Determinants of the Profitability of the US Banking Industry*

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Abstract

This paper seeks to examine the determinants of the profitability of the US banks during the period 1995-2007. The empirical analysis combines bank specific (endogenous) and macroeconomic (exogenous) variables through the GMM system estimator. The empirical findings document a negative link between the capital ratio and the profitability, which supports the notion that banks are operating over-cautiously and ignoring potentially profitable trading opportunities. Additionally, they point to a non-monotonic relationship between the capital ratio and profitability, supporting the efficiency-risk and franchise-value hypotheses. The analysis also records that economies of scale do not occur if one takes into consideration the size of the bank.

Key words: Bank profitability, panel data, capital ratio

1. Introduction

The main role of a financial system is to lubricate the gears facilitating the economic operations. The banking system plays a major role in transferring funds from the saving units to the investing units. If a financial system is efficient, it should show improvements in profitability, increasing the volume of funds flowing from saver to borrowers, and better quality services for consumers. The financial intermediation provided by the banking sector supports economic acceleration by converting deposits into productive investments (Levine et al., 2000). During the last few decades, advances in technologies have allowed the banking sector to take advantage of this, showing a worldwide improvement in its profitability not only in bank-oriented countries like those in Eastern and Central Europe (Athanasoglou et al., 2006, Sufian and Habibullah, 2009), but also in market-oriented countries like the US (Berger, 1995b, Berger and Bonaccorsi di Patti, 2006, Zhang et al., 2006). Both intrinsic and exogenous determinants have affected the profitability and earnings in the banks (Athanasoglou et al., 2008, Ramlall, 2009, Sufian and Habibullah, 2009).

One of the main determinants of a bank's profitability is its capital structure. In this respect, the empirical literature devoted to the analysis of a bank's profitability has mostly focused on a monotonic linear relationship between the bank's capital structure and its performance (Chaudhry et al., 1995, Goddard et al., 2004, Molyneux and Thornton, 1992). Despite the important empirical findings of these researches, it appears that there are some issues that have not been addressed properly in the study of profitability in the banking sector. On the one hand, the capital-earning relationship in the banking industry may also be non-monotonic; whilst on the other hand the determinants of the profitability might have a wider dimension, considering not only the afore-mentioned internal determinants but also the external determinants of the bank's profitability. Additionally, and no less importantly, the econometric analysis in most empirical literature does not take into consideration the classical problems of endogeneity or simultaneity, and unobservable heterogeneity of the data, which are so common in studies of managerial decisions (Arellano and Bover, 1990).

Furthermore, regulators and supervisory entities that set minimums for equity capital, and establish other types of regulations in order to deter excessive risk taking, can affect the bank's capital structure decisions, and hence its earnings. The regulators establish the conditions of entry to the banking industry, the compliance with the capital ratios and liquidity rules, the enforcement of the larger exposure rules in the foreign exchange market, and the right of inspection (Valdez, 2007). For some countries, the regulatory framework is very complex. In the case of the USA, the role played by the Federal Reserve, individual states, the Federal Deposit Insurance Corporation (FDIC) and the Controller of the Currency and the Saving and Loan Associations, reporting to the Federal Home Loan Bank System, represents a complex and mixed mechanism of control on the banking industry,

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which will determine, at least to some extent, both the capital structure's decision making process of banks and their profitability.[1] Moreover, in a world of global financial systems in which foreign bank involvement in domestic banking markets has increased, thereby intensifying competition and reducing margins, the analysis of a bank's profitability becomes a particularly exciting phenomenon to study.

This paper will examine the determinants of the US banks' profitability, using a dynamic panel model over the period 1995-2007 for 11,777 banks.[2] To do so, the analysis focuses on the internal and external determinants of bank profitability (Rasiah, 2010), applying a suitable methodology to control the endogeneity –simultaneity– and the unobservable heterogeneity problems. The main findings show a non-monotonic U-shaped relationship between profitability and the capital ratio for the US banking industry. They also show diseconomies of scale in terms of the profitability and the size of the bank. Finally, the external factors are also statistically significant in determining the profitability of the banks in the sample.

The organisation of the rest of the paper is as follows: Section 2 reviews the theoretical and empirical arguments about the hypothesis of earning-capital relationship and the hypotheses regarding other typical determinants of a bank's profitability. Section 3 describes the empirical model and variables. Section 4 presents the methodology and sample we used for the estimations. Section 5 contains the interpretation of the results, while section 6 summarizes the conclusions.

2. Theoretical and empirical arguments

2.1 Hypotheses about the profitability-capital relationship

Let us consider the assumption of perfect capital markets according to Modigliani and Miller (1958); that is, value-maximization behaviour, no frictions –bankruptcy costs, taxes, or barriers to entry to the market, distribution of perfect information is asymmetrical – and no deposit insurance. In this model, market and book rates of return are identical. Here, an increase in equity by substituting additional equity for debt reduces the risk of both securities, and therefore lowers the market's required rate of return by both, as long as investors are risk averse and cannot completely diversify away the bank's risk. So, in this situation we can expect a negative relationship between the bank's profitability and capital ratio.

However, when market imperfections arise, the previously described relationship might also be direct. Bourke (1989) reports that capital ratios are positively related to profitability under the assumption that well capitalized banks may enjoy access to cheaper and less risky sources of funds and better quality asset markets. Moreover, Berger (1995b) argues that there are two potential explanations for a positive relationship between the bank's profits and the capital ratio. On the one hand, the expected bankruptcy costs hypothesis, according to which the greater the exogenous factors increasing its expected bankruptcy costs, the higher the optimal capital ratio for a bank will be. The definition of the bankruptcy costs is the likelihood of bank failure times the deadweight liquidation costs which creditors must absorb in the event of failure. When expected bankruptcy costs increase because of environmental changes that increase the probability of bank failure or increase the liquidation costs per failure, the optimal capital ratio increases in order to reduce the probability of failure and thereby lower the expected value of bankruptcy costs.

