEFF} + \sum \beta_4 \text{ DIV} + \sum \beta_5 \text{ LTD} + \sum \beta_6 \text{ CNPL} + \sum \beta_7 \text{ RNPL} + \sum \beta_8 \text{ EDEBT} \sum \beta_9 \text{ INF} + \sum \beta_{10} \text{ EXR} + \sum \beta_{11} \text{ GDP} + \sum \beta_{12} \text{ IDEBT} + \sum \beta_{13} \text{ INT} + \sum \beta_{14} \text{ FDI} + e_{it} \quad (2)$$

Table (1) List of banks in the sample

Listed banks	**Non-listed banks**
Commercial International Bank (CIB)	National Bank of Egypt (NBE)
Abu Dhabi Islamic Bank (ADIB)	Ahli Bank of Kuwait (ABK)
Abu Dhabi Commercial Bank (ADCB)	Banque Misr
Egyptian Gulf Bank (EG Bank)	Blom Bank
Suez Canal Bank	Hongkong and Shanghai Banking Corporation (HSBC)
Credit Agricole Bank	National Bank of Dubai (NBD)
National Bank of Kuwait (NBK)	Arab Bank
Qatar National Bank (QNB)	First Abu Dhabi Bank (FAB)
Baraka Bank	Ahli United Bank (AUB)
Housing and Development Bank (HDB)	Arab African International Bank (AAIB)
Faisal Islamic Bank of Egypt	Arab Investment Bank (AIB)
Société Arabe Internationale de Banque (SAIB)	Arab International Bank
Export Development Bank of Egypt (EBE)	Alex Bank

	Arab Banking Corporation (ABC)

Table (2) Variables and Measurements

Variables	Measurements
Dependent variables:	
Capital risk (CAR)	Capital Adequacy ratio = Core and Supplementary Capital / Risk-adjusted assets
Independent variables:	
Bank-specific:	
Profitability (ROA)	Return on Assets (ROA) = Net profit for the year / Total Assets
Bank size (SIZE)	Log of total assets
Operating efficiency (OPEFF)	Expenses-to-income ratio = Total expenses / Total income
Income Diversification (DIV)	Non-interest income ratio = Fee income / Total income
Liquidity (LTD)	Loan-to-deposit ratio = Total loans / total deposits
Corporate Credit Risk (CNPL)	Corporate NPL ratio = Corporate NPLs / Total Corporate Loans
Retail Credit risk (RNPL)	Retail NPL ratio = Retail NPLs / Total Retail Loans
Macroeconomic:	
External Debt (EDEBT)	External debt % from the GDP
Inflation (INF)	% change in Consumer Price Index (CPI)
Exchange rate (EXR)	EGP/USD
Economic growth (GDP)	Real GDP growth rate
Internal debt (IDEBT)	Internal debt % from the GDP
Interest rate (INT)	Annual Bank lending interest rate
Foreign Direct Investments (FDI)	FDI % from GDP

- **Results and discussion**
- ***Descriptive analysis for the listed banks***

In this section, the paper has conducted a descriptive analysis by describing the collected data in terms of observations (Obs), mean, standard deviation (Std. Dev), minimum (Min), and maximum (Max) as shown in Tables 3 and 4. On one side, Table (3) shows the descriptive analysis of the listed banks and it found that the number of observations is 169 since the paper covers 13 years during 2011-2023 with a sample of 13 listed banks. Additionally, the mean of the CAR is 17.7% exceeding the required capital ratio by the Central Bank, indicating that the banks have enough buffer and cushion against unexpected losses. Simultaneously, it implies that the banks take more precautions since they expect higher exposure to credit and insolvency risks. In addition, the ROA has a mean of 1.6% indicating that the listed banks on average achieve 1.6% which is normal in the banking industry compared to the other developing countries. Furthermore, OPEFF has a mean of 60%, indicating that the total expenses account for 60% of the total income implying that the management is inefficient and needs more attention from the top management and regulators to control the costs relative to income to enhance their efficiency level. Moreover, the DIV is 8.1% indicating that the banks have a very low-income diversification because their fee income accounts for only 8.1% of the total income, demonstrating that the banks rely more on traditional investments than fee-based investments. Further, LTD has a mean of 49% which is normal in the banking sector and shows that the loans are 49% of the total deposits. In addition, the SIZE has the highest standard deviation compared to the other bank-

