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FACTORS IMPACTING LIQUIDITY OF BANKS: AN EMPIRICAL STUDY FROM THE BANKING SECTOR IN THE UAE

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ABSTRACT

The primary purpose of this research is to substantiate the factors that impact the liquidity of the banks in the UAE. This research paper is an extension of the thesis that the primary author has undertaken to prove the test of significance and provide concrete evidence that the identified idiosyncratic and market related factors have significant impact on the liquidity risk for the banks in the UAE. The primary author has performed linear regression to identify the relation of the dependent and independent variables and once the test of significance is proved, the factors have been ranked using MURAME approach as part of ultimate thesis research objectives (MURAME approach is not forming part of this research paper). The research paper focusses on top 10 banks in the UAE and the study spans from 2010 to 2019. The study employs idiosyncratic factors like Deposit growth, NPL, CAR, ROA and market factors like GDP, Inflation, Unemployment, Oil prices and studies its relationship on dependent factor i.e., liquidity. Series of diagnostic tests are performed to find the impact of liquidity on idiosyncratic and market related factors.

INTRODUCTION

Liquidity has different meanings in different contexts. In general, liquidity refers to the amount of cash available for meeting the expenses as well as for investment. Within the banking context, liquidity refers to the ability to meet the maturities related to debt and credit within defined timelines. Liquidity risk is the absence of liquidity that is required to meet these liabilities. Absence of liquidity can be one of the reasons for the banks to fail. Liquidity crunch may be seen as an important aspect for alleviating the expected and unexpected balance sheet movements and increasing the resources for targeting the growth (Çetinkaya, 2018). The risk is important in meeting the funding needs as well have having sufficient buffers of liquidity for meeting the uncertain liabilities as and when they come due. This aids in the sustainable growth of the bank and the sector.

Banks are an important intermediary for facilitating funds to their customers. Banks are able to achieve this objective by sometimes using their own equity to collaborate with customers in lending activities and bridging the gap (Santomero, 1997). Thus, banks act as an intermediary in facilitating finances among several industries. The performance of the banking sector is of prime importance to ensure safeguarded financial performance of the country (Munir et al., 2012). Basis traditional view of the banking sector, banks aid in channeling cash from and to the people through custodian and lending activities. Hence, banks consider liquidity risk as seriously since the time of their establishment (Hakimi & Zaghdoudi, 2017). Liquidity risk for the bank would be the state wherein the bank is unable to meet the customers' demands as and when they arrive. Such a situation would trigger a red alarm that would signal the market that the bank does not have sufficient liquidity. There can be several reasons for liquidity risk in the banking sector, the most common being the short-term assets funding the long-term liability and vice versa. While banks have advanced risk management systems that track maturities of assets and liabilities, there may be times when the bank would face liquidity blockages leading to liquidity

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shortfalls (Kumar & Yadav, 2013).

The banks have major responsibility of managing their own liquidity since they are a source of liquidity for their customers. The banks enjoy this pivotal role of creation of liquidity and management of liquidity. Creation of liquidity is successfully carried by clearing off liquidity concerns for large business owners by grating finances. This gives rise to creation of liquidity risk since the banks have issued large lending to the corporates (Alqemzi et al., 2022).

To avert liquidity crises, Regulatory bodies and Central Banks have implemented strict levels of liquidity to be always maintained. This level of cushion is required to maintain liquidity at a certain level. The banks in the UAE are subject to minimum cash reserve requirements that is part of fiscal and monetary policies of the central bank. Policy makers suggest that banks must be able to maintain higher level of liquid assets so that they can hedge against untoward negative market movements. This led to an international debate to create standards that would optimize liquidity risks. The 2008 financial crises shocked the world and resulted in a deep concern among the Central Banks around the world. Consequently, the BASEL committee pronounced BASEL III with an aim to accumulated reserves that would specifically address the liquidity related issues. Liquidity crises is viewed as a serious issue in developed and developing countries. Liquidity assets include cash and cash equivalents that are less profitable and generate lower yields. Thus, the banks have to maintain an equilibrium between liquid assets and others as it would lose on opportunity costs. Banks try to maintain minimum level of liquidity that does not impact their profitability. Hence, the framework created by BASEL III ensured adequate liquidity levels to be maintained to avoid liquidity crises (Mwangi, 2014). Several studies have been performed in the past that have specifically focused on measuring credit risk as a yardstick for banks performance. However, the same is not true for liquidity risk as not many studies are available. There are few studies that have studied the relationship of liquidity and performance (Claeys & Vennet, 2008; Trujillo-Ponce, 2013). While some researchers found positive relationship between liquidity and performance, others did not conclude a significant relationship. Some researchers view that a decrease in liquidity risk positively affects a bank's performance (Bourke, 1989; Bordeleau & Graham, 2010; Lartey et al., 2013). However, some have found the opposite to be true (Konadu, 2009). Furthermore, there are some studies that do not find any significant relationship between the two variables (Lamberg & Valming, 2009). All these studies have different results as these have been performed in different jurisdictions and in several times. Further, since different dependent as well as independent factors were used, the impact on liquidity risk is different. Liquidity risk is studied by using different variables. Alzorqan (2014) in its study used variables like ROA and ROI to ascertain the Jordanian banks performance. Similarly, Rahman and Saeed (2015) also used ROA and ROE to research on the Malaysian banks' performance. Hakimi and Zaghdoudi (2017) used NIM to measure Tunisian banks performance. Thus, each researcher was able to ascertain the performance of the banks in different ways and its impact on the liquidity. LD ratio, liquid assets ratio, assets quality ratio and several other ratios are useful to ascertain banking liquidity positions (Chowdhury & Zaman, 2018; Hakimi & Zaghdoudi, 2017; Ferrouhi, 2014). One of the notable researchers Mwangi (2014) quoted that the impact of liquidity on the performance of the bank can also be determined through the business model and the liquidity cycle the bank faces. This may lead to further research in this area. This can be proven from the fact that macro-economic variables like GDP, inflation, oil price movement in the UAE will also have an impact on the liquidity of the banks in the UAE. The current study is, therefore, focused on providing insights into the impact of the liquidity risks on the banking sector in the UAE. The independent factors are chosen from idiosyncratic and macro-economic factors that have been selected through thorough literature review. The current research is a piece of a wider research by Kapur (2020), that focusses on ranking the identified idiosyncratic and market related factors using MURAME approach. The current research aims at identifying the impact of the factors using regression analysis.