On the other hand, the signalling hypothesis can serve to explain the positive relationship between capital ratio and earnings. Here, the symmetric information assumption is relaxed, allowing managers to have private information about the future stream of cash flows. Therefore, managers might be willing to signal this information through capital decisions (Myers and Majluf, 1984). As a result, a signalling equilibrium may exist, in which banks that expect to have improved future performance have higher capital. Bourke (1989) tests this hypothesis in his work for European, Australian and North American banks, finding empirical support for this positive relationship between capital and profitability. In principle, a bank's capacity to absorb unexpected losses determines its level of risk. Several ratios commonly provide a proxy for risk, including the equity-asset (capital) ratio (Goddard et al., 2004). In theory, an excessively high capital ratio could denote that a bank is operating conservatively and ignoring potentially profitable investment opportunities.

[1] For a further explanation about the role of banks as financial intermediaries see Pringle (1975) and Demirgüç-Kunt and Levine (1996).

[2] This work considers the profitability efficiency only –profit generating evaluation. For the analysis of marketability efficiency of banks –based on the real value of a bank defined by the current stock market, see Luo (2003).

High levels of capital imply that the bank is unlikely to earn high profits, but is also less liable to risk; therefore shareholders should be willing to accept a lower return on equity.

In Granger-causality tests, Berger (1995b) finds a positive relationship between the capital ratio and the return on equity. Berger bases his argument supporting this relationship on the expected bankruptcy costs, which may be relatively high for a bank maintaining capital ratios below its equilibrium values. A subsequent increase in capital ratio should lead to an increase in the return on equity by lowering insurance expenses on uninsured debt.

As Jensen and Meckling (1976) point out, the effect of leverage on total agency costs is likely to be non-monotonic. At low levels of leverage (high capital ratio), increases of debt will motivate managers to reduce the agency cost of debt, and therefore, increase the profitability. However, at some point where bankruptcy and financial distress become more likely, the asymmetric problems and agency costs of debt will exceed the agency costs of equity, so further increases in leverage (lower capital ratio) will result in higher total agency costs and thus in lower profitability.

In the same vein, Berger and Bonaccorsi di Patti (2006) explain the possible reverse causation from performance to capital structure, basing it on two arguments. Firstly, they support this issue under the efficiency-risk hypothesis, where more efficient firms tend to choose relatively low equity ratios, as higher expected returns from the greater profit efficiency substitute equity capital to some degree, in terms of protecting the firms against financial distress, bankruptcy, or liquidation. Secondly, they refer to the franchise-value hypothesis, where more efficient firms tend to choose relatively high equity ratios to protect the future income derived from high profit efficiency. Therefore, in line with the previous arguments, a non-monotonic linear relationship between profitability and capital ratio seems likely.

2.2 Hypotheses regarding the other determinants of bank profitability

Banking literature acknowledges several other determinants of bank profitability, such as the bank's size. According to Goddard et al. (2004), scale economies are evident at low asset size levels but become exhausted as size increases. In this case, the bank's size can account for existing economies, or diseconomies, of scale. Berger and Humphrey (1997) argue that, on average, large banks are more efficient than small banks, but it is less clear whether large banks benefit significantly from scale economies. Profitability is more likely to improve by emulating industry best practice in terms of technology and management structure than by increasing the size per se. In this aspect, the empirical literature has not produced conclusive findings for the bank's size variable. For instance, Akhavein, Swamy, and Taubman (1997) and Smirlock (1985) find a positive relationship between size and bank profitability. Demirgüç-Kunt and Maksimovic (1998) suggest that the extent to which various financial and legal factors, among others, affect bank profitability is closely linked to the bank's size.

In addition, Short (1979) argues that size affects the capital adequacy of banks, since relatively large banks tend to raise less expensive capital and hence appear more profitable. However, other empirical works suggest that little cost saving can result from increasing the size of banks (Berger and Humphrey, 1997), which suggests that eventually very large banks could face scale inefficiencies. For instance, Goddard et al. (2004) suggest that the relationship between the relative size of a bank's off-balance sheet portfolio and its profitability is positive for the UK, but negative for other European countries like Germany and Spain. Naceur and Goaied (2008) examine the impact of bank characteristics, financial structure, and macroeconomic conditions on Tunisian banks' net-interest margin and profitability during the period of 1980 to 2000. They suggest that banks that hold a relatively high amount of capital and higher overhead expenses tend to exhibit higher net-interest margin and profitability levels, while size has a negative relation to bank profitability. Thus, the relationship between size and profitability for US banks can be positive or negative, depending on their scale efficiencies or inefficiencies due to bureaucracy and related factors.

Another branch of research about the determinants of profitability refers to the market-power (MP) and efficient-structure (ES) hypotheses. The market-power hypothesis, also known as the structure-conduct-performance (SCP) hypothesis, states that there is a positive relationship between banking concentration and performance, because increased market-power yields monopolistic profits (Bourke, 1989, Hannan, 1979, Molyneux and Thornton, 1992). The collusion hypothesis also supports a positive relationship between banking concentration and profitability. According to this hypothesis, a small number of banks may be able to collude, either implicitly or explicitly. This cartel would lead to more expensive loans, and lower interest rates on deposits for individual investors.

However, if the number of banks is large, the collusion is more difficult to carry out (Goddard et al., 2004). The efficient-structure (ES) hypothesis says that firms (banks) with superior management or production technologies have lower costs and therefore higher profits. These firms are also assumed to gain large market shares, which may result in high levels of concentration, basically because highly concentrated markets will lower the cost of collusion and foster tacit and/or explicit collusion (Demsetz, 1973, Smirlock, 1985). Consequently, collusion has a positive effect on profitability.

Finally, credit risk is another variable which can explain banking profitability. In this respect, the financial institutions as a whole are more vulnerable to high-risk credit than non-financial institutions. Issues related to high-risk loans, such as the accumulation of unpaid loans, imply that these loan losses have produced lower returns (Bourke, 1989). Additionally, Miller and Noulas (1997) also state a negative relationship between credit risk and profitability. This negative relationship indicates that higher risk associated with loans makes the level of loan loss provisions higher, which thereby makes it more difficult for a bank to follow the profit-maximization rule. In consequence, it is valid to expect that the higher the credit risk, the lower the profitability.

