The effect of bank size on risk ratios: Implications of banks' performance

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Abstract

The aim of this study is to investigate the effects of bank capital and liquidity ratios on banks' profitability. The analysis of these ratios makes it possible to observe the behaviour of the banks in terms of risk during the current period. The empirical analysis relates to a sample of 1270 European banks observed over the period 2005-2012. Three panels' data are considered respectively large, medium and small banks in order to compare European banks according to their size. First, tests indicate homogeneity in behaviour of large banks. For the other samples, fixed effects regressions are implemented to insert individual specific effects in the models. To account for profitability persistence, we apply a dynamic panel model, using Generalized Methods of Moments (GMM). Estimation results show the evidence of positive and significant profitability persistence for medium sized bank. Finally, we find no real evidence of a positive relationship between greater efficiency and bank profitability. While capitalization levels increase bank profitability, liquidity risk depends on the size of the bank.

JEL Classification: G21;C23;L25

Keywords: bank profitability, panel data, bank capital, liquidity ratios, fixed effects model, dynamic panel.

Introduction

The European banking sector has experienced major transformations over the past decades of deregulation and the globalization of financial markets. Consequently, as a rational response to the financial sector liberalization, the banking system seems to have become a more concentrated sector. These developments have impacted profitability of banks in all countries. The increase of the ratio of credit to customer deposits for the benefit of external profits such as operations on securities was considered by analysts as an important criterion of banks' performance. The 2008 financial crisis implies that opportunities for banks to make profits are gradually reducing and banks have been exposed to a wide set of risks. So, the performance of banks has become a major concern for economics and policy makers due to the fact that the role of banks remains central in financing economic activities. Although the authorities have taken some measures (consolidation of banks, prudential guidelines…), to contribute of the stability of the system, the determinants of bank performance have attracted the interest of academic research as well as of bank management and supervisors.

The performance of banks can be affected by internal and external factors (Aburime, 2005, Sufian, 2011). The internal factors are individual bank characteristics which affect the bank's performance. Many studies have analyzed the relation to bank performances focused on sector-specific factors (Chantapong, 2005; Olweny & Shipho, 2011; Azam & Siddiqoui, 2012). In particular the impact of the size on the banking performances is widely discussed between researchers. Economic theory suggests that market structure affects firm performance since larger institutions could provide services at lower cost until diseconomies of scale set in. Literature has shown that the relationship between the bank size and profitability can be positive or negative (Staikouras & Wood, 2004; Athanasoglou et al., 2008; Dietrich & Wanzenried, 2010; Naceur & Omran, 2011).

The aim of the paper is precisely to reexamine the relationship between the performance and the size of banks to better understand their risk profile using bank specific indicators such as capital and liquidity risk ratios.

Indeed, from the 2008 financial crisis, solvability ratios have strongly increased on the requirement of the investors, but whereas equities contribute to absorb abnormal losses of banks, does a strengthening of their solvency ratios provide incentives in the risk taking of liquidity? The Basel III committee underlines the necessity of setting up new liquidity ratios requirements. Nevertheless, a question remains concerning the efficiency of this prudential mechanism, in particular the relation between bank capital and liquidity creation. In this study, we investigate the effects of bank capital and liquidity risk ratios on European banks' profitability for the recent period. The paper is structured as follows. Section 1 introduces methodology and data used in this study. Section 2 presents summary statistics. Estimations and results are given in the last section.

1. Data and Methodology

The data used in the empirical study is obtained from Bankscope, a regular financial database of Fitch, IBCA and Van Dijk desk. The sample includes annual financial data of 1270 European banks observed for the period of 2005 to 2012. The sample is divided into three panel data sets according to the total assets of the banks for 2012. The three panels involve 346, 487 and 835 retail banks such as commercial banks, cooperative banks and savings banks. Each panel represents respectively the large banks, the medium sized banks and the small banks of our whole sample.

The measure of performance used in the study is the return of assets. ROA is a ratio computed by dividing the net income over total assets. ROA has been used in most bank performance studies (for example Sufian, 2011). It measures the profit earned per Euro of assets and reflects how well bank management uses the banks' real investment resources to generate profits. This ratio does not take into account off balance sheet activities, nor the seasonal variations of assets during the year. To limit these effects, we use an adjusted ROA, the return on average assets (ROAA), thus accounting for changes in assets during a fiscal year.

Six bank characteristic indicators are used as internal determinants of performance. They comprise the total assets (TA), the ratio of equity to total assets (EQTA), the ratio of equity to total loans (EQNL), a credit risk ratio defined as net loans to total assets (NLTA), the liquidity risk defined as liquid assets to customer deposits and short term fundings (LA_Cust) and the ratio total loans to customer deposit total (TL_CDT).