Liquidity as well as performance of the bank can be measured using several parameters. Idiosyncratic factors can be measured using financial ratios like Return on Asset (ROA), Return on Equity (ROE), Deposit growth, Capital Adequacy Ratio (CAR), etc. (Murthy & Sree, 2003).

The current research has been performed on top 10 banks in the UAE. Since UAE has more than 50 banks, it can be said that the market is fragmented. Hence, in order to provide conclusive evidence of the impact of the liquidity risk, the sample is limited to top 10 banks.

LITERATURE REVIEW

There have been numerous studies conducted that aim to quantify liquidity risk; these have performed analyses of several banks around the world. In the UAE, however, very limited literature is available on this subject. Most of the times the research is conducted using ratio analysis as an indicator to judge the banks' performances. During the 1990s, the concept of liquidity began to gain popularity through the collapse of Enron. Healy and Palepu (2003) have studied the fall of Enron in detail; they question the role played by market intermediaries, governance torchbearers and regulators involved in maintaining the sound function of the stock market. While Enron was a classic example of fraud and the manipulation of stock market, the fact that the company did not build up liquidity was also one of the reasons for its collapse. Healy and Palepu's research proposes that certain system-level and capital-market changes were required to avert the recurrence of fraud like that seen in the Enron case.

Molyneux and Thornton (1992) conducted an analysis based on ratios, in which liquidity risk was considered as an independent factor. The objective of the research was to ascertain the determinants of the profitability of European banks. The study was comprehensively conducted and included 600-plus banks across 18 European countries. Specifically, the dependent variables included net profit before and after taxes, linked to capital/reserves; total assets; staff operating expenses; and provision for loss loans. The independent variables included government policies, the concentration of depositors, the IMF-denominated long-term bank market rate in each country, the IMF-denominated money supply in each country, cash/marketable securities, the consumer price index (CPI) and staff expenses. The study was conducted using a

simple linear equation for the period between 1986 to 1989 and concluded by stating that all the factors had a positive relationship, apart from the relationship between the government and profitability. The results were comparable to those concerning US markets, and the authors did not seem to find any evidence of risk aversion by the banks. The gearing in the bank was found to be high, which seemed to affect the liquidity of the banks.

The above study by Molyneux and Thornton (1992) was an extension to the research already conducted by Bourke (1989), which utilized factors such as the profitability of international banks and simulated previous research to conclude that the concentration of liquidity is positively correlated to profitability. These results also suggested that banks were subject to a high degree of risk avoidance and that they had high market power. The quantification and analysis of data was achieved through a pooled time-series method that estimated linear equations for several bank-specific factors such as staff expenses and capital and liquidity ratios. External factors were also used to determine the profitability of the banks, including concentration, government ownership, inflation, market growth and interest rates.

Demirgüç-Kunt, Laeven, and Levine (2003) have studied the impact of and correlation between bank regulations, market structure, and national institutions and the effect it has on net interest margins and the banks' overhead costs. Specifically, the analysis studies the liquid assets to total assets ratio to quantify the impact that concentration has on a bank's interest margin. The analysis was conducted using data from more than 1,400 banks spanning across 72 countries, and mainly concerns bank-specific factors such as profitability, total assets, depositors and concentration. The research uses the linear equation model; the results indicate that strict laws from the regulator enhance bank activities and thereby boost financial interbank-intermediary costs. In terms of external factors, the study finds that inflation causes a positive correlation between the profitability of a bank and its operational costs. Furthermore, it is observed that concentration is positively correlated with net interest margins; however, this correlation is not effective when controlling factors such as regulatory impact and competition are introduced. In addition, individual regulation for banks is insignificant when determining the correlation between market factors such as inflation and global assets and liabilities. These would, however, be considered significant when calculating interest margins and operating costs. The research concludes by stating that regulations that are prescribed by the regulators cannot be viewed in isolation, as they are made while keeping monetary policies, national interest and competition from foreign banks in view.

Kosmidou and Zopounidis (2008) measure the performance of commercial and co-operative banks in Greece using the PROMETHEE method and specific financial ratios. The research includes ratios for return on equity, ROA, net profit before taxes, gross profit, loan to deposit, equity-to-assets ratio, NPL and loan loss provisions to total assets. The objective of the research is to ascertain the performance and efficiency of co-operative banks and compare them with those of the commercial banks during the period 2003–2004. As PROMETHEE is a ranking method, the results rank the banks' strengths and weaknesses and compare the competition among them. The results of the method indicate that commercial banks are in a better position to maximize their profits and attract higher customer deposits due to lower operational costs and higher margins. Additionally, the results indicate that co-operative banks are not as symmetrical as those banks that had an increasing profits and market share reported deterioration in the financial conditions, and thus had higher NPL ratios. The combined results indicate that liquidity is a factor of ROA and NPL: the higher the ROA, the higher the liquidity; conversely, NPL higher would be the available liquidity. Kosimidou states that liquidity risk is the relationship between liquid assets and a combination of short-term funds and deposits (customer deposits). The ratio is termed as deposit run-off ratio, which highlights the bank's capacity to meet its short-term funding requirements by selling assets in situations where short-term liabilities are not available. Some ratios that require liquidity to be more than 100% of the total liabilities expose banks to a higher risk of liquidity due to the cost of holding liquidity.

Several studies were conducted by Demirgüç-Kunt and Huizinga (1999) that examine the ratio between loans to total assets to measure the extent of its effect on the liquidity of the banks. This ratio of loans to total assets is considered more appropriate than the ratio of loans to deposits because the latter does not consider the impact on total liabilities. In addition, the new generation of authors (Shen, Chen, & Kao, 2009; Soula, 2015) are very vocal in terms of their presentation of liquidity, using ratios as proxies for its computation. Chen et al. (2018) utilize data from 12 local commercial banks during the period 1994–2006 to ascertain the impact of liquidity on the bank performance. The authors employ a two-stage least squares regression method as part of their analysis, concluding that they have proved that liquidity risk is not only dependent on HQLAs, which are internal to the bank, but also on supervisory and regulatory changes and macroeconomic factors, which are external influences. In addition, they state that liquidity risk affects a bank's profits by significantly reducing the return on average assets and return on average equity and increasing the cost of deposits for the bank. Conversely, the model used by Soula (2015) integrates the risk factor model to ascertain the impact of liquidity risk for the sampled banks between the period 2005–2012. The results indicate that idiosyncratic factors are a major cause of liquidity risk, and that liquidity has high heterogeneity during normal periods. However, during stressed periods, the risk is systemic in nature, with a significant reduction in heterogeneity.