3 Model and Variables

The test of the previous hypotheses uses the following econometric model:

$$EFCROE_{it} = f(CAP_{it}, Z_{it},) + e_{it} \quad (1)$$

The dependent variable is the efficiency in the return on equity (EFCROE), which is determined by the capital ratio (CAP),[3] appearing here as the equity capital over total assets for the bank i during the period t; the vector Z, which includes the other independent variables, and e_{it} is the stochastic error term. Following previous literature, vector Z in the model consists of a set of other variables/characteristics that are likely to influence profit efficiency (Smirlock, 1985). These variables are: bank size, market concentration, loan capacity, demand for deposits, interest expenses, investment in securities, the bank's risk, plus a series of control variables like the USA Federal Reserve Bank Discount Rate, the NASDAQ Bank Index and the bank's reputation.

Bank size is measured as the natural logarithm of total assets (SIZE). The contradictory findings about the relationship between the size of the banks and their profitability leave the door open to a positive or negative relation for these variables. The market concentration determines the bank's performance through exercising its market power (Delis et al., 2008, Fred and Lee, 1973). Two measures exist for market concentration: the Herfindahl index of market concentration (HERF) and the bank's share of market deposit per year and per state (SHAREDEPOSIT). In each case, these measures serve as a proxy for the degree of monopoly, which may produce an increase in the cost of intermediation and in the bank's profits. As mentioned previously, these variables and EFCROE may have a positive relationship. The business capacity of the bank depends on the loans. This capacity (LOAN) relates to the total gross loans and leases over total assets.

A positive relation between LOAN and EFCROE is expected. The demand for deposits is equal to the total deposit over total assets (DEP), which represents the market profit opportunities (Berger, 1995b, Berger, 1995a, Berger and Bonaccorsi di Patti, 2006, Goddard et al., 2004). The demand for deposits is a primary source of agency problems due to the insurance protections given by the government (Berger, 1995b). In this case, one can expect a negative relationship between this variable and the bank's profitability. The analysis measured interest expenses (INTEXP) as the interest expenses divided by the amount of equity. An increase in interest expenses leads to lower profitability. The interest expense might also be called the cost of efficiency. To offset this effect, banks would charge a higher cost of intermediation and, in consequence, the aforementioned relationship could be positive if the bank is efficient enough and able to take advantage of a higher interest expense.

Besides, the investment in securities (SEC) should have a positive relationship to the bank's performance. This variable is measured as the investment in security at market value over total assets. To measure the bank's risk (SEFCROE), the analysis uses the standard deviation of return on equity over the time span. Additionally, it integrated a number of other financial indicators to check for the effect of external factors on the cost of intermediation and operational performance of US banks. For instance, the USA Federal Reserve Bank Discount Rate (RATE) appears as an external determinant for the cost of intermediation.

[3] The use of CAP as an inverse measure of leverage is standard in banking research, in part because of the regulatory attention paid to capital ratios.

Considering that RATE is the rate that the Federal Reserve charges to banks for their loans, an indirect relation between RATE and EFCROE is predictable. The NASDAQ Bank Index may be considered as a rational measure of the banking industry performance as a whole; the natural logarithm of this index (LNASDAQ) has been computed because it is the usual transformation whenever the variable takes on non-negative values and has a great variance. The same transformation takes place for the proxies used for the bank's size and reputation – described hereafter. Reputation is also a positive determinant of the bank performance; the proxy for reputation is the natural logarithm of the number of years since the foundation of the bank (LLIFE). There is a direct link between this indicator and EFCROE. Bank profits show a tendency to persist over time (Berger and Bonaccorsi di Patti, 2006). This persistence can be the result of the market competition barriers, banks' regulatory capital ratios, informational opacity and/or sensitivity to external shocks, to the extent that there is a serial correlation between them (Goddard et al., 2004, Memmel and Raupach, 2010). The aforementioned arguments support the application of a dynamic model about the banking profitability. For doing so, we must consider the dependent variable, delayed for one period, as one more determinant of the bank's profitability on the right hand side of the equation (1).

4 Methodology

4.1 Panel data

The use of panel data is the most suitable tool when the sample comprises cross-sectional and time-series data. In this case, the main advantage of using panel data is that it allows overcoming of the unobservable, constant, and heterogeneous characteristics of each bank included in the sample. However, the methodology has to address the classic problem of endogeneity in this kind of study, since the dependent variable (EFROE) might determine some variables on the right side of the model simultaneously (e.g. CAP). Baltagi (1995), and López (2005), for instance, account for the easy control of the individual heterogeneity of the observations by using panel data. The use of panel data brings up another set of advantages in the estimation, namely the better identification and measure of those effects which are not observable either with cross-sectional or time-series analysis (López, 2005, Himmelberg et al., 1999).

The endogeneity problem of the independent variable (CAP), makes the use of instrumental variables necessary.[4] The usual approach today when facing endogeneity of unknown forms is to use the Generalized Method of Moments (GMM) (Baum and Schaffer, 2003, Annacker and Hildebrandt, 2004). Since GMM considers the unobserved effect by transforming the variables into first differences, this technique is an efficient tool for dealing with endogeneity problems. When the unobserved effect correlates with the independent variables, pooled OLS regression produces estimations that are biased and inconsistent. This problem can be offset by using the first difference or the fixed effect (with-in) estimators (Hansen, 1982). Nevertheless, whether the strict exogeneity of the independent variables' condition fails or not, either the first difference or the fixed effect estimators are inconsistent and have different probability limits. The general approach in this case is to use a transformation to eliminate the unobservable effects and instruments to deal with the endogeneity (Nickell, 1981). Therefore, the best method is to use the two-step system estimator (SE) with adjusted standard errors for potential heteroskedasticity (Blundell and Bond, 1998, Blundell et al., 2000). The Hansen/Sargan tests asess the model specification validity (Hansen, 1996). This test examines the lack of correlation between the instruments and the error term. The AR1 and AR2 statistics measure the first and second serial correlation, respectively. The Wald test of joint significance is also used to asses the significance of all the independent variables in the sample.