In this study the following baseline model is used:

$$ROAA_{it} = c + \sum_{j=1}^{k} \beta_j X_{it}^{j} + \varepsilon_{it} \qquad (1)$$

where ROAA, the dependent variable is the performance of bank i at time t , i=1,….,n and t=2005,….,2012.

c is a constant term.

β_j the vector of coefficients, X_{it}^{j} the vector of explanatory variables.

ε_{it} the disturbance relative of bank i at time t. In equation (1), we suppose that: $\mathrm{E}(\varepsilon_{it}) = 0 \; \forall i, t$ and $\mathrm{E}(\varepsilon_{it})^2 = \sigma_{\varepsilon}^2$.

In this model common intercept is considered for all cross section subjects. Then, it supposes that there are no specific individual effects across banks. Coefficients are estimated by a pooled ordinary least squared regression model.

$$ROAA_{it} = \sum_{j=1}^{k} \beta_j X_{it}^{j} + \alpha_i + \mu_{it} \quad (2)$$

With α_i the unobserved bank specific effect and μ_{it} a disturbance effect independent across banks. In the second model, the individual specific effects α_i can explicitly take into account the individual heterogeneity.

Bank profits show a tendency to persist over time, reflecting impediments to market competition, informational opacity and/or sensitivity to macroeconomic shocks to the extent that these are serially correlated (Berger et al., 2000). Therefore, a third model adopts a dynamic specification of the model 2 by including a lagged dependent variable among the regression.

$$ROAA_{it} = \gamma ROA_{it-1} + \sum_{j=1}^{k} \beta_j X_{it}^{j} + \varepsilon_{it} \quad (3)$$

where $ROAA_{it-1}$ is the one-period lagged profitability, γ is defined as the speed of adjustment to equilibrium. A value of γ between 0 and 1 implies that profitability persists. A value of γ close to 0 means that the market is fairly competitive (high speed of adjustment). A value of γ close to 1 implies a less competitive structure (very slow adjustment).

Traditional least squared method of estimation is inconsistent for a dynamic panel data model with individual effects. The bias is caused by having to eliminate the unknown individual effects from each observation, which creates a correlation of order (1/T) between the explanatory variables and the residuals in the transformed model (see Baltagi, 2001). To avoid this bias, in this paper, we use the GMM method suggested by Arellano and Bond (1991).

2. Summary Statistics

Tables 1 report some descriptive statistics about the data set. The average value of ROAA varies greatly between the three samples, 0.53% for large banks, 0.36% for medium sized banks and 0.47% for small banks. For large banks, this result is not surprising due to their higher resource mobilization and aggressive strategy in deposit collection. This is consolidated by the average value of liquidity ratio LA_Cust, which is equal to 28.14; 19.09 and 19.93 for large, medium sized and small banks, respectively.

Regarding capital, large banks have a lower equity-to-asset ratio (7.01%) than the other samples. The figure is below the 8% supervision requirement for large banks whereas small banks are more capitalized.

Tables 1: General features of the data

1-1 Large banks (3 million<TA<2 billion)

Variables	Mean	Std. Dev	Median	Quartile 3
ROAA	0.53	1.92	0.34	0.69
TA	42434856.64	177710043.64	5795724.60	12954269.70
EQTA	7.01	3.66	6.32	8.21
EQNL	15.92	23.09	11.26	15.71
NLTA	57.24	20.09	61.73	72.16
LA_CUST	28.14	25.92	19.75	35.86
TL_CDT	121.03	83.69	100.59	140.84

1-2 Medium sized banks (1 million<TA<3 million)