specific variables which indicates that the size of the banks in assets largely varies from one bank to another. The mean of the CNPL is greater than the RNPL having 9.1% and 4.7% respectively, showing that the corporate credit risk is higher than the retail credit risk and accounts for the majority of the total credit risk. The CNPL has a higher standard deviation compared to the RNPL showing that the CNPL is more volatile than the RNPL which implies that the banks need to place more attention on the CNPL than the RNPL to have better control of the total credit risk exposure. On the other side, the descriptive analysis of the macroeconomic data found that most of the variables have higher standard deviation than the bank-specific variables implying that the banks of Egypt are operating in unstable economic conditions. In other words, inflation, exchange rate, and lending interest rate have the highest volatility among the variables, threatening the survival and growth of the banks in the credit markets and weakening their ability to boost economic sustainability. Moreover, the inflation had spikes reaching 33.7% in maximum, while the exchange rate reached 50 EGP per dollar due to the devaluation of the Egyptian currency against the USD.

Table (3) Descriptive statistics of the listed banks

Variable	Obs	Mean	Std. Dev.	Min.	Max
CAR	169	.176625	.047789	.0862	.3141
ROA	169	.0164586	.0120554	-.0586985	.0485148
SIZE	169	10.20795	.9953901	7.753954	11.79276
OPEFF	169	.6000469	.1270797	.3462459	.890988
DIV	169	.0815017	.0466235	.0219	.3194818
LTD	169	.4878851	.1608623	.102603	.8300353
CNPL	169	.0914663	.0942107	.0000806	.7350476
RNPL	169	.0470322	.0634452	0	.3550739
EDEBT	169	1.889982	.2447934	1.52763	2.225309
INF	169	13.66069	8.414011	4.66	33.7
EXR	169	14.09154	7.493049	5.9	30.94
GDP	169	3.838462	1.37382	1.8	6.6
IDEBT	169	.8872308	.0658729	.762	1.03
INT	169	13.75385	3.363406	9.5	19.8
FDI	169	1.94459	.9643017	-.2045428	3.260263

- ***Descriptive analysis for the non-listed banks***

In this part, as indicated in Table (4), the article describes the data acquired from non-listed banks. The research covers 13 years from 2011 to 2023 and includes 14 non-listed banks, thus there are 182 observations. Most of the findings are similar to those of the listed banks, however the discrepancies are as follows. In the non-listed banks, the mean of the DIV is 9% while the listed is 8% indicating that the non-listed banks have slightly more diversification in income than the listed ones. Furthermore, non-listed banks have lower OPEFF than listed banks, signifying they are more efficient in management. In addition, the CNPL and RNPL are 8.4% and 2.6%, respectively, showing that non-listed banks are less susceptible to credit risk than listed banks, which have 9.1% and 4.7%, respectively.

Table (4) Descriptive statistics of the non-listed banks

Variable	Obs	Mean	Std. Dev.	Min.	Max
CAR	182	.1742422	.0618159	0	.448

ROA	182	.0145802	.0132254	-.0254982	.089889
SIZE	182	10.02723	1.335226	6.346637	12.35702
OPEFF	182	.576652	.1766653	.190713	1.045256
DIV	182	.0896705	.0379186	.0132167	.2554944
LTD	182	.4794929	.1409476	.1252558	.753396
CNPL	182	.0849781	.0898849	.0039378	.659285
RNPL	182	.0264541	.0346838	.0000378	.2457867
EDEBT	182	1.889385	.243998	1.52763	2.225309
INF	182	13.42348	8.29675	4.66	33.7
EXR	182	13.95797	7.344538	5.9	30.94
GDP	182	3.819231	1.358913	1.8	6.6
IDEBT	182	.8872857	.065729	.762	1.03
INT	182	13.67802	3.364268	9.5	19.8
FDI	182	1.931404	.9645619	-.2045428	3.260263

- ***Diagnostic Tests for Model Robustness***

In this section, as shown in Table (5), the paper investigates the robustness of the two GMM models of the classified CARs using the Wald, Arellano-Bond (AR), and Sargan tests to assess the validity of the models and ensure that the instruments are valid, thereby increasing confidence in the findings. In this regard, the Wald test P-values are 0.000, implying that the selected factors are significant, supporting the relevance of the chosen macroeconomic and bank-specific variables in influencing the value of the categorized CARs. Moreover, the Arellano-Bond test 1 and 2 have p-values above 0.05 implying no significant autocorrelation in the residuals indicating that the parameters are likely to be unbiased and consistent. Furthermore, the Sargan-Hansen test P-values are greater than 0.05, indicating that the instruments are valid and that there are no correlations in the error term in the GMM models, hence increasing the models' robustness. As a result, the GMM models are valid and dependable, and we can utilize them to test the hypotheses.