4.2 Sample

Tests on the hypotheses used information on 11,777 US banks from 1995 through 2007, with a total of 108,439 bank-year observations. The source of information is twofold. On the one hand, the source is the individual balance sheets and income statements from BANK REGULATORY database managed by COMPUSTAT; and on the other hand it is the GLOBAL FINANCIAL DATA, basically for forming the control variables already defined. The descriptive statistics of the variables appear in Table 1, Panel A. The endogenous variables are EFCROE, CAP, and CAP2. Table 1 Panel B shows the mean values for EFCROE and CAP over the years, indicating that the capital ratio (CAP) is very steady over time. However, profitability shows an almost constant growth rate from 1995 until 2006, and in 2007 there is a contraction of two percentage points.

[4] Athanasoglou et al. (2008) suggest that capital ratio is better modelled as an endogenous determinant of bank profitability in econometrical models.

As previously mentioned, the banks' profit is persistent over time, and this persistence is the consequence of certain barriers, informational opacity and the reaction to external shocks (Levine et al., 2000). An important factor here is the banks' extensive use of off-balance sheet operations in the run-up to the sub-prime bubble, leading to the 2007- present day economic recession.

5 Results

5.1 Descriptive analysis

Table 1, Panel A, displays the descriptive statistics of the variables in this study. The results show that a typical bank returns 20 cent of net income for each dollar of equity. Banking is an industry with high leverage, on average. For instance, the average CAP ratio is 11.56%; or in other words, the leverage ratio is about 88.44% of total assets. This result is comparable with the bank's mean leverage for EU banks of 92.60% (Gropp and Heider, 2009). The total loans and leases represent 61.06% of the total assets and the total deposits reach 82.16% of the total bank assets.

Insert Table 1 here

The size of the bank exhibits considerable heterogeneity in the cross-section, and almost the same happens with the reputation of the bank, measured as the natural logarithm of the years since the bank's foundation. The Herfindhal index reveals that the market concentration is not very great in the banking industry, considering each state in the US individually. This result is also evident in the banks' share of market deposits, with an average of 0.67%, which means that the market power and the monopoly forces are weak relative to other industries. The matrix of correlation coefficients (table 2) exhibits a negative and statistically significant correlation between the profitability (EFCROE) and the capital ratio (CAP); the total loans and leases (LOAN); the discount rate (RATE); the investment in securities (SEC); share deposits (SHAREDEPOSIT); and the size of the bank (SIZE). However, the relation with the deposits (DEP); the interest expenses (INTEXP); the bank risk (SEFCROE); with the Nasdaq Bank Index (LNASDAQ); and with the proxy for reputation (LLIFE), is positive and significant.

Insert Table 2 here

5.2 Explanatory analysis

This part of the analysis focuses on the relationship between efficiency in the return on equity and its determinants controlling the unobservable heterogeneity, assuming the firms' fixed effects (table 3); and then accounting for the heterogeneity and endogeneity (or simultaneity) problems by means of the GMM two-step system estimator (table 4). Each table reports the estimated coefficients, whether they are statistically significant (p-value) or not; the Wald test of the joint significance of the model; the first and second-order serial correlation tests (AR1 and AR2 for table 4 only); and the Hansen/Sargan test of validity of the instrument (for table 4 only). In the case of the GMM two-step system estimator models, the validity of the instruments is positive and both the absence of second-order serial correlation and the validity of the instruments used to avoid the simultaneity problem are clear.

The simple causality regression with EFCROE as a dependent variable and CAP as an independent variable appears in column 1 of tables 3, 4, and 5 (the non-monotonic relationship between those variables appears later). A negative and statistically significant relationship exists between EFCROE and CAP (Tables 3, 4, and 5). This result suggests that a higher capital ratio leads to or predicts lower profitability. The traditionally tested signalling hypothesis suggests that as the information between managers and investors has an asymmetrical distribution, it can be less costly for managers of low risk banks to signal the bank's quality through high capital ratios than for managers of high risk banks. This hypothesis suggests a positive relationship between capital-asset ratio and the bank's profitability. Nevertheless, there is another theory which supports the contrary relationship: the efficiency-risk hypothesis. The results, *a priori*, seem to support these alternative hypotheses about the profit-capital relationship for the American banking industry. The efficiency-risk hypothesis suggests that more efficient banks tend to choose low capital ratios, as higher expected returns from the greater profit efficiency substitute for equity capital to a certain extent by protecting the banks against distress, default risk, or liquidation (Athanasoglou et al., 2008).

Insert Table 3 here

Insert Table 4 here

Insert Table 5 here

Besides the previous finding, the non-monotonic relationship between profitability and the capital ratio can be analysed considering the quadratic form, as in the second columns in Tables 3, 4, and 5. The efficiency-risk hypothesis and the franchise-value hypothesis support this quadratic framework. The franchise-value hypothesis argue that more efficient firms tend to choose relatively high equity ratios to protect the future income derived from high profit efficiency; while the efficiency-risk hypothesis suggests the opposite relationship. According to Athanasoglou et al. (2008) the impact of equity capital on bank profitability is ambiguous. This argument claims that lower capital ratios imply a relatively risky position, which leads to the indication of a negative relationship between capital ratios and profitability (Athanasoglou et al., 2008). However, it could be the case that higher levels of equity would decrease the cost of capital, leading to a positive impact on profitability (Berger, 1995a). Consideration of these arguments led to a study of this quadratic –non-monotonic– relation. The results do suggest a U-shaped relationship between EFCROE and CAP in the fixed effect (with-in) estimation, the GMM system estimator, and the OLS pooled estimation (tables 3, 4, and 5). Just considering the regression results from the GMM system estimator, which overcome the problems of endogeneity and constant heterogeneity, the return on equity drops whenever the capital asset ratio increases up to a level of 41.35%.[5]

At this level of capital asset ratio the average return on equity is about 3.35%. The interpretation of this result is that when the CAP ratio grows to 41.35%, profitability decreases to 3.35%, and beyond this threshold, profitability increases. The bankruptcy costs argument also supports the existence of this relationship. In this case, the expected bankruptcy costs might be relatively high for a bank maintaining capital ratios below its equilibrium value (Goddard et al., 2004). Consequently, a subsequent increase in capital ratios –a decrease in debt ratios– should lead to an increase in the return on equity by lowering insurance expenses on uninsured debt.