The objective of each approach is to assess the impact of liquidity risk on other components and assess its stability. Under the balance sheet analysis approach, liquidity is evaluated based on balance sheet components. The items in the balance sheet on the asset side that directly have a consequential effect on liquidity include the receivables, loans and advances and investment, the latter of which is categorized into trading and available for sale, repo and reverse repo bonds and collateralized borrowings. On the liability side, the items include customer deposits, repos and reverse repos, other long- and short-term liabilities and equity. The liquidity analysis for the balance sheet consists of comparing the asset side with the liability side, looking for available liquid assets to fund the liabilities. In either case, the objective is to ensure the stability of funding sources, which are required to meet obligations as they become due.

The peer-group ratio comparison involves comparing several ratios from the balance sheets of different banks. This method relies on collecting all significant sources of liquidity and their uses by the bank. An illustration of this method

would be to compare the use of ratios relating liquid assets to total assets by several banks. One of the limitations of this ratio comparison is that banks need to have similar business models, equivalent asset sizes, similar geographies, etc. Other ratios under the peer-group analysis could include loans to deposits or loans to total assets.

The liquidity index indicates the latent losses that a bank might derive from an immediate sale or disposal of an asset in the open market. The ratio is calculated as the 'weighted sum of the price of each asset in the event of fire sale to its fair market price (the price it would receive in the market under normal situation'. The bank must construct stressed scenarios that cater to these types of distress sales if it is to have an understanding of the liquidity skewness in the market. One of the limitations of this ratio is that it considers the assets side of the balance sheet; hence, it can be used to gauge market risk liquidity rather than funding liquidity.

The financing gap is a measure that requires mature judgement concerning deposit withdrawals made by the deposit holders. Mathematically, it is expressed as the difference between average total loans and average total deposits. The bank must create scenarios that depict the expected withdrawals under both normal and stressed situations, which will allow it to understand the resulting financing gap. The larger the finance gap, the more liquidity problems, as a larger gap would indicate that the bank does not have enough core deposits to meet its obligations. In such a situation, a bank would have to use cash and/or other liquid assets or borrow funds in the interbank market. A continuous incremental finance gap indicates chronic liquidity issues, which may lead to insolvency if not properly addressed through a contingency funding plan.
The financing requirement refers to summing up the financing gap using readily available and convertible HQLAs.

An additional objective of this study is to consider how it is that market-related events have a strong impact on the liquidity risk management of a particular bank. The 2008 liquidity crisis, as well as the 2020 COVID-19 pandemic (even though both have a low probability of recurrence), are systemic issues that had/are having a devastating effect on the entire banking system. Brunnermeier and Cheridito (2019) state that aggregate fiscal and liquidity policies by the central banks are important when determining any market-related data points, particularly when these policies are made during economic growth and downturn phases. The authors initiate the development of several risk indicators with practical relevance, in that they quantify bank-specific liquidity risk indicators and systemic factors. The research further substantiates its position by considering two moments in time: the time 't', an ex-ante time period during which the bank manages to generate cash flows on the assets and liabilities that assume liquidity risk, and the time period 't+1', which reflects the economic conditions. The rationale behind the creation of this model using the time periods 't' and 't+1' is that it allows an explanation of the liquidity index in several economic conditions in 't+1' time, while the total liquidity index equates to the starting time period 't'. Each asset and liability in the balance sheet is assigned to the respective cash index to achieve the equivalent cash asset and liability indices. During the methodology phase, the liquidity mismatch is generated by calculating the difference between the asset cash index and the liability cash index and assigning equivalent weights for each index. Subsequently, the VaR method is used to estimate the probability of liquidity risk at time period 't', with a confidence interval of 5%. It is important to note that during the methodology stage, it is vital to consider the variation in the assets and liabilities for each time period ('t' or 't+1', respectively). These factors can then be used to conduct an analysis of liquidity exposure for a standalone single sector.

Drehmann and Nikolau (2013) observe that liquidity risk can be bifurcated into two distinct components: inflows/outflows and financing (funding) pricing. The authors put forward the theory of the funding premium approach, whereby the interest rates applied to the refinancing options are provided by the central banks. The authors use the difference between the final bid and the minimum bid price as a liquidity risk proxy (LRP), using the assumption that the markets will remain tight, and the bank has a risk-averting strategy. In practical terms, banks exposed to a higher funding risk would generally be willing to pay higher prices for liquidity from the central bank; as such, funds would be highly stable in nature. These proxies can be used as a single source of spread, allowing the development of further liquidity risk measures. The conclusion of the research notes the opportunity cost between the bid price and marginal interest rate, allowing the accurate calculation of the LRP. In mathematical terms, this LRP is characterized by the variation of spread for every bank that participates in the bid auction.

Singh and Sharma (2016) have studied the bank-specific and macroeconomic factors that affect the liquidity of the banks in India. They perform an exploratory study into the association between these factors as well as their random and fixed-term effects, for 59 banks in India for the period 2000–2013. The study includes bank-specific factors such as bank size (in terms of the bank's total assets), profitability in each of the years under study, the cost of deposit and funding, CAR and total deposits. Regarding the systemic factors, the authors study India's GDP, its inflation and its unemployment rate. The findings indicate that management is also a factor that affects the banks' liquidity. None of the bank-specific factors (except the cost of deposit) had a significant impact on liquidity; neither did any of the macroeconomic factors (except unemployment). Specific factors included the size of the bank, the deposit size, the profitability of the bank, CAR and India's GDP and inflation. Hence, in the final analysis, the size of the bank and India's GDP were seen to have a negative effect on the liquidity of the bank, while a positive effect occurred because of the total deposits, profits and CAR. The results are very useful as they enable a judgement of the impact of liquidity on emerging countries such as India.

Mahmood et al. (2019) have studied the impact of macro- and bank-specific factors on bank liquidity using the fully modified OLS approach. The study is based on a previous investigation conducted by Gafrej and Abbes (2017), which conducted a macroeconomic examination of the determinants of commercial bank liquidity factors in the Czech Republic. Both studies suggest that macroeconomic factors have a significant impact on bank liquidity; specifically, they indicate that factors such as inflation not only impact the liquidity of the banks but also have a detrimental impact on the economy. The study also finds that other macro-economic indicators such as interest rates, NPLs, and GDP serve as factors that have a significant impact on bank liquidity risks. It has been seen in the market that NPLs have a positive correlation with liquidity, in that whenever NPLs rise, liquidity also rises, as it induces the bank to preserve liquidity for any unforeseen circumstances.

