How Do Banks Make Money for their Owners? An Analysis of the Determinants of Profit and Shareholder Value Creation in European Banking

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Abstract

This paper empirically investigates the determinants of profit and shareholder value creation in European banking focussing on both listed and non-listed European banks over 1997-2002. Overall, we find that bank's cost and profit efficiency have a positive influence on bank's profits, while only profit efficiency display a positive impact on shareholder value creation. Liquidity and Credit risk do not seems to influence bank's profits and shareholder value suggesting that there are no substantial difference in the way these risks are managed by banks. Instead, we found a larger market risk exposure (measured by investing securities on total assets) supply a positive contribution on bank's profit, while the operational exposure is positively linked to the shareholder value: this result is not surprising since the proxy used to measure the operational risk exposure (following the Basle simple approach) is based on the bank's gross income. Nevertheless, it is surprising that the operational risk exposure is statistically significant linked to the bank's EVA and not to the bank's ROA suggesting that the relationship between bank's operational risk and bank's performance need further investigation. Leverage is also found to be inversely related to shareholder value creation (especially in Italy and U.K) suggesting that highly capitalised banks are more likely to generate profits and value for their owners compared with lowly capitalised counterparts. We also found that banks with a larger market share at time t-1 have a substantial advantage in creating shareholder value, especially if these banks operate in less concentrated banking industries. We also find that quoted banks do better at creating shareholder value than their non-quoted counterparts, especially in France and Italy.

JEL classification: M41; G14, G21

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1. Introduction

This paper examines the determinants of profit and shareholder value creation for a large sample of European listed and unlisted banks between 1995 and 2002. There is a substantial literature that focuses on various factors that influence the performance of banks (see Molyneux and Thornton, 1992; Berger, 1995; Berger and Hannan 1997; Berger and Mester 2003; and, Berger and Bonaccorsi di Patti, 2006).

Few of these studies, however, consider the shareholder value creation indicators as measures of bank performance, which is surprising given that creating value for shareholders (generating returns in excess of the cost of capital) has been the main strategic objective of quoted banks over the last decade or so[1].

A number of studies (Beccalli et al., 2005, Fernandez et al., 2002, Eisenbeis et al. 1999, Chu and Lim, 1998) have sought to link measures of bank productive efficiency to stock returns, generally finding a positive relationship. However these studies do not really tell us much about the determinants of shareholder value creation as cost of capital considerations are, typically, ignored. Others have investigated the relationship between operational risk and bank stock price reactions (Cummings et al., 2004) and the role played by corporate risk management in the shareholder value creation process Bartram (2000 and 2002). Overall, however, it can be seen that the extant empirical literature on the determinants of shareholder value creation in banking is somewhat esoteric and limited.

This paper aims to extend the established literature by examining whether various factors (e.g. market structure and bank's relative power, bank efficiency, financial structure and

[1] See Fiodelisi and Molyneux (2006). Note that the literature dealing with shareholder value is substantial, but these studies usually focuses on developing and comparing new performance measures (e.g. O'Hanlon and Peasnell 1998, Garvey and Milbourn 2000, Fernández 2002), assessing the value-relevance of different company items such performance measures, accounting information, etc. (e.g. Barth and Beaver, 2001, Holthausen and Watts 2001), modelling the link between market value and accounting values (e.g. Ohlson 1995, Felthman and Ohlson 1995, Morel 1999, Dechow et al. 1999, Lo and Lys 2000, Ahmed et al. 2000, Liu and Ohlson 2000, Biddle et al., 2001, Ota 2002).

bank's risk exposure) that are believed to impact on profit and shareholder value creation in banking. The contribution of this paper is that, as far as we are aware, this is the first comprehensive study: 1) on the analysis of determinants of shareholder value creation in banking; 2) to explicitly compare the processes of profit generation and the shareholder value creation; 3) to consider the impact of the most important types of risk on the bank's performance; 4) to assess if bank's from different countries (namely, France, Germany, Italy and the U.K.) or different type (namely, commercial, cooperative and savings bank) may have an advantage\disadvantage in generating profits and\or shareholder value.