The previous result is consistent even in a dynamic model. The third column of each of Tables 3, 4, and 5 shows the same relationship as discussed previously, but this time considering the dependent variable, delayed by a one year period, $EFCROE_{t-1}$. The tables show that the coefficient for $EFCROE_{t-1}$ is positive and statistically significant in each regression. The economic extent to which this variable determines the return on equity in the current period $EFCROE_t$ is really high. Depending on the kind of regression (OLS, with-in estimation, or GMM system estimator) this coefficient ranges from 0.62 (in the with-in estimation) to 0.95 (in the GMM system estimator). This result in the dynamic model suggests that there is still significant persistence of profit from one year to the next. In other words, if a bank earns an abnormal profit in the current year, its expected profit for the following year should include a sizeable proportion of the current year's abnormal profit. Although competition is eventually effective in eliminating abnormal profit in this kind of industry, the adjustments are by no means instantaneous. This result is comparable to the one Goddard et al. (2004) estimated for developed economies.

There is a statistically significant negative relationship between the size of the bank and its profitability in the pooled, fixed effect, and in the system estimator regressions (see Tables 3, 4, and 5). A bank can take advantage of the scale economies at a low asset size level, but these scale economies become exhausted as the bank's size increases. As the tables illustrate, the empirical results for US banks show diseconomies of scale, because the larger the bank, the lower its profitability. Following Berger and Humphrey (1997), the profitability is more likely to improve by emulating the best practices in the banking industry - for instance, applying a new technology - than by increasing the size per se. These arguments support the negative relationship found.

The Herfindahl index (HERF) and the bank's share of market deposit (DEP) have acted as proxies for market concentration (market power). Both measures have a positive and statistically significant relationship with the return on equity. This result implies a direct relationship between the cost of intermediation and the bank's profit. Both the market-power hypothesis and the efficient-structure hypothesis support this argument. According to the market-power hypothesis, an increase in the market power yields monopolistic profits. The collusion hypothesis, whereby banks can collude either implicitly or explicitly to gain abnormal profits, supports the same conclusion. The results are consistent when using the share deposit variable.

[5] The capital ratio (CAP) at which the return on equity (EFCROE) falls is calculated as follows. The coefficients in the second column in table 4 report the following equation $EFCROE = 0{,}2843 - 1{,}2132 \cdot CAP + 1{,}4669 \cdot CAP^2$; then computing the first derived $\partial EFCROE / \partial CAP = 0$; and then solving for CAP it is obtained $CAP = 0{,}4135$.

However, when taking into account the fixed effect model in Table 4, the coefficient of HERF variable is negative; while the coefficient of share deposit is still positive. Nevertheless, the results in table 5 show that share deposit is positive and statistically significant too, but the HERF variable is not significant. Moreover, the share deposit variable seems to be even more significant than the Herfindahl index both in its economic extent –its coefficient is higher than for the HERF variable– and statistically. Thus, the results are robust both on measuring the market concentration and on reducing the endogeneity and heterogeneity problems (table 4). The business capacity of the bank appears as the total gross loans and leases, divided by total assets: LOAN. The interpretation of this variable is conflicting because in both the pooled and the fixed effect models the variable is negative and significant. However, in the GMM system estimator model the relationship of loan capacity and profitability is positive and statistically significant. Notwithstanding these results, the estimations in table 4 are the most consistent and the least biased, due to the proper approach to the endogeneity and heterogeneity problems. Thus, the business capacity of a bank has a positive relationship to its loans in the markets.

In contrast to the expected results, the demand for deposits (DEP) has a negative relationship with the bank's profitability. On the one hand, this variable commonly serves as a proxy for the market profit opportunities (Berger and Humphrey, 1997); while on the other hand, it is clear that the banks' access to government deposit insurance and other safety net protections may increase incentives for risk shifting or lax risk management, which potentially might increase the agency costs of outside debt (Berger, 1995b). In the case of US banks, the results show that the *ex-post* asset substitution problems originated by the deposit increase the agency cost of external sources of funds. These higher agency costs lead to a lower profitability. This result is robust in each of the regressions in Tables 3, 4, and 5.

The interest expenses (INTEXP) have a negative connection with profitability. The interest expenses are usually called the cost of intermediation. The higher the costs, the lower the rate of return, as the last two columns in Tables 3, 4, and 5 show. The standard deviation of the return on equity measures the bank risk (SEFCROE) during the period this study covers. This variable relates directly to profitability, which means that the risky banks can achieve higher rates of return. This result is significant only in the pooled estimation. Furthermore, the investment in securities (SEC) has a positive relationship with the bank's performance. The results, however, display a negative relationship for each of the estimations Tables 3, 4, and 5. It seems that US banks are over-investing, and the performance of their portfolio has dwindled due to this non-optimal investment strategy.

The exogenous factors which can determine the bank's performance are: the rate of discount as an external determinant of the cost of intermediation (RATE), the Nasdaq Bank Index (LNASDAQ) to control the efficiency and performance in the banking industry as a whole, and the reputation (LLIFE), whose proxy is the number of years since the foundation of the bank (Berger and Bonaccorsi di Patti, 2006). The cost of intermediation (RATE) is not significant in either of the regressions. However, LNASDAQ correlates directly with the banks' rate of return. Thus, the net income immediately reflects the market quotation, as expected. Finally, the reputation seems to be significant only in the pooled estimation. In this case, the larger the number of years since the foundation of the bank, the more likely the bank is to achieve positive returns on its equity. Thus, all the models in Tables 3, 4, and 5 are clearly quite robust in terms of the estimations applied.