A similar situation is seen in relation to GDP growth, in that during a period of GDP growth, many borrowers are willing to take out more loans; this, by default, forces banks to maintain an adequate level of liquidity. The interbank rate has a positive relationship with liquidity, as banks invest excess liquidity as interest rates increase. As regards bank size in terms of total assets, the stated principle supports the ideology of 'too big to fail' and the possibility of support from the lender of last resort. Massoc (2020) studies competition in retail banking and structural banking reform in relation to the 'too big to fail' concept. The research focuses on a single global and domestic bank in Europe, examining how the market dynamics have affected it since the 2008 financial crisis. Based on a competitive analysis of bank structure and regulatory banking policies in the UK, France and Germany, the study explains how vulnerable banks can be in the wake of a global financial crisis. Gafrej and Abbes (2017) firmly concludes by stating that interest margins, monetary policies and interest margins do not have a significant impact on the liquidity of banks in the Czech Republic.

Rani and Zergaw (2017) and Trenca et al. (2015) echo this assessment of the impact macroeconomic variables have upon banking system liquidity. The studies are very similar to that conducted by Gafrej and Abbes (2017), concluding by saying there is a negative relationship between liquidity and financial crises. Banks' liquid assets, which are received from total assets and deposits as well as from short-term funding, reduce in line with the higher profitability, increased capital adequacy and size of the bank. However, the abovementioned studies challenge Gafrej and Abbes (2017) findings in respect of unemployment and the public deficit. The study also found that GDP and unemployment have an effect on the bank liquidity in that region.

This literature review includes several studies that consider idiosyncratic and market-related factors. Macroeconomic factors are also important, as these can be determinant towards gathering liquidity during both normal and stressed market conditions. While idiosyncratic factors can be gathered from financial statements, macroeconomic indicators arise from a country's economic, monetary and fiscal policies. We have already seen, in the earlier sections, how the 2008 financial crisis that emanated from one financial institution spread to other financial markets and thus became a systemic issue. Hence, it can clearly be concluded that factors affecting liquidity not only arise from individual banks but also from systemic market factors, which may be related to the quantity and quality of liquidity in the interbank market.

Over the last four decades, a major attribute of the economic success of the UAE is the positive movement of oil prices. The discovery and export of oil changed the face of UAE, from a fishing economy to an oil giant, ultimately creating a revenue-rich country. The GDP of the UAE is one of the highest in the Middle East, standing at USD 421 billion as of 31 December 2019. In contrast, it stood at merely USD 17 million in 1960.

El-Chaarani (2019) documents the influence of oil prices by studying the balance sheet and income statements of several banks in the Middle East. Of the many countries considered, one country selected is the UAE. Banks from several other countries (such as Saudi Arabia, Qatar, Bahrain, Kuwait, Jordan, Oman and Iran) were also studied. Since the drop in oil prices in 2014, the central and federal governments of the Middle Eastern countries that are mainly engaged in oil-producing businesses have tried to diversify into hydrocarbons and trading activities. Other non-oil sectors include manufacturing, tourism, health/ medical activities and finance. The study also propounds the idea that many scholars have ventured into analyzing the correlation of the banking sector with oil price fluctuations; however, no clear propensity of the nature of their relationship has been determined.

A study conducted by El Mahmah and Trabelsi (2021) focuses on the impact of the drop in oil prices on the financial stability of GCC banks over the period 2000–2014. The method used by the study is a panel VAR model that is specifically constructed to show when the price drops below 1%. The results of the study reveal that "Oil price shocks were a determinant of the overall financial stability of banking sector in the region. The oil price drop in the middle of 2014 was associated with high level of non-performing loans and a low level of financial stability".

The study was further done in 2019, when the oil prices had fallen significantly, to negative levels. This study highlights serious financial concerns for banks in GCC countries, as oil-producing companies withdrew massive deposits in order to continue as going concerns.

Tabash and Khan (2018) reinforce the long- and short-term correlation between oil price movements and the financial performance of Islamic banks in the UAE between the end of 1990 and mid-2015. Their research clearly shows that the movement of oil prices, as well as the shocks, resulted in a significantly large negative correlation with the banking sector in an emerging economy such as the UAE; however, it also shows that the Islamic banks were not significantly impacted due to their Sharia lending principles and additional capital requirements. The research gap, identified by the study itself, is that it does not consider conventional banks, as Islamic banks were the focus of the research.

A more recent study has been undertaken by Musa (2021); this examines the relationship between oil prices and Islamic bank performance in OPEC members for the period 2007 to 2016. The authors observe that each country has specific oil-price management characteristics and that the impact of oil prices is different in every country. Based on the results, the study notes that

Given the importance of oil price movement in the Middle East, there are very few research conducted that have measured its impact on the liquidity of the banks?.

MATERIALS AND METHODS

A regression analysis predicts a continuous variable from a set of independent variables. The independent variables can be either dichotomous or continuous. A multiple regression analysis provides information about the interaction between dependent and independent variables, or between several independent variables, which can then be used to enable further manipulation (Kroll & Chesler, 1992). Through regression, the determination of the statistical significance of a coefficient is possible. It is also possible to retain those factors that are statistically significant while rejecting those that are not. In this study, the regression is performed on naturally occurring variables that have been calculated from the balance sheets found

in the banks' annual financial statements (for bank-specific factors) and in the UAE's national statistics register (for market-related factors).

The author has performed the routine diagnostics for regression by ensuring the accuracy of the data, accounting for missing data, confirming the number of cases and noting any outliers. All diagnostics have been performed using SPSS software for data cleaning and analysis. The data for the annual financial statements was plotted on an Excel sheet; this data was then uploaded into SPSS using an .xls file.

Diagnostic Validation for Bank-Specific Factors Using Regression Analysis

Table 1. Dependent and Independent variables

Dependent Variable	Liquidity Ratio
Independent variables	Deposit growth, NPL, CAR, ROA

The dependent and independent variables have been derived from the published annual financial statements of the sampled banks for the period 2010–2019.

Test of Normality

The test of normality can be judged through Histogram, P-P plot, Q-Q plot and test of normality. Elliott & Woodward (2007) stated that the normality tests are also supplemented with the graphical assessment of normality.