Table (5) Robustness Check Tests

Tests	P-values of listed banks	P-values of non-listed banks
Wald test	0.000	0.000
Arellano-Bond test for AR(1)	0.100	1.000
Arellano-Bond test for AR(2)	0.265	0.113
Sargan-Hansen test of overid. Restrictions	0.464	0.319

- ***Regression analysis***

In this section, the paper tests the early formulated hypotheses by employing the Fixed-effect and GMM regression models to examine the effect of the macroeconomic and bank-specific variables on the capital risk of the listed and non-listed banks as shown in Tables 6 and 7. The One-step system GMM findings of the listed banks revealed that ROA, SIZE, INF, EXR, and GDP are statistically significant as shown in Table (6). In other words, the ROA has a positive effect on the listed CAR, showing that increases in profitability enhance the solvency level of the listed banks and lower the capital risk arguing that more earnings will be injected into the retained earnings will increase the buffer and reduce the capital risk exposure, the results are consistent with the findings of Abiodun et al. (2020)

and Vu and Dang (2020). Additionally, based on the beta coefficients, the ROA is considered the most influential factor in determining the CAR's value compared to the other variables. Furthermore, SIZE has a positive association with CAR, but the results contradicted the literature for Ansary and Hafez (2015); EHIEDU (2022); and Naoaj (2023). However, the positive effect is justified illustrating that large-sized banks can develop well-diversified portfolios and use more advanced risk management systems and specialists to reduce credit and solvency risks, resulting in lower capital risk exposure. Moreover, the fixed effect results show that the DIV has a negative impact on listed banks' CAR, highlighting the importance of income diversification in minimizing capital risk exposure by avoiding reliance on traditional investments and instead investing in fee-based and off-balance-sheet activities. Specifically, to mitigate the adverse impact of recessions on bank performance. On the other hand, the results of the GMM found that the macroeconomic variables significantly affect the CAR of the listed banks, specifically the INF, EXR, and GDP. The INF has a negative effect on CAR supported by the results of Naoaj (2023) arguing that more inflationary pressures negatively affect borrowers' repayment capacity leading to spikes in banks' bad debt expenses deteriorating bank capital and increasing the exposure to capital risk. In addition, the EXR has a positive relationship with CAR which is not supported by the results of Hadi et al. (2022) the paper justified the relationship by demonstrating that more devaluation in the EGP against the USD forces the listed banks to inject more equity relative to assets to increase their buffer, specifically for the last 8 years after the adoption of the floatation system in Egypt's FX system, which resulted in banks worrying about more currency devaluation, forcing them to take aggressive precautions by having high CAR standing ready to absorb any loss. In this respect, higher devaluation in the EGP/USD raises the CAR to increase the cushion against capital risk. Moreover, the GDP is significant and has a negative effect on the CAR of the listed banks, demonstrating that during times of economic boom, banks begin to relax their credit terms and increase their loans to encourage production, resulting in increased asset size relative to capital, lower levels of CAR, and thus increased capital risk.

Table (6) Regression Results of listed banks

Variables	Fixed effect		One-Step System GMM	
	Coef.	P-value	Coef.	P-value
ROA	**.7629008*** **	**0.081**	**.5580427** **	**0.042**
SIZE	-.0034565	0.384	**.0054193*** **	**0.054**
OPEFF	**-.0867312** **	**0.042**	-.0287381	0.264
DIV	**-.2072146** **	**0.039**	-.0551581	0.416
LTD	**.059462*** **	**0.084**	-.016187	0.340
CNPL	.048203	0.339	.0374822	0.334
RNPL	**-.114624** **	**0.024**	.0373004	0.695
DEBT	-.0282435	0.525	-.0240546	0.506
INF	**-.013258** **	**0.050**	**-.0015279* **	**0.005**
EXR	**.0054626* **	**0.001**	**.0038303* **	**0.002**
GDP	-.004716	0.180	**-.0062198** **	**0.032**
IDEBT	.0739468	0.340	.1049278	0.883
INT	-.0036953	0.104	-.002236	0.331
FDI	-.0110667	0.154	.1049278	0.883