6 Conclusions

This study analyses the determinants of the profitability for the US banking industry. The study involved basically three stages: Firstly, analysis of the hypotheses which explain the most important determinants of a bank's profitability; secondly, application of a suitable methodology which overcomes the classical econometric problems involved in this kind of studies; and finally, empirical testing of the hypotheses. The main conclusions derived from this study are: in first place, a non-monotonic empirical relationship between the bank's profitability and its equity capital ratio. Specifically, for the US banking industry the efficiency-risk and the franchise-value hypotheses are the most important elements which explain the relationship between profitability and capital. The efficiency-risk hypothesis claims that the most efficient banks (those with higher rates of return) will choose low levels of capital ratios; while with the franchise-value hypothesis the most efficient banks will look for high capital ratios. Empirically speaking, the efficiency-risk hypothesis dominates whenever the capital ratio is lower than 41%. Afterward, the franchise-value hypothesis comes into force. If we ignore the non-monotonic relationship and pay attention to the single causality, a strong negative relationship between capital and profitability becomes apparent.

That is, an unexpected increase in capital tends to lead to a decrease in the bank's profitability. This connection is conventional wisdom in banking. In fact, Berger (1995b) points out that this negative relationship has an intuitive appeal and is consistent with the stand alone one-period model with asymmetrical information between the bank and its individual investors. A higher capital ratio tends to reduce the risk on equity and therefore lowers the expected return on equity that investors seek. In other words, a high capital ratio signifies that a bank is operating over-cautiously and ignoring potentially profitable trading opportunities.

Secondly, there are diseconomies of scale in the US banking industry. Only small banks can take advantage of their size. The fact is that the profitability of the banks as financial intermediaries is mostly the result of the application and efficient usage of new technology rather than the size of their portfolio of investments.

Thirdly, besides the bank-based (endogenous) factors which explain the profitability, the results show that the exogenous factors determine the efficiency in the profitability of banks. The income statements of banks in the US immediately reflect the market quotation.

In order to test the robustness of the results, different estimation tools have successfully examined the consistency of the outcomes. Moreover, the classic econometric problems of unobservable heterogeneity and endogeneity, which are usually the shortcomings in this kind of cross-sectional and time-series analysis, have been controlled. An extension of this study lies in a cross-country comparison and in the analysis of the determinant of the leverage in the banking industry. These should be the future lines of research for this work.

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Table 1. Variable definition and descriptive statistics

Panel A includes the description and the descriptive statistics or the variables used in the empirical analysis. EFCROE is the return on equity which corresponds to the dependent variable in the estimations. The independent variables are the capital ratio (CAP); the business capacity of the bank (LOAN); the demand for deposits (DEP); the USA Federal Reserve Bank Discount Rate (RATE); the interest expenses (INTEXP); the investment in securities (SEC); the bank's share of market deposit per year and per state (SHAREDEPOSIT); the bank's size (SIZE); the Herfindahl index of market concentration (HERF); the bank's risk (SEFCROE); the NASDAQ Bank Index (LNASDAQ); and the bank's the reputation (LLIFE).
Panel B describes the mean values for EFCROE and CAP per year for the period of analysis considered in this study.

Panel A

Variable	Description	Mean	Std. Dev.	Min	Max
EFCROE	Net income / equity	0.20256	0.33932	-0.50440	1.99940
CAP	Equity / total assets	0.11562	0.08734	0.00000	1.00000
CAP^2	CAP squared	0.02100	0.07362	0.00000	1.00000
LOAN	Total loans & leases, gross / total assets	0.61060	0.16884	0.00000	1.20730
DEPOSIT	Total deposits / total assets	0.82165	0.12720	0.00000	0.99060
RATE	USA Federal Reserve Bank Discount Rate	4.21895	1.68020	0.75000	6.25000
INTEXP	Interest expense / equity	0.28099	0.62016	0.00000	193.46990
SEC	Investment in security at market value / total assets	0.06096	0.12726	0.00000	0.99800
SHAREDEPOSIT	Bank's share of market deposits per year and state	0.00671	0.04217	0.00000	1.00000
SIZE	Natural log of total assets	11.60202	1.35750	4.04310	21.00010
HERF	Herfindahl index for bank concentration for state and year	0.21242	0.17777	0.00000	1.00000
SEFCROE	Standard deviation of EFCROE	0.12973	0.16031	0.00000	1.33771
LNASDAQ	Natural log of Nasdaq Bank Index	7.63309	0.35825	6.91712	8.13661
LLIFE	Natural Log of years since the bank's foundation	3.86876	1.00078	0.00000	5.33272
Number of Banks		11,777			
Bank's year obs.		108,439			

Panel B

		Mean	
Year	Observations	EFCROE	CAP
1995	10,199	0.17155	0.11503
1996	9,769	0.17486	0.11517
1997	9,385	0.18579	0.11551
1998	8,950	0.18432	0.11590
1999	8,685	0.18687	0.11623
2000	8,408	0.19121	0.11609
2001	8,122	0.19486	0.11545
2002	7,855	0.21363	0.11515
2003	7,724	0.22194	0.11505
2004	7,569	0.22920	0.11633
2005	7,374	0.24079	0.11634
2006	7,226	0.24427	0.11558
2007	7,173	0.22764	0.11549
Total	108,439		

Table 2. Matrix of correlation coefficients

The matrix includes the correlation coefficients and the statistical significance in parenthesis among the variables used in the econometric analysis. EFCROE is the return on equity which corresponds to the dependent variable in the estimations. The independent variables are the capital ratio (CAP); the business capacity of the bank (LOAN); the demand for deposits (DEP); the USA Federal Reserve Bank Discount Rate (RATE); the interest expenses (INTEXP); the investment in securities (SEC); the bank's share of market deposit per year and per state (SHAREDEPOSIT); the bank's size (SIZE); the Herfindahl index of market concentration (HERF); the bank's risk (SEFCROE); the NASDAQ Bank Index (LNASDAQ); and the bank's the reputation (LLIFE).