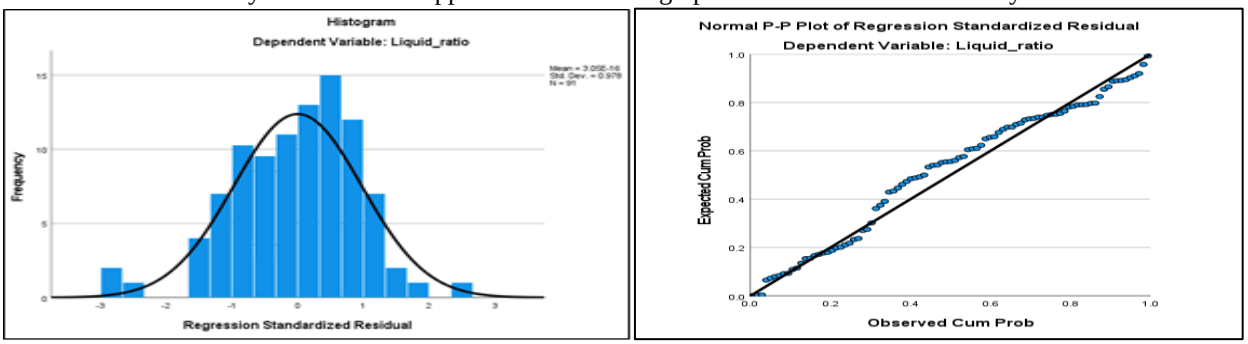

Figure 1. Normal distribution and PP Plot diagram for idiosyncratic factors

Based on figure 1, the visual representation of the dependent variable shows a normally distributed bell curve while the variable also aligns reasonably perfect on the P-P plot.

Table 2. Test of Normality for Idiosyncratic factors

Test of Normality						
				Kolmogorov-Smirnov[a]		Shapiro-Wilk
	Statistic	df	Sig.	Statistic	df	Sig.
Liquid_Ratio	0.184	91	.200*	0.898	91	0.207
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

The Shapiro and Wilk (1965) test of normality states that if $p > 0.05$, then the dependent variable is normally distributed. Since in the given case, the significance is at 0.207, it satisfies the Shapiro-Wilk test for normality.

Homoscedasticity Test

The test highlights if the residuals are equally distributed or if the accumulate together at specific values or if they are far apart. The test is to verify if the errors have the same (but unknown) variance. This is constant variance assumption also known as homogeneity of error variance or error variance homoscedasticity assumption. The plotted diagram is shown below and visually we can see that the data is randomly distributed.

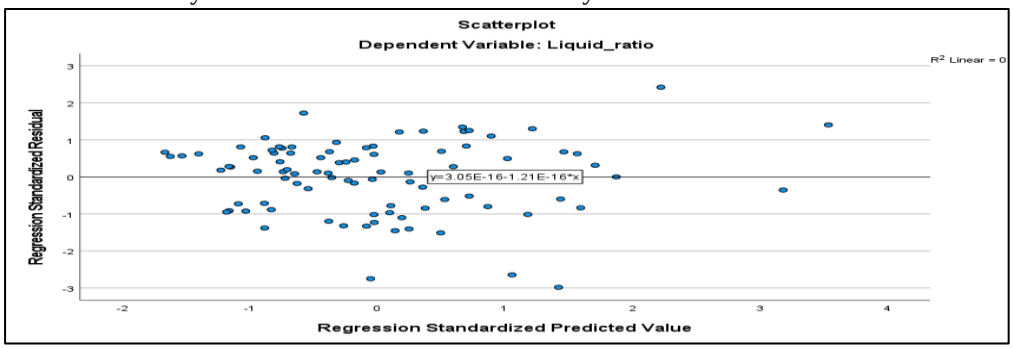

Figure 2. Scatter plot for idiosyncratic factors

Test of Linearity

Linearity refers to the predictor variables having a linear relationship with the outcome variable.

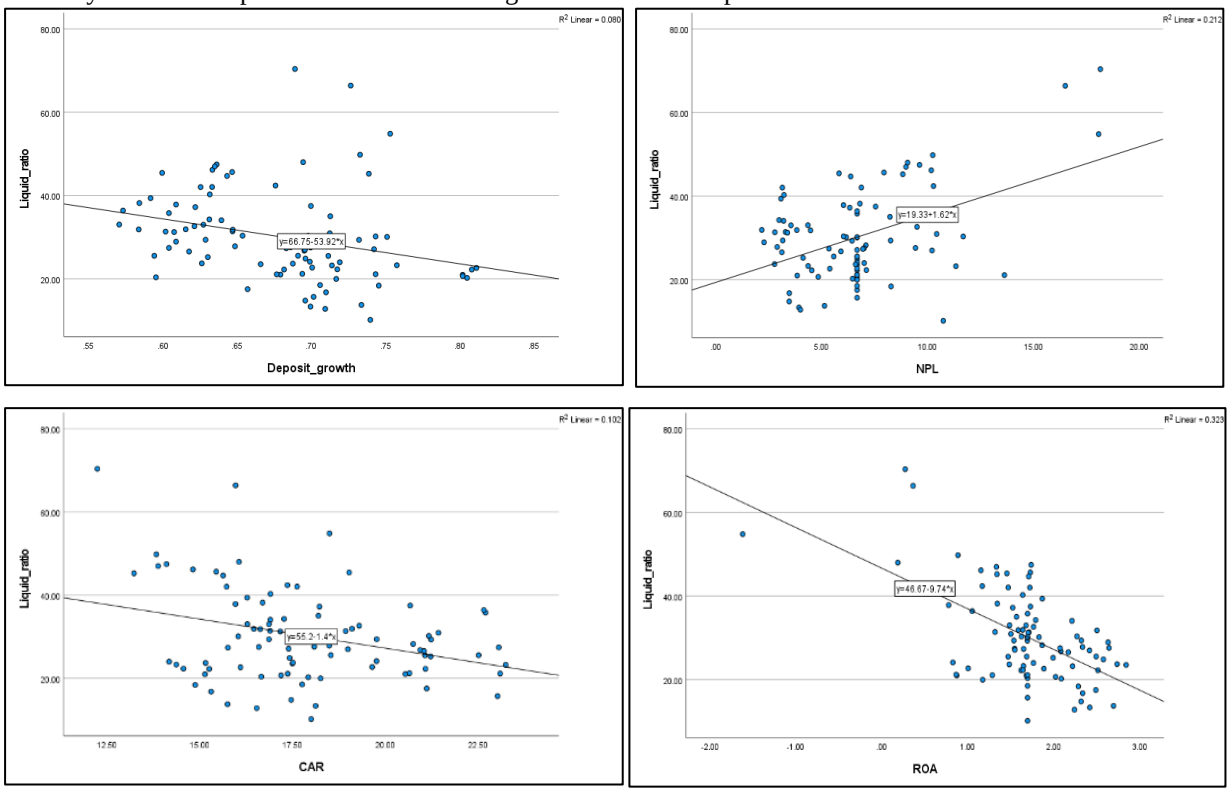

Figure 3. Linearity test for idiosyncratic factors

Multicollinearity Test

Table 3 calculated from SPSS indicates the correlation coefficient using the Pearson correlation.

