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Capital, liquidity, and profitability in European banks

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Abstract

The research aims to investigate the impact of increased capital requirements and high liquidity levels on the profitability of European banks in the post crisis period. The study examines the largest banks in the European Union spanning 28 countries using data from 2010 to 2018. It used three measures to define bank profitability: return on average assets, return on average equity, and operating profit to risk weighted assets. Capital, liquidity, size, and asset quality represent bank specific determinants, while economic growth and inflation are considered as the main external determinants having influence on profitability. We used multiple regression models to analyze the association amongst the variables. The results revealed a positive and significant association between liquidity level and bank performance. Asset quality showed a negative and statistically significant influence on bank performance, while economic growth and inflation have no significant influence on bank performance. The study concludes that there is limited influence of the Basel III on bank profitability although the policy is important in achieving banking stability. This study contributes to the literature by empirically analyzing the impact of capital regulation on bank performance for the biggest banks in Europe. Although the Basel III framework is important for prudential banking, its effects on the performance of European bank is debatable.

KEYWORDS
asset quality, Basel III framework, capital, liquidity, profitability

1 | INTRODUCTION

The banking sector is a critical financial intermediary in the development of any economy. Banks mobilize funds from areas of the economy with excess to those who require the funds (Rahman et al., 2015). The sector provides credit facilities to aid in the funding of productive activities (Kashyap et al., 2017). Thus, banking institutions offer liquidity and enhance the diversification of risk (Durand, 2019). Rahman et al. (2015) note that the efficiency in the banking sector can be observed through their profitability and increased movement of funds from surplus zones to needy spaces. Yusuf et al. (2019) indicate that profitability is indicative of a bank's management efficiency, as they are

responsible for ensuring investors receive yields from their investments and creditors obtain payments for borrowed funds.

Changing banking guidelines have resulted in significant increase in theoretical and empirical banking research globally (Ozili, 2015). More specifically, the capital rules based on the Basel framework have driven debates among academicians, policymakers and others regarding the relationship between these regulations and the financial stability of banks (Carletti et al., 2018). From 2012, Basel III guidelines have been gradually implemented by banks to be fully applied by 2020 (Durand, 2019) yet, the dimensions and probable consequences on economies have been questioned ever since its initiation in 2010

(Adesina & Mwamba, 2015). Thus, understanding whether this regulation inhibits profitability in banks is a pertinent concern to be investigated. Extensive literature exists supporting the introduction of the Basel III rules regarding capital guidelines where significant economic benefits have been discussed in increasing the bank's equity position (Swamy, 2018). Adesina and Mwamba (2015) note that increasing banks' equity position reduces the risk of bank runs, the risk that was witnessed at the peak of the crisis in 2008, and thus protects depositors. Similarly, Swamy (2018) observes that increasing the capital standing of banks reduces the leverage and probability of insolvencies. Furthermore, Van den Heuvel (2016) indicates that the guidelines lessen extreme allocation of credit and unsatisfactory liquidity positions, thus avoiding the occurrence of moral hazard in banks.

Nevertheless, there are arguments against increased regulations, which may adversely affect banking performance through stifling innovation and risk taking. For example, Saona and Azad (2018) find that financial guidelines decrease competition and thus customers have to accept increased banking charges. Likewise, Adesina and Mwamba (2015) indicate that increasing equity capital compared to debt raises the cost of bank funding, thereby causing an increase in borrowing rates. Van den Heuvel (2016) observe that these regulations constrain banks from creating net liquidity through converting illiquid loans into liquid deposits because capital guidelines restrict the amount of loans that are offered by deposit-type liabilities while liquidity standards obligate banks to hold a higher level of liquid assets which affects liquidity conversion thereby limiting the assets on the bank's balance sheet. The adoption of Basel III guidelines may eventually pose a threat on bank's profitability and in turn influence a restraint on the financial steadiness that it aims to accomplish (Durand, 2019).

This research expounds the literature in both banking and finance in different dimensions. The paper elucidates on the impact of the present regulation in the banking industry on bank's profitability. It further examines the impact of other variables which may affect the lending function of banks since lending is widely accepted as the main activity that generates a major portion of bank profits. The study provides a guideline for academicians, policy makers, financial authorities, and other interested parties in understanding the impact of regulatory requirements and related both bank specific and external variables on bank profitability and therefore the impacts on banks performance. Consequently, the objective of this research is to explore the impacts of the Basel III regulations on banks profitability in European banks, focusing on bank capital and liquidity positions.

The rest of the paper proceeds as follows; the next section presents the literature review. Section 3 presents study design, Section 4 presents the analysis and discussion while Section 5 concludes the paper.

2 | LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Bank profitability has been researched extensively from various dimensions. Some studies focus on the impacts of the Basel regulations alone (Adesina & Mwamba, 2015; Adi, 2018; Van den Heuvel, 2016) while others have examined either bank-specific, external factors or both (Abbas et al., 2019; Topak & Talu, 2017). The current study primarily examines the influence of the Basel III regulations and other related variables on bank profitability. These include bank-specific and macroeconomic determinants of bank profitability. The next section provides a background information as part of the literature review.