Variables	EFCROE	CAP	LOAN	DEP	RATE	INTEXP	SEC	SHAREDEPOSIT	SIZE	HERF	SEFCROE	LNASDAQ	LLIFE
EFCROE	1.000												
CAP	-0.015 (0.000)	1.000											
LOAN	-0.063 (0.000)	-0.398 (0.000)	1.000										
DEP	0.105 (0.000)	-0.677 (0.000)	0.241 (0.000)	1.000									
RATE	-0.010 (0.001)	0.002 (0.568)	-0.006 (0.051)	0.002 (0.490)	1.000								
INTEXP	0.014 (0.000)	-0.110 (0.000)	0.046 (0.000)	0.032 (0.000)	-0.007 (0.017)	1.000							
SEC	-0.039 (0.000)	0.040 (0.000)	-0.167 (0.000)	-0.052 (0.000)	0.007 (0.026)	-0.071 (0.000)	1.000						
SHAREDEPOSIT	-0.055 (0.000)	-0.036 (0.000)	0.008 (0.013)	-0.088 (0.000)	-0.004 (0.152)	0.005 (0.097)	0.008 (0.008)	1.000					
SIZE	-0.336 (0.000)	-0.226 (0.000)	0.196 (0.000)	-0.164 (0.000)	-0.003 (0.286)	0.038 (0.000)	0.060 (0.000)	0.371 (0.000)	1.000				
HERF	0.005 (0.079)	-0.004 (0.185)	0.005 (0.116)	-0.016 (0.000)	-0.093 (0.000)	0.001 (0.868)	-0.010 (0.001)	0.077 (0.000)	0.027 (0.000)	1.000			
SEFCROE	0.593 (0.000)	-0.006 (0.041)	-0.037 (0.000)	0.060 (0.000)	-0.012 (0.000)	0.006 (0.051)	0.004 (0.178)	-0.019 (0.000)	-0.209 (0.000)	-0.007 (0.018)	1.000		
LNASDAQ	0.066 (0.000)	0.002 (0.492)	0.026 (0.000)	-0.003 (0.305)	-0.219 (0.000)	0.000 (0.985)	-0.010 (0.002)	0.016 (0.000)	0.008 (0.006)	0.177 (0.000)	0.009 (0.005)	1.000	
LLIFE	0.089 (0.000)	0.014 (0.000)	0.008 (0.010)	-0.040 (0.000)	0.001 (0.677)	0.008 (0.011)	0.007 (0.028)	-0.024 (0.000)	-0.001 (0.740)	0.071 (0.000)	-0.063 (0.000)	-0.080 (0.000)	1.000

Table 3. Fixed effect estimations

Estimated coefficients and standard errors (below the coefficients) are based on the fixed effect estimations of the equation (1). The dependent variable is the return on equity measured. The independent variables are the capital ratio (CAP); the market concentration -the Herfindahl index of market concentration (HERF) and the bank's share of market deposit per year and per state (SHAREDEPOSIT)-; the bank's size (SIZE); the business capacity of the bank (LOAN); the demand for deposits (DEP); the interest expenses (INTEXP); the investment in securities (SEC); the bank's risk (SEFCROE). Additionally, we have included a number of other financial indicators to control for the effect of external factors on the cost of intermediation and operational performance of US banks. We included the USA Federal Reserve Bank Discount Rate (RATE); the NASDAQ Bank Index (LNASDAQ); the reputation (LLIFE). (***) stands for significant to a confidence level higher than 99%; (**) for a level higher than 95% and (*) for a level higher than 90%.

	With-in EFROE		**With-in EFROE**		**With-in EFROE**		**With-in EFROE**		**With-in EFROE**	
	Coeff.		**Coeff.**		**Coeff.**		**Coeff.**		**Coeff.**	
	St. Dev.		**St. Dev.**		**St. Dev.**		**St. Dev.**		**St. Dev.**	
Intercept	0,2033	***	0,2239	***	0,0959	***	0,8395	**	0,6355	*
	0,0013		0,0028		0,0025		0,3379		0,3732	
$EFROE_{t-1}$					0,6246	***	0,5223	***	0,5221	***
					0,0029		0,0029		0,0029	
CAP	-0,0064		-0,2346	***	-0,0915	***	-0,7909	***	-0,7844	***
	0,0100		0,0292		0,0249		0,0264		0,0264	
CAP^2			0,2771	***	0,1591	***	0,4963	***	0,5006	***
			0,0333		0,0284		0,0270		0,0270	
CAP MINIMUM			**0,4234**		**0,2875**		**0,7967**		**0,7834**	
SIZE							-0,0811	***	-0,0812	***
							0,0008		0,0008	
LOAN							-0,0447	***	-0,0440	***
							0,0052		0,0052	
SEC							-0,0253	***	-0,0245	***
							0,0045		0,0045	
DEP							-0,0919	***	-0,0800	***
							0,0088		0,0090	
INTEXP							0,0052	***	0,0049	***
							0,0010		0,0010	
SEFCROE							0,7020		0,6995	
							2,2181		2,2173	
RATE							-0,0001		-0,0001	
							0,0003		0,0002	
LNASDAQ							0,0747	***	0,0739	***
							0,0019		0,0019	
SHAREDEPOSIT									0,4521	***
									0,0235	
HERF							-0,0111	***		
							0,0040			
LLIFE							-0,0701		-0,0193	
							0,0449		0,0619	
Obs	108.439		108.439		95.600		95.582		95.582	
R sqr	0,1276		0,1276		0,3543		0,4373		0,4375	
F	0,4100		6.993,7100		15322,47		4.648,5300		4.653,8600	
p-value	0,5196		0,0000		0,0000		0,0000		0,0000	

Table 4. GMM with system estimator

Estimated coefficients and standard errors (below the coefficients) are based on the GMM system estimator for the equation (1). The dependent variable is the return on equity measured. The independent variables are the capital ratio (CAP); the market concentration -the Herfindahl index of market concentration (HERF) and the bank's share of market deposit per year and per state (SHAREDEPOSIT)-; the bank's size (SIZE); the business capacity of the bank (LOAN); the demand for deposits (DEP); the interest expenses (INTEXP); the investment in securities (SEC); the bank's risk (SEFCROE). Additionally, we have included a number of other financial indicators to control for the effect of external factors on the cost of intermediation and operational performance of US banks. We included the USA Federal Reserve Bank Discount Rate (RATE); the NASDAQ Bank Index (LNASDAQ); the reputation (LLIFE). (***) stands for significant to a confidence level higher than 99%; (**) for a level higher than 95% and (*) for a level higher than 90%.