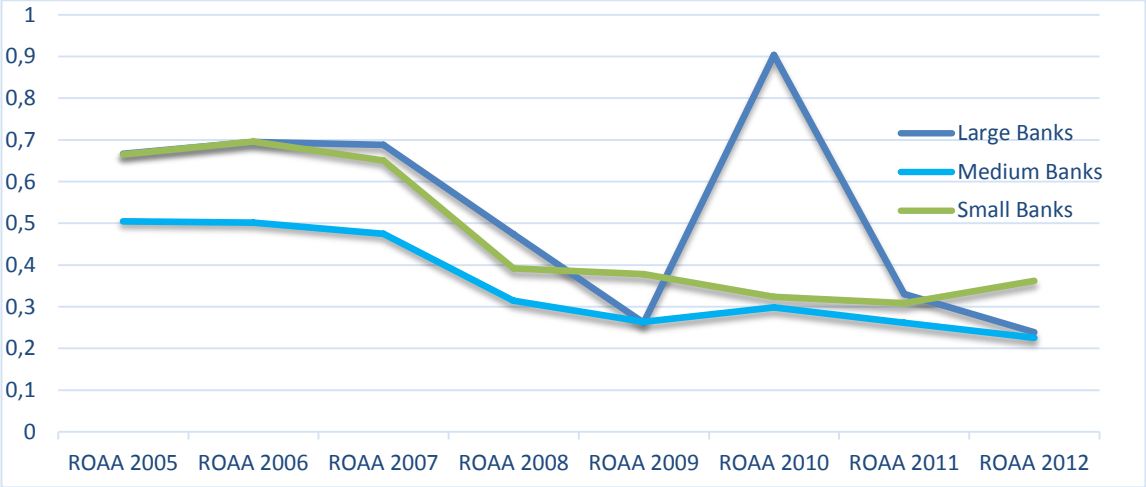
Variables	Mean	Std. Dev	Median	Quartile 3
ROAA	0.36	0.57	0.25	0.52
TA	1535234.26	622960.18	1421060.91	1866418.67
EQTA	7.51	3.66	6.65	8.47
EQNL	14.17	14.24	11.19	14.37
NLTA	60.76	15.70	62.05	71.45
LA_Cust	19.09	16.24	14.49	22.47
TL_CDT	103.34	60.28	88.53	119.29

1-3 Small banks (TA<1 million)

Variables	Mean	Std. Dev	Median	Quartile 3
ROAA	0.47	0.69	0.37	0.69
TA	331229.29	226655.59	280900.56	465650.00
EQTA	9.41	4.47	8.20	11.06
EQNL	17.77	22.92	13.49	18.71
NLTA	60.59	15.02	62.21	71.09
LA_Cust	19.93	17.18	15.84	22.85
TL_CDT	100.47	49.23	89.05	116.94

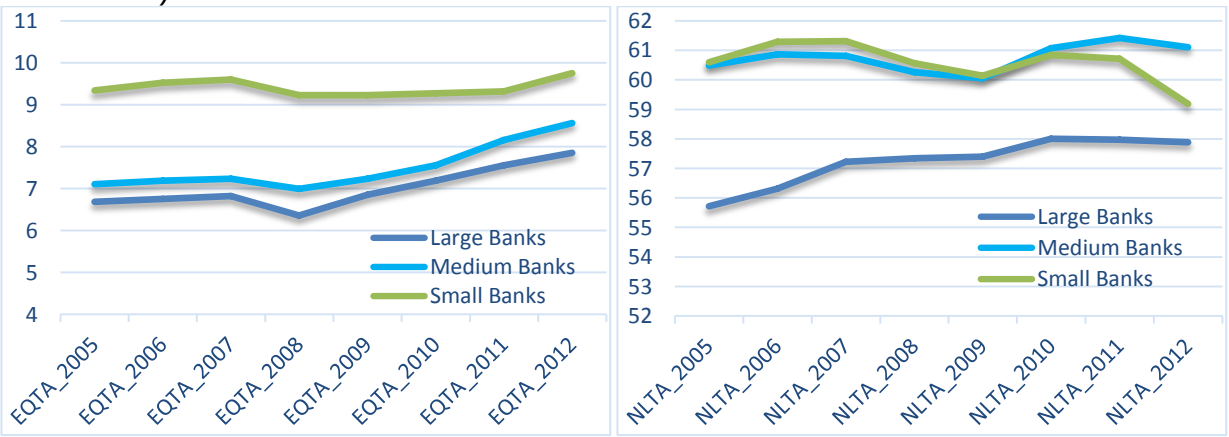
Figure 1 shows the return on average assets (ROAA) for the three samples of banks under the period of study.

Figure 1: Profitability Measures (ROAA)



As observed in Figure 1, for the whole period, lineal measures of ROAAs show a general negative trend. More precisely, for all samples, we observe an upward trend or a relative stability over the period 2005-2007, and then a sudden drop afterwards due to the worldwide financial crisis (2008-2009). In 2010, large banks on average recover from their loss and achieve the outstanding level of 0.9%. From 2011, however, the ratio falls below 2005 level for large banks while for the other samples, the profitability has stayed at a lower level of around 0.3% for medium sized banks and 0.4% for small banks. For 2012, we notice that small banks obtain the highest value of performance.