2.1 | Basel III regulatory determinants

The banking system in Europe has experienced significant developments which have affected its operations. These regulatory and structural developments have also impacted banks profitability (Petria et al., 2015). These include the establishment of the Rome Treaty in 1957 that focused on creating a one banking market for European Union countries. This was initially implemented by consolidating banking regulations in 1977 and permitting a one-bank license for the region in 1989. The Maastricht Treaty of 1992 which resulted in the combined Europe's market, the introduction of the single currency in 1999, and the Financial Services Action Plan of 2005 all have had significant impacts on the banking sector in the EU (Petria et al., 2015). Additionally, the Basel Committee on Bank Supervision (BCBS) introduced Basel I in 1988 to provide guidance on the capital requirements for international banking institutions, then in 2006, Basel II was introduced to tighten guidance on supervision and market control. The financial crisis in 2007/8 ushered in the Basel III, which was introduced in 2010 not only to improve the amount of bank capital but also the quality of capital by incorporating leverage and liquidity standards (Phi et al., 2019). Under Basel II, the minimum capital requirement (MCR) was based on 1% VaR (Value at Risk) estimates with a holding period of at least 10 trading days. However, the MCR reflects the maximum of the current VaR and the averaged VaR of preceding 60 trading days (Kinateder, 2016). Under Basel III, the 2010 guidelines

contains the previous framework mentioned in Basel II but included a stressed value-at-risk (sVaR) capital requirement based on a continuous 12-month period of significant financial stress (Kinateder, 2016). Currently, Basel III guidelines are being implemented and its effects on the banking system has been widespread to all bank operations including lending, funding, treasury, capital, liquidity and operations which are highly interrelated with impact on the profitability of the sector (Swamy, 2018).

The latest banking regulatory guidelines primarily that focused on the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR) as additions to the previous capital requirements have spurred scrutiny by researchers and authorities on its diverse implications on financial steadiness and subsequently on bank profitability (Carletti et al., 2018). Phi et al. (2019) note that the Basel capital guidelines are initiated to aid in the monitoring and supervision of banking undertakings. Bitar et al. (2018) indicate that the Basel III guidelines aim to make banks more careful in structuring their capital arrangement so as to advance the quality and improve banks' equity positions. However, Kashyap et al. (2017) indicate that LCR motivates banks into increasing their short-term liquidity especially with high capital base while the NSFR focuses on equating the long-term financing to long term assets. Furthermore, according to Emilios (2015) these capital guidelines are essential as bank funding provides three main purposes: firstly, to guard against unforeseen losses; secondly, to restrict risk; and thirdly, to monitor and act as a controlling tool. Giordana and Schumacher (2017) find that if all banks had adhered to Basel III guidelines before the global financial crisis (GFC), there would have been a reduction in the possibilities of default. Similarly, Emilios (2015) finds that bank runs would be an exceptional occurrence in the face of the Basel capital rules because weak capital organizations are the main triggers to the various bank runs observed during the GFC and they would have been identified much earlier. Although banking regulations can lead to the reduction in banks vulnerability and reduce the possibility of the occurrence of bank failures, thus enhancing the stability of the financial sector, these rules also have effects on banks assets and liabilities in diverse ways (Kashyap et al., 2017), so bank regulations could affect banks profitability through their effects on banking operations, including capital and liquidity positions. Whilst previous studies have considered the positive effects of the regulations, not many studies have examined its adverse effects on bank performance. This study explores the implications of the capital and liquidity regulations on the profitability of the biggest European banks.

2.2 | Hypotheses development

2.2.1 | Capital

Rahman et al. (2015) refer to bank capital as the security in the event of extreme happenings while Ayaydin and Karakaya (2014) identify three specific advantages of a strong capital base to a bank. Firstly, as a cushion during losses, secondly, it raises investors' confidence, and thirdly, it is indicative of the banking funding model in terms of their risks. Rahman et al. (2015) show that bank capital is chiefly acquired either from retained earnings or by issuing shares. Thus, profitability and equity are the major contributing factors to bank capital.

Studies have reported different findings on the relationship between bank capital and profitability. Some studies have found positive associations between these two variables. Petria et al. (2015) note that a high capital adequacy ratio (CAR) can be positively related to profitability since the ratio indicates reduction in the risks undertaken by the bank. Mashamba (2018) agree that banks with high capital have reduced risk, which raises their stability rankings and attracts more capital at lower costs since investors demand a lower rate of return thus enhancing profitability. Likewise, Ozili (2017) established that regulated capital positively influences profits for African commercial banks. Furthermore, Islam and Nishiyama (2016) find a positive influence of equity capital on profitability for South Asia commercial banks. Bitar et al. (2016) examine various risk and non-risk regulatory capital ratios on bank risk and performance for countries in the MENA region and find that adherence to the Basel capital requirements guard against bank risks and augments efficiency and profitability. Jabra et al. (2016) also find positive relationships between the two variables by assessing the BRICS nations i.e. Brazil, Russia, India, China, and South Africa.