	System		**System**		**System**		**System**		**System**	
	EFCROE		**EFCROE**		**EFCROE**		**EFCROE**		**EFCROE**	
	Coeff.		**Coeff.**		**Coeff.**		**Coeff.**		**Coeff.**	
	St. Dev.		**St. Dev.**		**St. Dev.**		**St. Dev.**		**St. Dev.**	
Intercept	0,2845	***	0,2843	***	-0,0386	***	1,2711	***	1,4749	***
	0,0088		0,0124		0,0107		0,5174		0,5304	
$EFROE_{t-1}$					0,9499	***	0,8036	***	0,7641	***
					0,0195		0,0326		0,0324	
CAP	-0,7989	***	-1,2132	***	0,6499	***	-2,3463	***	-1,8804	***
	0,0714		0,1307		0,0943		0,7228		0,7110	
CAP^2			1,4669	***	-0,6242	***	1,4871	***	1,0925	*
			0,1658		0,1073		0,5628		0,5734	
CAP MINIMUM			**0,4135**		**0,5206**		**0,7889**		**0,8606**	
SIZE							-0,0566	**	-0,0867	***
							0,0263		0,0302	
LOAN							0,3969	**	0,3050	*
							0,1756		0,1702	
SEC							-0,5939	***	-0,5323	***
							0,1979		0,1957	
DEP							-0,9561	***	-0,9192	***
							0,2575		0,2655	
INTEXP							-0,5815	***	-0,4089	**
							0,1716		0,1691	
SEFCROE							0,2566		0,3714	
							0,3339		0,3412	
RATE							0,0003		0,0003	
							0,0004		0,0004	
LNASDAQ							0,0306	***	0,0379	***
							0,0053		0,0039	
SHAREDEPOSIT									2,3356	***
									1,9532	
HERF							0,0627	**		
							0,0295			
LLIFE							0,0347		0,0378	
							0,0374		0,0385	
Obs	108.439		108.439		94.899		94.881		94.881	
AR1	41,0600	***	40,2800	***	-3,6900	***	4,4000	***	4,3800	***
p-value	0,0000		0,0000		0,0000		0,0000		0,0000	
AR2	37,1400	***	36,4400	***	-0,5600	***	4,3300	***	4,3300	***
p-value	0,0000		0,0000		0,0000		0,0000		0,0000	
Sargan	446,8400		1068,0400		314,9200		187,5400		197,3600	
p-value	0,4290		0,3380		0,3740		0,2080		0,2600	

Table 5. OLS estimations. Determinants of the efficiency in the USA banking industry

Estimated coefficients and standard errors (below the coefficients) are based on the Ordinary Least Square estimations of the equation (1). The dependent variable is the return on equity measured as the net income over equity. The dependent variable is the return on equity measured. The independent variables are the capital ratio (CAP); the market concentration -the Herfindahl index of market concentration (HERF) and the bank's share of market deposit per year and per state (SHAREDEPOSIT)-; the bank's size (SIZE); the business capacity of the bank (LOAN); the demand for deposits (DEP); the interest expenses (INTEXP); the investment in securities (SEC); the bank's risk (SEFCROE). Additionally, we have included a number of other financial indicators to control for the effect of external factors on the cost of intermediation and operational performance of US banks. We included the USA Federal Reserve Bank Discount Rate (RATE); the NASDAQ Bank Index (LNASDAQ); the reputation (LLIFE). (***) stands for significant to a confidence level higher than 99%; (**) for a level higher than 95% and (*) for a level higher than 90%.

	OLS		**OLS**		**OLS**		**OLS**		**OLS**	
	EFROE		**EFROE**		**EFROE**		**EFROE**		**EFROE**	
	Coeff.		**Coeff.**		**Coeff.**		**Coeff.**		**Coeff.**	
	St. Dev.		**St. Dev.**		**St. Dev.**		**St. Dev.**		**St. Dev.**	
Intercept	0,2091	***	0,2189	***	0,0539	***	-0,1724	***	-0,1774	***
	0,0017		0,0033		0,0023		0,0186		0,0187	
$EFROE_{t-1}$					0,7453	***	0,5669	***	0,5668	***
					0,0020		0,0022		0,0022	
CAP	-0,0568	***	-0,1668		-0,0309		-0,3593	***	-0,3558	***
	0,0118		0,0341		0,0227		0,0226		0,0226	
CAP^2			0,1391	***	0,0627	**	0,2466	***	0,2516	***
			0,0404		0,0270		0,0241		0,0242	
CAP MINIMUM			**0,5996**		**0,2461**		**0,7283**		**0,7072**	
SIZE							-0,0325	***	-0,0325	***
							0,0006		0,0006	
LOAN							-0,0503	***	-0,0500	***
							0,0040		0,0040	
SEC							-0,0480	***	-0,0473	***
							0,0049		0,0049	
DEP							-0,0244	***	-0,0158	**
							0,0073		0,0075	
INTEXP							0,0034	***	0,0033	***
							0,0010		0,0010	
SEFCROE							0,6048	***	0,6047	***
							0,0044		0,0044	
RATE							-0,0002		-0,0001	
							0,0004		0,0004	
LNASDAQ							0,0742	***	0,0736	***
							0,0018		0,0018	
SHAREDEPOSIT									0,1919	***
									0,0156	
HERF							-0,0036			
							0,0035			
LLIFE							0,0212	***	0,0211	***
							0,0006		0,0006	
Obs	108.439		108.439		108.438		107.389		107.389	
R^2	0,5223		0,5043		0,5553		0,6545		0,6546	
F	23,1700		17,5100		45.136,4200		14.530,7500		14.534,1900	
p-value	0,0000		0,0000		0,0000		0,0000		0,0000	