Figure 2: Capital adequacy (equity over total assets) and liquidity risk (total loans over total assets)



From Figure 2, we notice a low level of these ratios for the large banks compared to the other samples. However, both measures of capitalization and liquidity have increased after the 2008 crisis except for small banks for 2011 and 2012. In terms of the degree of capital adequacy, there is a downturn in this ratio in 2008 but a stiff recovery afterwards. With regards to the degree of loans over assets there is a slight drop to 2008 but a gradual increase soon after. These ratios suggest that despite world recession in 2008, the banking system has increased its capital level and has increased its overall loan levels during the period.
The next step of the study is to see whether bank specific indicators as capital and liquidity ratios have the same impact on profitability of banks according the size of institutions. For that, regression analyses are implemented in the next section.

3. Estimation Results

The first thing to do before deciding to choose between different panel data models is to test the presence of individual effects which may impact profitability.
To test the existence of fixed effects, we use a Fisher test comparing the pooled cross-sectional results with the results from the within estimation model. In this test, the pooled cross-sectional model is the restricted model and the null hypothesis is the absence of fixed effects. The p-value is superior to 5% for large banks, which leads us to use equation 1 for estimating the profitability measure. For the others samples, the Fisher test validates the presence of individual effects (see table 2).

Table 2: test for individual effects

Large Banks	Medium banks	Small banks
0.77 (p-value=0.99)	3.88 (p-value=0.00)	1.77 (p-value=0.00)

To choose between a fixed effects and a random effects model, we perform a Hausman test which tests the null hypothesis of an absence of correlation between the individual specific effects and the regressors (see table 3).

Table 3: Hausman test

Medium banks	Small banks
1777.49 p-value =0.00	150.83 p-value = 0.00

We conclude that fixed effects models seem to be more appropriate. The next step is to implement a dynamic model, to see whether the inclusion of a lagged dependent variable

in the explicative variables increases or not the power of our models and modifies the results. The lagged dependent variable is significant only for medium sized banks, which tends to confirm the use of a dynamic model for this sample (see table 4, for medium sized banks).

Estimation results are given in Table 4 for large, medium sized and small banks respectively.

One of the tables reports the GMM estimation for the profitability determinants during 2005-2012 for medium sized banks. The Sargan test shows no evidence of over-identifying restrictions and the Arellano-Bond test does not reject the null hypothesis of rejecting autocorrelation. The statistical significance of the lagged dependent variable shows the tendency of medium sized bank profits to persist over time. The coefficient value is 0.48 which means that the market is rather competitive.

The coefficient of the capital variable (*EQTA*) is positive and significant at 1% for all samples over the period 2005-2012. Indeed, during the period, high EQTA is a signal of less risky institutions. Moreover, well capitalized banks may access to cheaper and less risky sources of funds and better quality asset markets. This may create a security signal involving a positive association between *EQTA* and *ROAA*.

However, the risk management of banks depends on the management of liquidity. We observe that the effect of liquidity ratios on ROAA vary greatly according the size of institutions.

Credit risk (*TL_CDT*) is negatively related to bank profitability (significant at 5%) for large banks. This ratio shows the relationship between comparatively stable funding sources (i.e. deposits and other short term funding) and comparatively illiquid assets (i.e. loans), indicating a negative relationship between bank profitability and the level of liquid assets held by the bank. Indeed, total loans are associated with decreased large bank profitability and, hence higher provisions usually indicate higher probability of non-performing ratios and lower asset quality. Then, higher liquidity would be associated with lower profitability for these banks. This explains why large banks suffer from the lack of provisions to cover expected credit losses over the crisis period (2008-2009). After the crisis the ratio declines but without reaching the 100% level as for the other samples.

Referring to liquidity risk (LA_Cust), the ratio is statistically significant at 1 % and positively related to the profitability for small banks. One reason is that on average small banks have less demand deposits relative than large and medium banks. As a result, large banks should not need to rely on liquid assets to meet liquidity needs as much as smaller ones. Furthermore, large banks have better access to external funds. The positive correlation between size and demand deposits can also explain why on average

small banks have higher ratios of capitalization than large and medium banks (figure 2). For these banks capitalization seems to be positively related to liquidity.