2. The Determinants of Profit and Shareholder Value Creation in Banking

This paper investigates the determinants of profit and shareholder value creation in European Banking. The motivation of the paper is that we believe that the creation of profit and shareholder value may be influence by the same factor, but in a different way. As such, while we first identify common set of profit and shareholder value determinants\drivers (i.e. a set of bank's features expected to have a significant influence on the ability to generate returns) and next we investigate if these drivers play a different role in generating profits or shareholder value.

Shareholder value and profits are two different measure of bank performance. While profits express the bank's ability of achieve income superior to its costs over a given time period, a bank creates value for shareholders when the return on invested capital is greater than its opportunity cost, or than the rate that investors could earn by investing in other securities with the same risk.

Among various corporate factors that are believed to have an impact on bank's profit and shareholder value, we analyse some banking features: 1) the bank's efficiency; 2) the risk management ability, 3) the bank's financial structure and 4) the bank's competitive strength. Regarding the first potential driver of profit and shareholder value creation, we focus both on cost efficiency (i.e. the ability of a firm to choose inputs and/or output levels and to mix these to minimise cost) and profit efficiency (i.e. the bank's ability to produce at the maximum possible profit given a particular level of input prices and output prices and other variables)[2]. There are a substantial number of papers dealing with bank efficiency which focus on methodological issues (e.g. Berger 1993, Altumbas and Chakravarty, 2001), compare estimates from different methodologies (e.g. Berger and Mester 1997 and 2003, Bauer et al., 1997), examine bank efficiency focussing on countries and/or financial sectors poorly analysed by previous studies (e.g. Sathye 2001, Green and Segal 2004, Beccalli 2004), and /or assess the source of inefficiency and the role of environmental factors (e.g. Dietsch and Lozano-Vives 2000, Berger and De Young 2001, Chaffai et al., 2001, Carbo and Humphrey, 2004). Following on from Berger (1995) and Berger and Mester (2003), we recognise that efficiency is likely to have an impact on bank performance, but we do not have a clear expectation about the relationship between bank efficiency and shareholder value created over a period[3]. One may expect improvements in efficiency (cost and profit) to have a positive influence on present and expected future cash flows (by reducing costs, keeping constant outputs, and/or improving profits, keeping inputs constant). Beccalli et al (2005), for example, find a positive relationship between bank efficiency and stock returns suggesting a positive relationship between

[2] Berger and Mester (1997) develop an "alternative" profit efficiency" concept referring to the bank's ability of producing at the maximum possible profit given a particular level of output levels, rather than its output prices

[3] Some studies (e.g. Beccalli et al., 2005) note that stock returns may be influenced by efficiency changes across two consecutive periods (e.g. bank *j* improved its cost or profit efficiency by 40% between period *t-1* and *t*), rather than its efficiency levels (e.g. 30% cost efficiency in *t-1* and 70% in *t*). As such, we run model (2) considering cost and profit efficiency changes (obtained comparing efficiency estimates in two different periods) as independent variables: results are very similar to these discussed for cost and profit efficiency levels in the papers.

efficiency and shareholder value creation. However, high efficiency levels (or efficiency improvements) may result in various externalities that may have a negative influence on expected free cash flow and, so, on bank's returns. For example, 'aggressive' efficiency programmes may result in reduced customer satisfaction and have an adverse impact on workforce motivation. As such the impact of cost and profit efficiency on bank's profit and shareholder value creation cannot be confidently identified *ex-ante*. In addition, bank's efficiency improvements may have a different influence on bank's profits and shareholder value: for example, 'aggressive' efficiency programmes may also increase the corporate risk with a negative effect on the shareholder value created in a given time period (by increasing the cost opportunity of the capital invested), while this would not be affected the profit created in the same period.