Yet, other studies have noted a negative influence between bank capital and profitability. For example, Buchory (2015) findings suggest a negative association between bank capital represented by CAR and profitability for banks in Indonesia. They attribute this finding to reduction in bank lending. Swamy (2014) agrees that increasing the capital ratio raises the funding costs. The study notes that this effect can be moderated through alternative funding approaches. The findings in Bitar et al. (2018) show that high capital ratios are negatively associated with bank efficiency and profitability. The study analyses the adoption of increased capital ratios in decreasing risk and augmenting efficiency and profitability in 39 OECD countries for the period between 1999 and 2013 by checking over 1900 banks. Given the arguments that banks with high capital

experience reduced financing costs (Mashamba, 2018) and high bank capital lessens the risk exposure to liquidation since the higher the CAR the lower the requirement for additional financing (Ozili, 2015), our first null hypothesis is that:

H1:   *There is no relationship between the Basel III capital regulations and bank profitability*

2.2.2 | Liquidity

The second principal component of the Basel III regulation is the bank liquidity position. Roy et al. (2019) define bank liquidity as the assurance banks have on ensuring that they can invest in assets and at the same time cover all their required commitments at the right time and at rational spending levels. Yusuf et al. (2019) describe bank liquidity as the holding of monetary funds or the easy conversion of assets to monies. Therefore, liquidity is the ability of banks to ensure account holders can easily access their funds at any time (Alali, 2019) and the guarantee banks provide to ensure all required financial commitments can be settled through possessing a high proportion of liquid assets (Davies, 2014). According to Yusuf et al. (2019) the expansion and profitability of an organization largely depend on the liquidity levels and how they are managed. Tran et al. (2016) agree that effective management of liquidity is critical for increased earnings. However, Yusuf et al. (2019) note that a profitable organization is not always liquid, and liquidity does not necessarily guarantee profitability.

Many scholars have investigated the associations between liquidity and profitability with diverse findings. Positive relationship between them have been noted in numerous studies. For example, Abbas et al. (2019) find a positive relationship between liquidity and profitability, where a 3.5 % increase in liquidity was associated with 1% rise in profitability. The study discovers that bigger banks require lesser liquidity than smaller banks in generating profit. For example, bigger banks can generate the same level of profit that is commensurate to their funding level while smaller banks require higher liquidity level for every unit of profit generation. Mashamba (2018) findings indicate that LCR requirements improve bank profitability for 11 developing countries for 2011-2016 based on the Basel III liquidity requirements. In a similar study, Alshatti (2015) finds that the proportion of liquidity ratio has impacts on the profitability of Jordanian banks. Gyamerah and Amoah (2015) report similar findings in the case of Ghanaian and Chinese banks respectively. However, mixed results are found by Ayaydin and Karakaya (2014) who adopt liquid assets to customer and short-term deposits as a measure of liquidity. The study observes a negative relationship between liquidity and NIM while a positive relation is found between liquidity and interest income to total assets. Another study by Tran et al. (2016) indicates that liquidity and profitability are inversely connected such that an increase in liquidity reduces the amount of profits realized. Given the arguments above our second null hypothesis is stated as:

H2:   *There is no relationship between the Basel III liquidity regulations and bank profitability*

2.2.3 | Other bank specific determinants of bank profitability

Basel III regulations have concentrated on capital and liquidity requirements, but extant literature has identified other factors that affect bank profitability. We focused on the other firm specific and macroeconomic variables. We consider some of these as control variables in this study and briefly explain our theoretical expectations below:

Bank size
Contemporary financial intermediary theory proposes that there are efficiency advantages resulting from the size of the bank due to economies of scale (Mashamba, 2018). The size of a bank influences numerous operational undertakings within banks that include investment prospects, diversifying of portfolios, reputation as observed by customers and investors and accessibility to equity funding (Rahman et al., 2015). Since economies of scale reduces the operational expenses while increasing revenue stream, bigger banks take advantage of spreading their expenses in numerous functions leading to reduced operational expenses thereby experiencing increased profitability (Mashamba, 2018). Ozili (2017) agree with this view and note that in bigger banks, the amount used in collecting, administering and making use of information is reduced contributing to increased profits. Djalilov and Piesse (2016) and Petria et al. (2015) agree to the notion of economies of scale surrounding bigger banks but note that in many situations, larger organization are inflexible and could be sluggish in responding to market opportunities due to bureaucracy which could impact on their operational efficiency and performance. Under this, a negative relationship between bank size and profitability will be observed (Petria et al., 2015). Overall, we expect a positive association between bank size and profitability.

Asset quality
Ozili (2017) indicates that bank lending is the principal element in a bank's total assets, which yields high interest income. Therefore, consideration of the lending factors is critical in the determination of bank profitability. Despite lending being observed as a profitable venture, there are

risks associated with these operations due to the possibilities of customer's default termed as credit risk (Abbas et al., 2019). Bank credit risk is indicative of the stability of their loan portfolio (Rahman et al., 2015). Higher credit risk is ordinarily associated with higher bank profitability since the bank can charge higher cost of lending. Petria et al. (2015) argue that the possibility of losses through default by borrowers poses substantial negative effect on bank lending. This shows that a high rate of non-performing loans or losses related to lending adversely affects banks performance (Ozili, 2017). We anticipate a negative relationship between asset quality and bank profitability.