Table 3. Correlation for Idiosyncratic factors

Correlations						
		Liquid_Ratio	**Deposit_Growth**	**NPL**	**CAR**	**ROA**
Pearson Correlation	**Liquid_Ratio**	1	-0.282	0.461	-0.32	-0.568
	Deposit_Growth	-0.282	1	0.283	-0.172	-0.06
	NPL	0.461	0.283	1	-0.099	-0.563
	CAR	-0.32	-0.172	-0.099	1	0.114
	ROA	-0.568	-0.06	-0.563	0.114	1
Sig. (1-tailed)	**Liquid_Ratio**	1	0.003	0	0.001	0
	Deposit_Growth	0.003	1	0.003	0.051	0.287
	NPL	0	0.003	1	0.176	0
	CAR	0.001	0.051	0.176	1	0
	ROA	0	0.287	0	0.142	1
N	**Liquid_Ratio**	91	91	91	91	91
	Deposit_Growth	91	91	91	91	91
	NPL	91	91	91	91	91
	CAR	91	91	91	91	91
	ROA	91	91	91	91	91

If the correlation coefficient in the Pearson correlation is greater than 0.8 it would indicate that independent variables are multicollinear as 0.8 would be strong high correlation. Based on the table above all the independent variables have correlation coefficient less than 0.8, which indicates absence of multicollinearity.

The second indicated method to verify multicollinearity is to analyze the VIF values.

Table 4. Coefficient for Idiosyncratic factors

Coefficients[a]							
Model	**Unstandardized B**	**Coefficients Std. Error**	**Standardized Coefficient Beta**	**t**	**Sig.**	**Collinearity Statistics**	
						Tolerance	**VIF**
1. (Constant)	117.093	11.407		10.265	0		
Deposit_Growth	-88.025	13.854	-0.461	-6.354	0	0.882	1.134
NPL	1.262	0.305	0.358	4.144		0.62	1.612

CAR	-1.415	0.304	-0.324	-4.655	0.959	1.042
ROA	-6.126	1.43	-0.357	-4.284	0.666	1.501
a. Dependent Variable: Liquid_ratio						

Table 4 shows that VIF values are less than 2 indicating absence of multicollinearity.

Error Term Test

The test assumes that the error term has mean equal to zero.

Table 5. Descriptive statistics for idiosyncratic factors

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Standardized Residual	91	-2.98371	2.42146	0	0.977525
Valid N (list wise)	91				

Table 5 shows that the mean is equal to zero. Hence, the assumption is satisfied that error term has mean equal to zero. Further, as per Standard residual test, the residual should be between +3 and -3. As per table 8, currently it is at -2.984 and +2.421 and hence the negative residual assumption is met.

Tale 6. Residual statistics for idiosyncratic factors

Residual Statistics[a]					
	Minimum	**Maximum**	**Mean**	**Std. Deviation**	**N**
Predicted Value	15.9363	60.4023	30.1831	8.54599	91
Std. Predicted Value	-1.667	3.536	0	1	91
Standard Error of Predicted Value	0.838	4.102	1.598	0.48	91
Adjusted Predicted Value	15.5269	58.6238	30.1617	8.49537	91
Residual	-21.23173	17.23087	0	6.95596	91
Std. Residual	-2.984	2.421	0	0.978	91
Stud Residual	-3.109	2.588	0.001	1.007	91
Deleted Residual	-23.057	19.67585	0.02145	7.38969	91
Stud. Deleted Residual	-3.281	2.679	-0.002	1.024	91
Mahal. Distance	0.259	28.916	3.956	3.722	91
Cook's Distance	0	0.19	0.013	0.031	91
Centered Leverage Value	0.003	0.321	0.044	0.041	91
a. Dependent Variable: Liquid_ratio					

Residual Independence Test

We will use Durbin Watson Test (DWT is measured on a scale of 0 to 4. We want to be as close to 2 as possible and avoid figures below 1 and above 3)

If d<2 positive auto correlation

If d>2 negative auto correlation

If d=2 no autocorrelation

Table 7. Residual Independence test for idiosyncratic factors

Model Summary[b]										
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**R Square Change**	**F Change**	**Df**	**Df2**	**Sig F Change**	**Durbin-Watson**
1	.776[a]	0.602	0.583	7.11589	0.602	32.453	4	86	0	0.805
a. Predictors : (Constant), ROA, Deposit_growth, CAR, NPL										
b. Dependent Variable: Liquid_ratio										

Table 7 shows that since, d<2 i.e., at 0.805, hence there is positive auto correlation

Outlier Test

Table 8. Frequencies for Idiosyncratic factors

Frequencies						
Statistics						
		Standardized DFBETA Intercept	**Standardized DFBETA Deposit_growth**	**Standardized DFBETA NPL**	**Standardized DFBETA CAR**	**Standardized DFBETA ROA**
N	**Valid**	91	91	91	91	91
	Missing	0	0	0	0	0
Minimum		-0.48636	-0.22685	-0.86069	-0.39028	-0.306
Maximum		0.20809	0.4866	0.68963	0.22538	0.27233

Table 8 shows that all the betas for dependent and independent variables are between +2 and -2 range indicating that there are no significant outliers.

Regression Model for Bank Specific Factors

Table 9. Regression analysis for idiosyncratic factors

Model Summary[b]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	Df	Df2	Sig F Change	Durbin-Watson
1	.776[a]	0.602	0.583	7.11589	0.602	32.453	4	86	0	0.805
a. Predictors : (Constant), ROA, Deposit_growth, CAR, NPL										
b. Dependent Variable: Liquid_ratio										

Table 9 shows that adjusted R square is at 58.3% indicating 58.3% of the variation is caused due to independent variables on dependent variables.

The Regression Model is statistically significant as F change is less than 0.05.