The risk-taking propensity of banks is another factor expected to have a significant influence on the ability to generate returns. We consider the main type of risk in banking, such as the credit risk, the market risk, the operational risk and the liquidity risk. Credit risk (i.e. the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms[4]) is the major risk faced by banks engaged in deposit-taking and lending. The number of studies dealing with credit risk is again substantial and deals with a variety of issues including: measurement methodologies (e.g. Duffie 2005, Lucas and Klaassen, 2006 and Galluccio and Roncoroni, 2006); the adequacy of new capital requirements to credit risk management practices in banking (e.g. Jacobson et al., 2006); relationships with other risks (e.g. Zheng 2006 and Jobst et al., 2006) and so on. After the deregulation process in European banking, commercial banks can also run their business in financial markets activities so shareholder value and bank's profits may be also influenced by the bank's ability in running these activities and the market risk undertaken (i.e. the risk

[4] Basle Committee on Banking Supervision (2000)

of losses in on- and off-balance sheet positions arising from movements in market prices). The number of studies dealing with market risk in banking is again large and deals with a variety of issues including measurement methodologies (e.g. Lopez 1999 and Berkovitz 2002); the adequacy of capital requirements to market risk in banking (e.g. Kupiec and O'Brien, 1996, Marchall and Venkataraman 1998); relationships with other risks (e.g. Barnhill et al., 2000) and so on. More recently various studies have focused on operational risk (i.e. the risk of loss resulting from inadequate or failed internal processes, people and systems of from external events[5]) mainly looking at measurement issues (e.g. Scandizzo 2005, De Fontnouvelle et al., 2005). Finally, the liquidity risk is the risk that bank is holding insufficient liquid assets and it unable to meet requirements without impairment to its financial or reputational capital. We expect that these risks have a negative influence on the bank's performance, e.g. superior risk management ability should be associated to higher bank profits and shareholder value. However, it is interesting to note this relationship since we cannot define ex-ante the following features: first, it is not clear the magnitude the impact of each risk on shareholder value and profits; 2) for each type of risk, the magnitude of the influence on profits may be different from the impact on value; 3) different types of bank (e.g. commercial, cooperative and savings bank) have different relationships.

The bank's financial structure can also influence bank performance and therefore it may be an important determinant of profit and\or shareholder value creation. Barth et al., (1998) provide evidence that companies having a bond rating (or the authors' fitted bond rating) above the S&P investment grade (labelled as financially healthy) tend to have higher price multiples on net income and lower pricing multiples on book value relative to less healthy firms (i.e. companies having a bond rating below investment grade). Focussing on US

[5] Basle Committee on Banking Supervision (2003)

banks, Berger and Bonnacorsi di Patti (2006) recently investigate the hypothesis under which high leverage reduces the agency costs of outside equity and increases firm value (since managers tend to act more in the interests of shareholders). The authors find strong evidence that higher leverage (or a lower equity capital ratio) is associated with higher profit efficiency, all else equal. As such, we use a bank leverage measure (as the ratio between the total amount of liabilities and equity capital) to account for financial structure.

So far we have discussed only bank-specific determinants of shareholder value creation however there is a substantial literature[6] that suggests that market structure features can impact on firm performance. Typically, the literature seeks to examine whether factors such as industry concentration (a test of the traditional structure-conduct-performance hypothesis) or individual market shares (a test of Berger`s (1995) relative market power hypothesis) impact on bank performance[7]. Some of the recent research[8] allows for the possibility that different sizes of banks may affect competitive conditions. Some other studies[9] test the hypothesis that state-owned banks may compete in different ways from privately-owned institutions, while others[10] suggest that foreign-owned banks may compete in different ways from domestically owned-banks. Few papers also investigate the effects of banking market structure in the U.S. on bank risk-taking[11]. Most of the literature to date that examines structure/competition issues typically focuses on the U.S. banking markets with a few exceptions, namely Panetta and Focarelli (2003), Beck, Demirgüç-Kunt, and Levine

[6] See Berger et al (2004), Berger (1995), Berger and Hannan (1989, 1998), Goldberg and Rai 1996, Berger and Hannan 1997 and 1998, Maudos 1998, Goddard et al., 2001, Mendes and Rebelo 2003 and Fu and Heffernan, 2007) who have all investigated the relationship between bank performance (but not focussing on shareholder value) and market structure - usually finding a positive relationship.