External determinants of bank profitability

These are factors that are beyond the control of the banks and they include the macro-economic variables (Al-Homaidi et al., 2018; Rehman et al., 2018) such as Economic Growth Rate, and Inflation level in a country. These variables are now explained below:

Economic growth rate

Rahman et al. (2015) describe GDP growth rate (GDPGR) as the overall advancement in the economy of a country and has been noted to have a substantial effect on the profitability of banks. Petria et al. (2015) explained further that the economic cycle has multiple impacts on the operations of a bank such as the level of deposits from customers, the degree of lending and the interest charged on loans. For instance, during periods of harsh economic times, the level of loans and deposits decline, thus reducing bank profitability. In the same context, during times of economic expansions, the possibility of defaulting in bank loans decreases since borrowers experience positive economic condition that enables them to make payments to their creditors when their loan installments are due, whereas in periods of hard economic times, borrowers find it difficult to make their loan repayments (Ozili, 2017). Rehman et al. (2018) indicate that increased economic growth can also affect bank profitability negatively due to increase in non-performing loans. High growth rates may increase the allocation of credit facilities to customers who are not qualified or may not have the ability to repay the credit offered. Literature has shown diverse findings regarding the effect of GDP on bank profitability. Many studies find a positive influence. For example, Boitan (2015) who examines the factors impacting on profitability for banks in the European Union (EU) countries finds a highly positive causality between GDPGR and bank profitability. Likewise, Basarır and Sarıhan (2017) investigation in the Turkish banking environment confirms a positive association between GDP and bank profitability. Opposing findings are reported by Bhattarai (2018) while studying the effect on Nepal commercial banks. Satria et al. (2018) when investigating the determinants of bank profitability in major Asian commercial banks find a negative relationship between GDP grow and bank profitability. Overall, we expect a positive association between GDP growth rate and bank profitability.

Inflation rate

Although high interest rates would seemingly be expected to increase bank profitability, its impact is very controversial and depends on the management efficiency of respective banks in effectively scrutinizing their borrowers before offering them loan facilities and in collecting the loan deposits. This is because high interest rates would definitely increase interest income on bank loans and thus high profits, but may cause the level of default to increase due to the high charge and heighten the level of non-performing loans leading to reduction in bank profits. Accurate prediction of change in inflation rate is critical in the connection between inflation rate and bank profitability, because prior knowledge would guide banks to suitably modify their interest rates based on the precise estimation of the rate. This would imply that inflation rates positively affect bank profitability (Islam & Nishiyama, 2016). According to Noman et al. (2015) and Ariyadasa et al. (2016), if the forecasting of inflation rate is not certain, then the rate would negatively affect bank profitability. We anticipate a positive association between inflation rate and bank profitability.

3 | RESEARCH DESIGN

3.1 | Sample selection and data collection

The study focuses on the largest banks in the European Union to advance the relevant literature. The largest three banks in each country based on total assets were selected for the study. The data for this investigation are mainly from Fitch Connect database. Additional data were collected from the annual report of the banks where these were available online.

World Bank database provides the quantitative data for the macroeconomic variables used in the study. The focus of the study is the post crisis period, ranging from 2010 to 2018 based on availability. This results in 84 banks across the 28 countries in our sample. We have 756 country-year observations. Table 1 below presents the variables and their definitions.

3.2 | Regression model

We used three measures of bank profitability in this study; return on average assets (ROA), return on average equity (ROE) and operating profit to risk weighted assets (OPRWA). The analysis in this paper is based on a

TABLE 1 Definitions and measurement of variables

Variable	Definition	Past studies using this definition
Dependent variables		
ROA	The ratio of net income to average total assets,	Abbas et al. (2019); Al-Homaidi et al. (2018)
ROE	The ratio of profit before interest and tax to average equity	Abbas et al. (2019); Al-Homaidi et al. (2018)
OPRWA:	The ratio of operating profit to risk weighted assets	Lotto (2019); Al-Homaidi et al. (2018)
Independent variables		
CAR1	$\dfrac{Total\ Equity\ (TE)}{Total\ Assets\ (TA)}$	Khatun and Siddiqui (2016); Pradhan and Shrestha (2016); Rahman et al. (2015)
CAR2	$\dfrac{Total\ Equity\ (TE)}{Risk\ Weighted\ Assets\ (RWA)}$	Khatun and Siddiqui (2016); Pradhan and Shrestha (2016); Rahman et al. (2015))
LIQ1	$\dfrac{Total\ Loans\ (TL)}{Total\ Customer\ Deposits\ (TCD)}$	Menicucci and Paolucci (2016)
LIQ2	$\dfrac{Total\ Customer\ Deposits\ (TCD)}{Total\ Funding\ (TF)}$	Menicucci and Paolucci (2016); Naeem et al. (2017); Al-Homaidi et al. (2018)
Control variables		
BS	*Ln Total Assets*	Petria, Capraru and Ihnatov (2015); Singh and Sharma (2016); Al-Homaidi et al. (2018)
NPLGL	$\dfrac{Non-Performing\ Loans\ (NPL)}{Gross\ Loans\ (GL)}$	Kadioglu, Telceken and Ocal (2017)
LLANPL	$\dfrac{Loan\ Loss\ Provisions\ (LLP)}{Non-Performing\ Loans\ (NPL)}$	Kadioglu, Telceken and Ocal (2017)
GDPGR	$\Delta\ in\ GDP\ Rate$ The change in GDP growth rate	
CPI	Consumer Price Index	