Table 10. Regression model for idiosyncratic factors

Coefficients[a]							
Model	**Unstandardized B**	**Coefficients Std. Error**	**Standardized Coefficient Beta**	**t**	**Sig.**	**Collinearity Statistics**	
						Tolerance	**VIF**
1. (Constant)	117.093	11.407		10.265	0		
Deposit_Growth	-88.025	13.854	-0.461	-6.354	0	0.882	1.134
NPL	1.262	0.305	0.358	4.144		0.62	1.612
CAR	-1.415	0.304	-0.324	-4.655		0.959	1.042
ROA	-6.126	1.43	-0.357	-4.284		0.666	1.501
a. Dependent Variable: Liquid_ratio							

Further, based on the table 10, all independent variables are statistically significant as "sig" is less than 0.05.

Table 11. ANOVA for Idiosyncratic factors

ANOVA[a]					
Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	6573.058	4	1643.265	32.453	.000[b]
Residual	4354.688	86	50.636		
Total	10927.746	90			
a. Dependent Variable: Liquid_ratio					
b. Predictors : (Constant), ROA, Deposit_growth, CAR, NPL					

In ANOVA table 11, since sig < 0.05, it is statistically significant, and we reject the null hypothesis

Diagnostic Validation for Market-Related Factors Using Regression Analysis

Table 12. Dependent and Independent variables

Dependent variable:	Liquidity ratio
Independent variables:	GDP, inflation, unemployment, oil prices

In order to arrive at the liquidity ratio, the author has averaged the liquidity ratio for all the sampled banks for each of the 10 years. The market indicators have been taken from the National Statistics Centre of the UAE.

When doing regression, the cases-to-independent variables ratio should ideally be 20:1; that is 20 cases for every independent variable in the model. The lowest your ratio should be is 5:1 (i.e., 5 cases for every independent variable in the model). The study has taken 10 years of market related data. However, the data is considered inadequate for conclusive regression analysis unlike bank specific factors. Nevertheless, the regression on the limited data showcases, that there is statistical significance between the independent and dependent variable for market related data.

Test of Normality

Table 13. Test of Normality for market-related factors

Test of Normality						
	Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Liquid_Ratio	0.154	10	.200*	0.893	10	0.184
***. This is a lower bound of the true significance.**						
a. Lilliefors Significance Correction						

The Shapiro-Wilk test results in table 13 are based on the correlation between the data and the corresponding normal scores and provides better power than the K-S test even after the Lilliefors correction. The Shapiro and Wilk (1965) test of normality states that if $p > 0.05$, then the dependent variable is normally distributed. Since in the given case, the significance is at 0.240, it satisfies the Shapiro-Wilk test for normality.

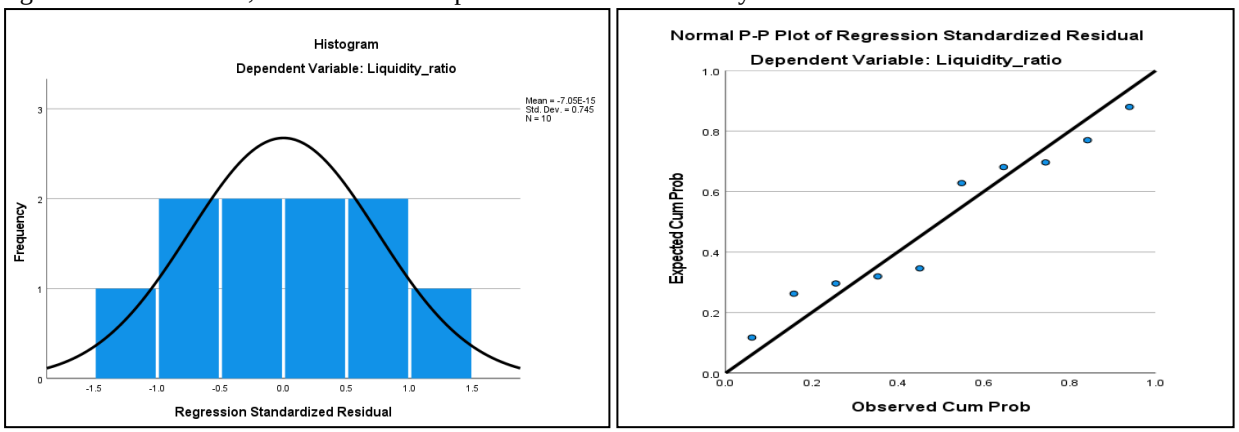

Figure 4. Normal distribution and PP plot for market-related factors

Based on graphs in figure 4, the visual representation of the dependent variable shows a normally distributed bell curve while the variable also aligns reasonably perfect on the Q-Q plot.

Homoscedasticity Test

The plotted diagram is shown in Figure 5 and visually we can see that the data is randomly distributed.

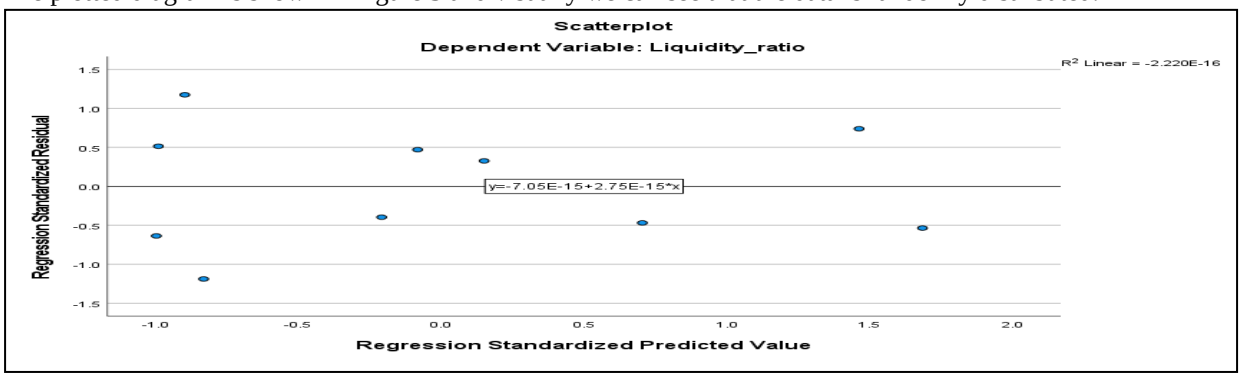

Figure 5. Scatter diagram for market-related factors

Test of Linearity

Test of linearity for market related factors could not be completed, as there were not sufficient observations to conclude the linear relationship. This has been considered as a limitation of the research.