[7] Note that one can only test for Berger's (1995) Relative market Power Hypothesis if the influence of bank level efficiency is controlled for.

[8] E.g. DeYoung et al, (2004)

[9] E.g. Barth et al, 2004, La Porta, et al, (2002), Berger et al, (2004)

[10] E.g. DeYoung and Nolle (1996), Berger et al, (2000)

[11] E.g., Keeley (1990)

(2003) and La Porta, Lopez-de-Silanes, and Shleifer (2002). By using a large sample of European banks, our paper analyse the possibility that banks with larger market share or competing in more concentrated markets have an advantage in generating profits and shareholder value. In addition, we also consider the possibility that listed banks may have an advantage\disadvantage in creating shareholder value and\or profits and that the type of bank (e.g. commercial, cooperative and savings bank) may have different relationships.

3. Methodology and Data

In order to examine the determinants of bank profits shareholder value creation in European banking, we specify a model similar to that proposed in by Molyneux and Thornton (1992), Berger (1995) and Berger and Bonnacorsi di Patti (2006)m where bank performance indicators are regressed against a number of potential determinants. We estimate the following model so as to deal with the panel dimensions of our dataset[12]:

$$\psi_{i,t} = \partial + \sum_{k=1}^{3} \alpha_k T_k + \sum_{j=0}^{2} \beta_j x - eff_{i,t-j} + \sum_{j=0}^{2} \chi_j \pi - eff_{i,t-j} + \sum_{j=0}^{2} \delta_j CR_{i,t-j} + \sum_{j=0}^{2} \phi_j OR_{i,t-j} + \varphi MR_{i,t} + \gamma LR_{i,t} + \\ + \sum_{j=0}^{2} \omega_j LEV_{i,t-j} + \sum_{j=0}^{2} \iota_j MS_{i,t-j} + \sum_{j=0}^{2} \kappa_j CONC_{i,t-j} + \sum_{k=1}^{m} \lambda_k Z_k + \mu L_{i,t} + e_{i,t} \quad (1)$$

where $\psi_{i,t}$ is the variable representing the bank performance (we use once the bank's ROA and a second time the ratio of Economic Value Added - EVA_{bkg} - and capital invested at time t-1[13]), ∂ is a constant (to capture missing variables); T_k (k=1, 2, 3) are dummy variables for the

[12] Considering the large size of our sample, model 1 is estimated using the Maximum Likelihood (Newton-Raphson) optimization procedure and the standard error of estimated coefficents is obtained using a bootstrapping procedure (with 200 replications). For further detail on MLE propeties, see Greene (1997, p. 133)

[13] Several studies (e.g. Easton, 1998, Easton and Sommers, 2003) empirically demonstrate the distortion generated by "scale effects" (which refers to the undue influence of large firms in the regression analysis) in studying the relationship between company's market returns and accounting data. While the independent variables in models (1) do not suffer

years considered (namely, 2000, 2001 and 2002); $x\text{-}eff_{i,t-h}$ is the cost efficiency for the bank i over the period $t\text{-}j$ (j=0, 1, 2)[14]; $\pi\text{-}eff_{i,t-h}$ is the profit efficiency for the bank i over the period $t\text{-}j$ (j=0, 1, 2)[15]; $CR_{i,t-h}$ is the unexpected credit risk losses for the bank i over the period $t\text{-}j$ (j=0, 1, 2),[16]; $OR_{i,t-h}$ is the operational risk exposure (calculated using the Basle simple indicator approach[17] for the bank i over the period $t\text{-}j$ (j=0, 1, 2); $MR_{i,t}$ is the market risk exposure (measured as the total amount of investment securities on total assets) for the bank i over the period t; $LR_{i,t}$ is the liquidity risk exposure (measured as the financing gap, i.e. the difference between the average loans and the average amount of deposits[18]) for the bank i over the period t; $LEV_{i,t-h}$ is the financial leverage (measured as the ratio between the total amount of liabilities and equity capital) for the bank i over the period $t\text{-}j$ (j=0, 1, 2); $MS_{i,t-h}$ is the asset market share for the bank i over the period $t\text{-}j$ (j=0, 1, 2); $CONC_{i,t-h}$ are domestic banking industry concentration estimates over the period $t\text{-}j$ (j=0, 1, 2); Z_k (k = 1, … , 9) is a set of dummy variables capturing country effects (namely, France, Germany, Italy, and U.K.) and specialisation (e.g. commercial, cooperative and savings banks)[19], $L_{i,t}$ is a dummy variable