TABLE 2 Summary statistics of all variables

Variable	ROA	ROE	OPRWA	CAR1	CAR2	LIQ1	LIQ2	BS	NPLGL	LLANPL	GDPGR	CPI
Mean	−0.18	0.73	0.16	3.91	3.72	1.95	1.77	4.85	0.70	1.63	0.29	0.11
S.D.	0.40	0.45	0.34	1.92	1.13	0.45	0.33	1.17	0.52	0.49	0.36	0.39
Min	−2.00	−0.64	−2.00	0.00	0.00	−0.85	0.00	0.00	−1.30	0.00	−1.59	−2.08
Max	0.81	1.73	1.73	6.92	6.26	3.15	2.00	7.16	1.76	2.37	1.40	0.78

Definitions and measurement of variables are shown In Table 1.

panel data structure that recognizes the peculiar features of the EU banking sector. Our regression model is specified below:

$$BANKPROF_{it} = \beta_0 + \beta_1 CAR1_{it} + \beta_2 CAR2_{it} + \beta_3 LIQ1_{it}$$
$$+ \beta_4 LIQ2_{it} + \beta_5 BS_{it} + \beta_6 NPLGL_{it} + \beta_7 LLANPL_{it}$$
$$+ \beta_8 GDPGR_{it} + \beta_9 CPI_{it} + e_{it} \qquad (1)$$

4 | RESULTS

4.1 | Descriptive statistics and correlation matrix

Table 2 presents the descriptive statistics of the variable used in the study. It shows reasonable variations in the variables, justifying the use of regression models.

For instance, ROA shows a mean = -.1837, S.D = .3950; OPRWA shows a mean = .1614, S.D = .3415; ROE shows a mean = .7256, S.D = .4527. All the bank-specific variables show some variations as depicted in Table 2 below. Table 3 presents the correlation matrix. None of the explanatory variables shows any high correlations to raise concern over multicollinearity except the correlation between CAR1 and BS. This high correlation will be explored further in the analysis.

4.2 | Regression results

4.2.1 | Pooled, fixed, and random effects with ROA

Table 4 below presents the results for the Pooled, Fixed Effects, and Random Effects models with ROA as the

TABLE 3   Correlation matrix

	ROA	ROE	OPRWA	CAR1	CAR2	LIQ1	LIQ2	BS	NPLGL	LLANPL	GDPGR	CPI
ROA	1.00											
ROE	0.43	1.00										
OPRWA	0.41	0.60	1.00									
CAR1	−0.19	0.00	0.14	1.00								
CAR2	−0.17	0.22	0.11	0.57	1.00							
LIQ1	−0.11	0.10	0.01	0.49	0.50	1.00						
LIQ2	0.10	0.23	0.12	0.08	0.22	0.32	1.00					
BS	−0.25	0.14	0.07	0.63	0.93	0.55	0.21	1.00				
NPLGL	0.07	−0.30	−0.28	0.15	−0.05	0.21	0.27	−0.04	1.00			
LLANPL	0.06	0.11	0.07	0.41	0.41	0.65	0.34	0.42	0.33	1.00		
GDPGR	0.20	0.27	0.25	−0.16	−0.12	−0.18	0.09	−0.18	−0.07	−0.06	1.00	
CPI	0.00	−0.02	−0.03	−0.05	−0.07	0.00	−0.03	−0.04	0.00	−0.02	−0.13	1.00

Definitions and measurement of variables are shown in Table 1.

TABLE 4   Pooled, fixed, and random model results with ROA

	Pooled Model	Fixed Effects Model	Random Effects Models
CAR1	−0.013 (0.173)	−0.012 (0.198)	−0.013 (0.173)
CAR2	0.105 (0.001)***	0.103 (0.002)***	0.106 (0.001)***
LIQ1	−0.084 (0.059)*	−0.078 (0.085)*	−0.084 (0.059)*
LIQ2	0.119 (0.009)***	0.111 (0.015)***	0.119 (0.008)***
BS	−0.176 (0.000)***	−0.174 (0.000)***	−0.176 (0.000)***
NPLGL	0.005 (0.000)***	0.007 (0.814)	0.005 (0.865)
LLANPL	0.170 (0.865)	0.166 (0.000)***	0.170 (0.001)***
GDPGR	0.130 (0.000)***	0.141 (0.002)***	0.130 (0.661)
CPI	0.015 (0.661)	0.024 (0.614)	0.015 (0.645)
AdjR2	0.135	0.1451	0.1453
N	756	756	756

*, ** and *** represents p-value less than 10%, 5% and 1%, respectively. The definitions and measurement of the used variables are summarized in Table 1. p-values are in parentheses.