Multicollinearity Test

Table 14 calculated from SPSS indicates the correlation coefficient using the Pearson correlation.

Table 14. Correlation for market-related factors

Correlations						
		Liquid_Ratio	**Oil_price_changes**	**Inflation**	**GDP**	**Unemployment**
Pearson Correlation	**Liquid_Ratio**	1	0.71	0.443	0.566	0.401
	Oil_price_changes	0.71	1	-0.266	0.338	0.568
	Inflation	0.443	-0.266	1	0.26	0.003
	GDP	0.566	0.338	0.26	1	0.573
	Unemployment	0.401	0.568	0.003	0.573	1
Sig. (1-tailed)	**Liquid_Ratio**	1	0.011	0.1	0.044	0.126
	Oil_price_changes	0.011	1	0.229	0.169	0.044
	Inflation	0.1	0.229	1	0.234	0.497
	GDP	0.044	0.169	0.234	1	0.042
	Unemployment	0.126	0.044	0.497	0.42	1
N	**Liquid_Ratio**	10	10	10	10	10
	Oil_price_changes	10	10	10	10	10
	Inflation	10	10	10	10	10
	GDP	10	10	10	10	10
	Unemployment	10	10	10	10	10

Table 14 shows that all the independent variables have correlation coefficient less than 0.8 that indicates absence of multicollinearity.

Table 15. Coefficients for market-related factors

Coefficients[a]							
Model	**Unstandardized B**	**Coefficients Std. Error**	**Standardized Coefficient Beta**	**t**	**Sig.**	**Collinearity Statistics**	
						Tolerance	**VIF**
1. (Constant)	-1.272	0.102		-12.489	0		
Oil_price_changes	0.012	0.001	0.958	12.841	0	0.595	1.68
Inflation	30.627	3.116	0.636	9.829	0	0.791	1.265
GDP	4.24	1.334	0.237	3.178	0.025	0.593	1.685
Unemployment	-2.767	0.79	-0.281	-3.502	0.017	0.514	1.946
a. Dependent Variable: Liquid_ratio							

Table 15 shows that VIF values are less than 2 indicating absence of multicollinearity.

Regression Model for Market Factors

Table 16. Regression analysis for market-related factors

Model Summary[b]										
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**R Square Change**	**F Change**	**Df**	**Df2**	**Sig F Change**	**Durbin-Watson**
1	.992[a]	0.944	0.899	0.654	0.944	74.212	4	5	0	0.941
a. Predictors : (Constant), Unemployment, Inflation, Oil_price_changes, GDP										
b. Dependent Variable: Liquid_ratio										

Table 16 shows that the adjusted R square is at 89.9% indicating almost 90% of the variation is caused due to independent variables on dependent variables.

The Regression Model is statistically significant as F change is less than 0.05.

Table 17. Regression model for market-related factors

Coefficients[a]							
Model	**Unstandardized B**	**Coefficients Std. Error**	**Standardized Coefficient Beta**	**t**	**Sig.**	**Collinearity Statistics**	
						Tolerance	**VIF**
1. (Constant)	-1.272	0.102		-12.489	0		
Oil_price_changes	0.012	0.001	0.958	12.841	0	0.595	1.68
Inflation	30.627	3.116	0.636	9.829	0	0.791	1.265
GDP	4.24	1.334	0.237	3.178	0.025	0.593	1.685
Unemployment	-2.767	0.79	-0.281	-3.502	0.017	0.514	1.946
a. Dependent Variable: Liquid_ratio							

Further, table 17 shows that all independent variables are statistically significant as “sig” is less than 0.05. GDP contribution is highest as it is at 0.997 as compared to other independent variables.

Table 18. ANOVA for market-related factors

ANOVA[a]					
Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	0.188	4	0.047	74.212	.000[b]
Residual	0.003	5	0.001		
Total	0.191	9			
a. Dependent Variable: Liquid_ratio					
b. Predictors : (Constant), Unemployment, Inflation, Oil_price_changes, GDP					

In ANOVA table 18, since sig < 0.05, it is statistically significant, and we reject the null hypothesis.

Regression Analysis for Idiosyncratic and Market-Related Factors

Table 19 shows the overall regression calculation for idiosyncratic and market-related factors. It indicates that all the factors are significant to the liquidity ratio. Based on the values in the table, all independent variables are statistically significant, as the p-value is less than 0.05.

Regression Analysis for All Factors

Table 19. Summary table for all factors

	Coefficients	Standard Error	T-stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Deposit growth	-57.98	86.79	-0.66	0.04	-431.4	315.47	-431.44	315.47
NPL	-0.89	1.73	-0.51	0.04	-8.34	6.55	-8.34	6.55
CAR	2.78	2.79	0.99	0.04	-9.25	14.81	-9.25	14.81
ROA	12.22	11.98	1.01	0.04	-39.35	63.79	-39.35	63.79
Unemployment	129.56	194.20	0.66	0.037	-706.0	965.15	-706.0	965.15
Inflation	-649.7	703.41	-0.92	0.04	-3676.	2376.8	-3676.3	2376.8
GDP	-76.10	108.47	-0.70	0.02	-542.8	390.62	-542.8	390.62
Average oil prices	0.05	0.148	0.35	0.01	-0.58	0.69	-0.58	0.69

RESULTS

This research evaluated the impact and statistical significance of the bank-specific and market-related factors on the liquidity of banks in the UAE. The test was conducted using a linear regression model that tested the significance of each independent variable on the dependent variable.

It has clearly been shown that the bank-specific factors impact the liquidity of banks in the UAE. Additionally, while the data on the market-related factors was insufficient, it still managed to evidence that these factors have a statistically significant effect on the dependent variable. The diagnostic summary of the regression analysis for both the idiosyncratic and market-related factors is given in Table 20.

Summary Table Containing the Regression Analysis Results

Table 20. Summary Test data for all variables

Test Name (whether test conducted or not)	Idiosyncratic Factor	Market-related Factor
Missing data test	Yes	Yes
Test of normality	Yes	Yes
Homoscedasticity test	Yes	Yes
Test of linearity	Yes	No*
Multicollinearity test	Yes	Yes
Error-term test	Yes	No
Residual independence test	Yes	No
Outlier test	Yes	No
Regression model	Yes	Yes

* Analysis not conducted due to the inadequacy of available data.

As the significance has now been tested, the next step is to rank these factors according to their order of its impact—from highest to lowest—using the MURAME approach.

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