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from scale effects, it is necessary to standardise the dependent variable (i.e. EVA_{bkg}) to minimise heteroscedasticity and scale effect problems. Of the various solutions adopted in previous studies (see Brown et al. 1999, and Akbar and Stark, 2003), we use the capital invested (obtained following the EVA_{bkg} calculation procedure as a deflator for EVA): this measure seems preferable to other accounting measures because it faces less accounting distortions and provides a meaningful shareholder value indicator (i.e. the shareholder value created for any one euro of capital invested by shareholders). We lag the capital invested term by one period assuming that it will take at least a year for capital investments to feed through into additional EVA.

[14] The cost profit efficiency estimates are obtained using the stochastic frontier approach (details are outlined in the Annex).

[15] We estimated the alternative profit efficiency (following Berger and Mester,1997) using the stochastic frontier approach (details are outlined in the Annex).

[16] As a proxy for these unexpected losses, we focus on the annual provision to loan loss reserves, i.e. the reserve that covers future unexpected loan losses Expected loan losses are measured by write-downs on loan, but these do not really express the bank's risk exposure being "expected" losses.

[17] For further detail on the calculation, see the annex.

[18] Casu et al., (2006) support that the financing gap is one the most useful indicator of a bank's liquidity.

[19] It is worthwhile to note that we have already considered these dummy variables to control for the influence of a specific bank specialisation (namely, commercial, cooperative and savings bank) on bank's efficiency estimates. However, since Altunbas et al. (2001) and Goddard et al. (2004) highlight differences in both efficiency and profits performance for various types of European banks, we prefer to include a broader set of dummy variable to control for the influence of country (namely, France, Germany, Italy, and UK) and specialisation (e.g. commercial, cooperative and savings banks) on shareholder value created over a period.

expressing if the bank *i* is publicly listed[20] at time *t* that has been included to assess if quoted banks are significantly different to non-listed banks in terms of profit and shareholder value creation[21]. Also note that because many of the relationships being investigated are unlikely to be contemporaneous, we include up to two period (yearly) lags for all variables (except for liquidity and market risk)[22].

Our data set consists of commercial, cooperative and savings banks from France, Germany, Italy and U.K. between 1995 and 2002 with financial information obtained from Bankscope and (to identify quoted banks) Datastream databases. Details of the number of banks in the sample are shown in Table 1.

<< INSERT TABLE 1>>

The descriptive statistics of the sample are shown in the top-half of Table 2 which shows that European banks destroyed shareholder value (around 1.1%) over the period analysed. Cost efficiency estimates display superior mean levels than profit estimates: this result is common in the bank efficiency literature[23]. European banks are found to have lost around one-third of their potential profits through inefficiency, whereas cost inefficiencies (although substantial at around 25%) are lower. The equity capital required by regulators to cover bank's operational risk exposure is, on average, 0.01% of total assets, while the mean credit risk exposure (measured by annual provision of loan loss reserve) is around 0.4% of total loans. Although not reported in the

[20] Namely, L_i is 1 if bank *i* is publicly listed and 0 otherwise.
[21] Quoted banks may have some advantages in creating shareholder value since these banks can finance their size-growth by external sources "more economically and easily" than non-quoted banks (see Goddard et al, 2004).
[22] Since the liquidity and the market risk exposures may produce losses over the short-term, we expect that these risks may influence the bank performance "only" over the same time period.
[23] See Goddard et al (2001) and Berger and Mester (1997)

table, the German banking system has the lowest level of industry concentration, while the UK market is found to be the most concentrated among the four banking systems analysed.