dependent variable. We use the Hausman's test to decide the most appropriate model between the fixed and the random effects models. The table shows that the pooled model explains roughly 14% of the changes in bank performance and shows that CAR2 (β = 0.105, p-value = 0.001), LIQ2 (β = 0.119, p-value = 0.009), BS (β = −0.176, p-value. = 0.000), NPLGL (β = 0.005, p-value = 0.000) and GDPGR (β = 0.130, p-value = 0.000) all have significant predictive effects on ROA. Only banks size (BS) shows a negative relationship with bank performance. This implies that there is an inverse relationship between bank performance and bank size. The macro economic variables do not show consistent statistically significant relationship with bank performance as the economic growth shows significant and positive impacts on bank performance while inflation has an insignificant relationship with bank performance. The table shows that most of the banks specific

variables are significant in the three models. The results of the Hausman's test (p-value = 0.000) indicate the support for the fixed effect model. The results from the pooled regression model is similar to the outcome of the fixed and random effect models as presented in the table except for the macro economic variables and one of the measures of asset quality (NPLGL).

4.2.2 | Pooled, fixed, and random effects with ROE

Table 5 below shows similar models with ROE as the dependent variable. The table shows that the pooled model explains roughly 29% of the changes in bank performance. It shows that CAR2 (β = 0.204, p-value = 0.000), LIQ2 (β = 0.324, p-value = 0.000), BS (β = −0.161,

TABLE 5 Pooled, fixed, and random model results with ROE

	Pooled Model	**Fixed Effects Model**	**Random Effects Models**
CAR1	−0.007 (0.501)	−0.006 (0.536)	−0.007 (0.501)
CAR2	0.204 (0.000)***	0.205 (0.000)**	0.204 (0.000)***
LIQ1	0.060 (0.198)	0.055 (0.235)	0.060 (0.197)
LIQ2	0.324 (0.000)***	0.324 (0.000)***	0.324 (0.000)***
BS	−0.161 (0.000)***	−0.161 (0.000)***	−0.161 (0.000)***
NPLGL	−0.333 (0.000)***	−0.334 (0.000)***	−0.333 (0.000)***
LLANPL	0.099 (0.013)**	0.102 (0.011)**	0.099 (0.013)**
GDPGR	0.279 (0.000)***	0.306 (0.000)***	0.279 (0.000)***
CPI	0.037 (0.299)	0.023 (0.647)	0.037 (0.298)
AdjR2	0.2882	0.2961	0.2967
N	756	756	756

*, ** and *** represents *p*-value less than 10%, 5% and 1%, respectively. The definitions and measurement of the used variables are summarized in Table 1. *p*-values are in parentheses.

TABLE 6 Pooled, fixed, and random model results with OPRWA as the profitability factor

	Pooled Model	**Fixed Effects Model**	**Random Effects Models**
CAR1	0.052 (0.000)***	0.054 (0.000)***	0.052 (0.000)***
CAR2	0.079 (0.004)***	0.078 (0.004)***	0.079 (0.003)***
LIQ1	−0.067 (0.065)*	−0.058 (0.110)	−0.067 (0.065)*
LIQ2	0.191 (0.000)***	0.176 (0.000)***	0.191 (0.000)***
BS	−0.112 (0.000)***	−0.113 (0.000)***	−0.112 (0.000)***
NPLGL	−0.254 (0.000)***	−0.253 (0.000)***	−0.254 (0.000)***
LLANPL	0.094 (0.003)***	0.089 (0.005)***	0.094 (0.003)***
GDPGR	0.198 (0.000)***	0.223 (0.000)***	0.198 (0.000)***
CPI	0.018 (0.531)	0.048 (0.219)	0.018 (0.531)
AdjR2	0.2221	0.2297	0.2313
N	756	756	756

*, ** and *** represents *p*-value less than 10%, 5% and 1%, respectively. The definitions and measurement of the used variables are summarized in Table 1. *p*-values are in parentheses.

p-value = 0.000), NPLGL ($\beta = -0.333$, p-value = 0.000), LLANPL ($\beta = 0.099$, p-value = 0.013) and GDPGR ($\beta = 0.279$, p-value = 0.000) all show significant impacts on ROE. BS and NPLGL show negative and significant impact on ROE. The results indicate that there are negative relationships between bank size, asset quality measured as non-performing loans (NPL) and bank performance. The macro economic variables show inconsistent results similar to Table 4 except that in Table 5, economic growth has significant positive impact on bank performance in all the models. The results demonstrate that most of the bank specific variables are significant in the three models. The results of the Hausman's test (p-value = 0.000) indicate the support for the Fixed Effects model. The outcomes from the pooled regression model are similar to the results of the Fixed and Random Effects models.

4.2.3 | Pooled, fixed, and random effects with OPRWA

Table 6 shows the regression models with OPRWA as the dependent variable. The table shows that the pooled model explains roughly 22% of the changes in bank performance. It notes that CAR1 ($\beta = 0.052$, p-value = 0.000), CAR2 ($\beta = 0.079$, p-value = 0.004). LIQ1 ($\beta = -0.067$, p-value = 0.065), LIQ2 ($\beta = 0.191$, p-value = 0.000), BS ($\beta = -0.112$, p-value = 0.000), NPLGL ($\beta = -0.254$, p-value = 0.000), LLANPL ($\beta = 0.094$, p-value = 0.003) and GDPGR ($\beta = 0.198$, p-value = 0.000) are all significant variables in determining bank performance. The results show that there are negative relationships between LIQ1, BS, NPLGL and OPRWA. This implies that bank size, liquidity measured as total loans to total customer deposits,

asset quality measured as non-performance loans, have significant and negative impacts on bank performance. The results of the Hausman's test (p-value = 0.000) indicate the support for the fixed effect model. The macro economic variables show similar results to the results of Table 5.