Tables 4: Estimation results of ROAA

Large banks

Variables	coefficient	t-stat
c	-0.6411	-1.8530 (.)
TA	2.99E-10	0.7635
EQTA	0.2457	11.9951 (***)
EQNL	0.000134	0.0409
NLTA	-0.0067	-1.2431
LA_Cust	0.00395	1.1169
TL_CDT	-0.00242	-2.5979(**)
F-statistic	30.54	
Prob(F-statistic)	0,00000	
serial correlation test *	chisq =14.027	p-value: 0.08

***** Breusch-Godfrey-Wooldridge test

Medium sized banks

Variables	coefficient	z-value
ROA_{t-1}	0.4886	5.7692 (***)
TA	1.7158E-07	1.6070
EQTA	0.09732	2.6052 (**)
EQNL	-0.000087	-0.3041
NLTA	7.1790e-04	0.1087
LA_Cust	-0.001017	-0.3755
TL_CDT	-0.00134	-1.1719
Sargan Test	Chisq (20)=29,69	p.value=0.075
AR(1) Test	-4.31	p.value=7.96e-06
AR(2) Test	0.65	p.value=0.26

Small banks

Variables	Coefficient	t-value
TA	-5.9873e-07	-4.7425 (***)
EQTA	0.1011	15.4905 (***)
EQNL	3.6709e-03	5.5178 (***)
NLTA	2.8862e-03	1.3559
LA_Cust	3.5471e-03	3.9271 (***)
TL_CDT	-8.5907e-04	-1.3994
F-statistic	40.9748	
Prob(F-statistic)	0.00000	

4. Conclusion

This paper investigates the effects of capital and liquidity ratios on banks' profitability according to their size. The results confirm some previous findings that the bank capital has a significant and positive effect on bank profitability during the period, but the effect of liquidity ratios on ROAA vary greatly according the size of institutions. Large banks are the primary contributors to liquidity creation; however, higher liquidity measured in the paper by a credit risk ratio is associated with lower profitability for large banks while for smaller ones, there is a positive relationship between liquidity and profitability. A handful of recent papers have analyzed the impact of capital on liquidity creation and have shown a negative and bi-causal relation between the two indicators (see for example Horváth R., Seidle J., and Laurent Weill 2012). In our paper, the results indicate that improved bank capital in order to increase liquidity seems to be size dependent of the institutions. More research could be done on the differences between small and large banks. Indeed, finding significant differences in their behaviour have important implications for the regulation of banks.

References:

Azam M., Siddiqoui S. (2012): Domestic and Foreign Banks' Profitability: Differences and Their determinants. International Journal of Economics and Financial Issues 2(1), 33-40

Aburime U. (2005) Determinants of Bank Profitability: Company-Level Evidence from Nigeria: University of Nigeria, Enugu Campus.

Arellano M., Bond S.R (1991): Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies 58, 277–297.

Baltagi B.H (2001): Econometric Analysis of Panel Data, 2nd ed. John Wiley & Sons, Chichester.

Berger A., S. D. Bonime, D.M Covitz & D. Hancock (2000): "Why Are Bank Profits So Persistent? The Roles of Product Market Competition, Informational Opacity, and Regional/Macroeconomic Shocks." Journal of Banking and Finance Vol. 24, No. 7,1203-1235.

Chantapong S (2005): Comparative Study of Domestic and Foreign Bank Performance in Thailand: The Regression Analysis. The Office of Macroeconomic Policy and Analysis, Monetary Policy Group (MPG), the Central Bank of Thailand, Bangkhunprom,

Dietrich A., Wanzenried G.(2010): "Determinants of Bank Profitability before and during the Crisis: Evidence from Switzerland."Journal of International Financial Markets, Institutions and Money Vol. 21, No.3, 307-327

Horváth R., Seidle J., and Laurent Weill (2012): "Bank Capital and Liquidity Creation: Granger Causality Evidence", Institute for East and Southeast European Studies, 318,

Naceur S. B. ,Omran M. (2011): "The Effects of Bank Regulations, Competition and Financial Reforms on Mena Banks' Profitability." Emerging Markets Review, 12 ,1-20

Olweny, T., Shipho, T.M. (2011) Effects of Banking Sectoral Factors on the Profitability of Commercial Banks in Kenya. Economics and Finance Review, 1(5), 1-30.

Athanasoglou Panayiotis P., Brissimis Sophocles N., Delis Matthaios D. (2008) "Bank-specific, industry-specific and macroeconomic determinants of bank profitability" Journal of International Financial Markets, Institutions and Money 18 (2008), 121–136

Sufian F. (2011): "Profitability of the Korean Banking Sector: Panel Evidence on Bank-Specific and Macroeconomic Determinants." Journal of Economics and Management Vol. 7, No. 1, 43-72.

Staikouras C., Wood G. (2004): "The Determinants of European Bank Profitability." International Business and Economics Research Journal Vol. 3, No. 6, 57-68.