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

In Table (7) the paper examines the impact of the macroeconomic and bank-specific variables on the CAR of the non-listed banks and the results found that ROA, LTD, and RNPL are statistically significant which implies that the CAR of the non-listed banks are not affected by the macroeconomic variables, consistent with the results of Shehata (2019). Additionally, the ROA positively affects the CAR having the same argument as the listed banks. The beta

coefficient is higher in the case of the non-listed banks demonstrating a higher effect on CAR compared to the listed banks. Furthermore, LTD has a negative effect on CAR supported by EHIEDU (2022) but is contradicted by the results of El-Ansary and Hafez (2015) and Naoaj (2023) illustrating that more loans issued relative to deposits increase the exposure of credit risk and raises the bad debt expenses leading to lower CAR and higher level of capital risk. Moreover, the RNPL is significant and negatively affects the CAR which consisted with Abiodun et al. (2020) arguing that a higher level of retail credit risk increases the losses and deteriorates the level of bank capital and thus raises the capital risk exposure. The beta coefficient of the RNPL is **-.2143193** which is very high compared to the other variables and confirms the importance of carefully managing the RNPL to have better control over the capital risk in the non-listed banks of Egypt.

Table (7) Regression Results of non-listed banks

Variables	Fixed effect		One-Step System GMM	
	Coef.	P-value	Coef.	P-value
ROA	**1.052363****	**0.012**	**.7634693***	**0.004**
SIZE	-.0056354	0.223	-.0040822	0.222
OPEFF	-.0334125	0.365	-.0103098	0.678
DIV	-.198806	0.178	-.0828046	0.414
LTD	**-.1108877***	**0.005**	**-.0435685****	**0.042**
CNPL	-.0022724	0.971	-.0132044	0.733
RNPL	**.2869517*****	**0.062**	**-.2143193*****	**0.056**
EDEBT	-.0139697	0.809	-.0058048	-0.13
INF	-.0005366	0.551	-.0010521	0.118
EXR	**.0037728*****	**0.061**	.0018402	0.225
GDP	-.0010128	0.825	-.0034415	0.342
IDEBT	.1035446	0.287	.0768307	0.320
INT	**-.0062314****	**0.035**	-.0028264	0.131
FDI	.0026775	0.784	.0065978	0.536

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

In this context, the paper can conclude that the determinants of the macroeconomic and bank-specific variables are different between the listed and non-listed banks of Egypt, accordingly, the paper accepts H_1 and H_2. The findings of the paper are crucial in enhancing the prediction performance of capital risk in the banking sector and filling the gap in the current literature by providing new insights into the determinants of capital risk.

H_1: *The solvency of listed and non-listed banks is impacted differentially by macroeconomic factors*
H_2: *The solvency of listed and non-listed banks is impacted differentially by bank-specific factors*

- ***Conclusion***

The article examined the macroeconomic and bank-specific determinants of capital risk by conducting a comparative study between the listed and non-listed banks using a sample of banks operating in Egypt during 2011-2013. The results illustrated the importance of classifying capital risk into listed and non-listed to provide better insights to academics, bankers, and regulators to have better control over capital risk exposure which is considered the most important risk after the credit risk in terms of its probability of occurrence and impact size. Additionally, the paper created two customized estimated models for the listed and non-listed banks to provide better and more accurate predictions of capital risk exposure. Moreover, the paper recommends the bankers of the listed banks to carefully monitor the movements of the ROA, SIZE, EXR, INF, and GDP because they are the most influential factors to capital risk to take precautions and take proactive actions against any unexpected increase in the CAR to

enhance their survival and growth performance in the banking industry. On the other side, the paper recommends that non-listed banks to carefully monitor the movements of the ROA, LTD, and RNPL since they are found the most influential factors to the capital risk in the non-listed banks to enhance their risk management performance and to boost the economic sustainability. Further, the article recommends regulators to check the model results to improve their existing regulations to help the banks have better control over capital risk exposure. Finally, the paper recommends academics, in their future work, to use the same methodology of this paper in different countries to create more robust and accurate econometric models for capital risk in the banking sector to encourage the banks to have better risk measurement and management performance to boost the economic performance across the globe.

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