5 | DISCUSSION

5.1 | Profitability and bank capital

This study seeks to explore the determinants of bank profitability for a sample of EU banks. From the findings H1 is addressed mostly based on the fixed effects outcomes since it is confirmed to be the most suitable model as per the Hausman test. The assertion is that a positive influence draws from the bank capital towards profitability although there are some variations in the same outcomes. For instance, in the pooled regression it is confirmed that statistically significant difference is present between the determinants of bank profitability together with the industry and macroeconomic factors with ROA i.e. return on asset. For that reason, it is recommended that these observed variables are in real-life factors that must be taken care of if the cohort banks are to achieve stability in gains made from the assets. Although from this pooled regression model it is evident that CAR1 shows a non-significant beta while CAR2 significant.

In fact, the same results re-emerge in the case of the Fixed and Random Effects model since CAR1 maintained a non-significant beta, while CAR2 was significant in all the models. For that reason, there is evidence that not all aspects of the capital of the banks have positive influence on profitability. The results contradict the works by Petria et al. (2015); Rahman et al. (2015), and Ayaydin and Karakaya (2014) but we tend to think that unlike this research, previous scholars may have considered bank capital in a different manner than splitting them into CAR1 and CAR2. Indeed, the confirmation of CAR2 having the positive influence on banks' profitability supports the mentioned past studies including those by Abbas et al. (2019), Islam and Nishiyama (2016), Mashamba (2018) and Bitar et al. (2016). The decision not to reject H1 is based on the following judgment: both CAR1 and CAR2 rely on total equity but then as a ratio of total assets and risk weighted assets respectively which we consider to be unique portfolios that could not be synonymous.

In other words, total assets and risk-weighted assets are considered different aspects of bank capital hence they both show significant results for H1 to be fully affirmed. Moreover, the fact that CAR1 shows a non-significant predictive effects on ROA is a major reason for not rejecting H1 since the dimension of total assets is an important bank capital indicator; since it captures the non-varied assets that banks have and this is important for the shareholders. The assertions are aligned with the works by Ozili (2015) since for this author total assets constitute the stronger base of bank capital. Further results that lead to the non-rejection of H1 are based on the outcomes for ROE and OPRWA. However, the results from the fifixed and random effects involving OPRWA as the measure of profitability indicate that CAR1 shows a significant beta coefficient and this is the only incidence that H1 could be fully confirmed.

5.2 | Profitability and liquidity

The study establishes that the observed variables on liquidity serving as determinants of profitability prove statistically significant differences with all the profitability dimensions used in this study i.e. ROA, ROE, and OPRWA. For that reason, it is asserted that liquidity remains an important indicator that must be accorded due attention when developing modalities meant to increase profitability in the EU banks. The findings are aligned with the findings from Ayaydin and Karakaya (2014). As per H2 it is held that bank liquidity has negative influence on profitability. Worth noting that liquidity in the study is addressed using two sub-variables namely: (a) LIQ1 (LCD) and LIQ2 (CD/TF) where total customer deposits and total funding are considered respectively; thus, both cases should have returned negative beta values to confirm H2. Under the pooled regression model both LIQ1 and LIQ2 are significant when linked to ROA aspect of profitability although only LIQ1 has a negative beta, indicating that a negative influence is confirmed towards profitability of the EU banks; the LIQ2 due to a positive significant beta leads to the assumption for a positive influence which contradicts the studies by Mashamba (2018) and Tran et al. (2016) where liquid assets are said to reduce bank profitability. Given the mixed outcomes especially in the random effect models, we confirm that H2 is to be wholly rejected since the better cases of bank liquidity under LIQ1 has non-significant negative influence on profitability. Nonetheless, the negative influence confirms under LIQ1 and ROA in the findings of the research agrees with the findings in Tran et al. (2016). In terms of ROE and OPRWA a non-significant beta was achieved for LIQ1 while LIQ2 aspect of liquidity confirms a beta value. The latter case means a positive influence between liquidity and profitability is present, which supports the results by Abbas et al. (2019), Gyamerah and Amoah (2015) and Alshatti (2015), Hu and Xie (2016), Islam and Nishiyama (2016) since for these

scholars strengthening liquidity base raises profitability of banks. The non-rejection of H2 is further supported by the random effects models for ROA, ROE, OPRWA since the LIQ1 has a non-significant beta while LIQ2 reports a significant positive beta value which means a positive influence as opposed to a negative influence. The latter is, therefore, a strong basis to reject H2 in totality. Moreover, the non-significant results especially in the case of LIQ1 and bank profitability as evident in the random effects model compares to the assertions by Islam and Nishiyama (2016).

5.3 | Profitability and bank size

The study models the relationship between bank size and profitability. However, from the fixed effects based on ROA, ROE, OPRWA a negative significant beta emerges. It is the cogent case for the EU banks. The results of this research are consistent with the findings from Djalilov and Piesse (2016); Mashamba (2018); Ozili (2015), and Alhassan et al. (2016). We believe that the outcome is good news to the EU bank investors since it represents a good balance between bank size and profitability, since a negative relationship would mean that bank size is in itself a liability to the bank instead of adding the required profitability strength. It would also be inferred that smaller bank may have higher profitability than large banks.

5.4 | Profitability and asset quality

The other investigation carried out in the study includes the relationship in the case of profitability and asset quality i.e. NPLGL and LLANPL meaning two aspects of asset quality are operationised in the study. The focus is on the outcomes of the fixed effects model where for the case of ROA, mixed outcomes are emergent; for instance, LLANPL returns a positive significant beta and NPLGL returns a non-significant beta; then, ROE yields mixed outcomes both significant with LLANPL having a positive beta value. The results are in tandem with the findings from Abbas et al. (2019) and

Ozili (2017). For OPRWA as an aspect of bank profitability it is seen that NPLGL is a negative and significant while LLANPL is a positive and significant beta; this is mixed outcomes as this supports that asset quality, on one hand, impacts positively on profitability of banks and, on the other hand, having negative influence. The former corroborates to the works by Kadioglu et al. (2017); Ozurumba (2016), and Djalilov and Piesse (2016); while the latter supports the assertions by Bhattarai (2016).

5.5 | Profitability and macroeconomic factors

The study also assessed the impacts of inflation and GDP on bank profitability. From the fixed effects model results with the dependent variables of ROA, ROE, and OPRWA, GDPGR confirm positive and significant relationships, meaning a positive influence exists in the variables' relationships. The results are aligned with the findings in Basarır and Sarıhan (2017); Boitan (2015); Pradhan (2016); Topak and Talu (2017) although the study by Rehman et al. (2018) has not been confirmed since the author envisages a negative influence of GDP on profitability of banks. Similarly, the results at the policy level support that economic growth through fiscal and monetary policy have significant impacts on bank profitability hence the need for stability to support the banking industry. In terms of inflation all the models show that there are non-significant effects when linked to the different facets of bank profitability. In that case, inflation rate and profitability of EU banks do not prove to have positive relationships. Thus, the outcomes fail to confirm the findings in Cetin (2019); Noman et al. (2015); Rahman et al. (2015) and Ariyadasa et al. (2016). We find the results as a good sign since it means that the profitability of banks does not depend on the inflationary trends which are important for stabilizing banks products and services to the depositors.

6 | CONCLUSION

Overall, the study has demonstrated that the determinants such as bank capital, liquidity, asset quality, bank size and macroeconomic factors i.e. GDP and inflation have meaningful effects on profitability of banks in the European Union region. However, the outcomes also indicate that the relationships between the bank characteristics and profitability depend on the measure of performance used i.e. OPRWA, ROA, and ROE; in other words, it is established that positive influence of these factors on ROA may not be extended to ROE. Thus, the insinuation is that at a strategic point of view portfolio managers in the EU banking industry should consider driving profitability based on the determinants that have significant influence on them and re-direct other factors. Therefore, the study has proven that profitability of EU banks is a complex portfolio that requires proper management if it is to remain sustainable in the long-term. In the findings, it is established that inflation has not had any influence on banks' profitability in the EU and this is good news to the investors since the banking industry remains stable both in high and low rates. Otherwise, we opine that the staggering of the banks'

profitability in the region because of inflation can weaken the system and lead the banks to high liquidity problems. The consideration is that inflation is among the dynamics that vary every day in any economy and with zero influence in the banking industry in the EU remains an optimum result.

The effects of asset quality, bank capital, and liquidity are vital to support the profitability of EU banks and this has been confirmed in different aspects. The outlook of the EU banks, therefore, depicts a good interlink of the bank-specific, industry-specific, and macroeconomic factors and their spill-over effects on profitability. As a result of the study, we suggest that the focus of the banking industry in the EU should be to strengthen bank capital and asset quality to ensure there is sustainable profitability in the long-term. Moreover, the authorities should enact monetary and fiscal policies that are aimed at stabilizing regional economic growth since it has significant effects on the banks' profitability. The other concern is to facilitate the banks with stimulus packages to maintain a stable liquid, equity, and asset quality position. For instance, create flexible but strict regulations that require bank managers to report on the progress of the banks in each of the mentioned determinants and their compliance to the established thresholds.

The authenticity of the data used in this study depends on the accuracy of the sources which include Fitch Connect database, World Bank database and annual financial statements provided by respective banks. Hence, the findings are founded on the specific available data. Further, the study focused on some particular measures and did not incorporate all measures that have been provided by all studies with regards to the determinants of bank profitability and hence the study results are founded on the specific view of the subject matter and may have missed out on other critical variables that explain bank profitability.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

[Dataset] Adelopo, I., Vichou, N. and Cheung, K.Y. 2021 Capital, Liquidity and Profitability in European Banks. UWE data repository. Available from: http://researchdata.uwe.ac.uk/631

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APPENDIX A