<< INSERT TABLE 2>>

4. Results

Table 3 reports the results obtained from estimating our model for bank profits (i.e. using Return on Assets as dependant variable). According to our results, bank's efficiency is the most influential driver of bank's profits: profit efficiency coefficients at time *t* and t-1 are positive and statistically significant at the 1% and 10% confidence level, respectively, while the cost efficiency coefficient at time *t* is positive and statistically significant at the 1%. A quite surprising result is that estimated cost efficiency coefficient is larger than the profit efficient coefficients showing that a cost efficiency improvement will have a larger (positive) impact on the bank's ROA. Intuitively, one could expected that profit efficiency should have a larger influence on profits than cost efficiency, instead our result shows that if a bank is able to reduce its distance from the cost efficient frontier (e.g. by 10%), this will have a larger impact on the bank's ROA at the same year (i.e. ???) than those could be achieved (i.e. ???) by reducing its distance from the profit efficient frontier in a similar dimension (i.e. 10%). this show that a cost reduction normally generates an increase of bank's profits. We explain this (apparently) strange result considering that a bank's cost reduction is likely to improve the bank's profit in the same year and the bank's cost efficiency, but may not improve in the same way the profit efficiency (probably because the cost reduction may be partially offset by a revenue decline: e.g. staff cutting improve cost efficiency and bank's profit at the same time, but it is possible these may lead to customer dissatisfaction and income decline).

<< INSERT TABLE 4>>

Regarding the other factor we expected to impact on banks profit, we find that the market risk exposure is positively related (and statistically significant at the 1% confidence level) with the bank's ROA: this show that banks (i.e. have assumed this risk over the period analysed) slightly improved their performance over the same period, while banks focussed on lending missed this opportunity. The other source of risk in banking (credit, operational and liquidity risk) do not display a statistically significant (at least, at the 10% significance level) with bank's ROA: this result may be interpreted that there are no substantial difference in the way these risks were managed by banks so that these did not have statically significant impact on bank profits. We also find that some of control variables for country (namely, France) and type of banks are statistically significant at the 1% confidence level. Differently from the previous literature, the market structure features (as industry concentration and individual market share) do not display a statistically significant influence on bank's profits. Listed banks are not found to have a statistically significant relationship with bank's ROA.

<< INSERT TABLE 4>>

The influence of the bank's performance drivers analysed (efficiency, risks, market, financial structure and market condition) on shareholder value is substantially different than the one above discussed on bank's profits. Table 4 reports the results obtained from estimating our model for bank shareholder value (i.e. using EVA as dependant variable). According to our

results, the bank's profit efficiency at time *t* is found to be a statistically significant (at the 1% confidence kevel) driver of bank's EVA, while the bank cost efficiency is no anymore a statistically significant determinant of shareholder value. At first sight, this result may appear surprising, this provide evidence that cost reduction will lead banks to increase profits over the same period, but not necessarily shareholder value since, for example, cost reduction strategies may increase the bank risk and so the cost opportunity required by shareholders. The estimated profit efficiency coefficient is larger than those estimated analysing bank's profits (table 3) showing that a profit efficiency improvement will produce larger effect on bank's EVA than on ROA: this may happen since shareholders judge less risky a profit efficient bank requiring a smaller cost opportunity for the invested capital.

Regarding the relationship between banking risks and shareholder value, only the estimated coefficients for operational risk exposure at time t is positive and statistically significant: this result may signal that there are no substantial difference in the way these risks were managed by banks so that these did not have statically significant impact on bank shareholder value. The positive relationship between the operational risk exposure and bank's EVA is not really surprising since the Basle simple approach for measuring the operational risk exposure is based on the bank's gross income.

Differently from the analysis of bank's profits, market structure features display a statistically significant role in influencing the bank's EVA. According to our results, banks with a larger market share at time t-1 have a substantial advantage in creating shareholder value, especially if these banks operate in less concentrated banking industries. In addition, we found that listed banks display a statistically significant (at the 1% confidence level) advantage in creating shareholder value. In final, we find that some of control variables for

country (namely, Germany and Italy) and type of banks are statistically significant (at least at the 5% confidence level).

<< INSERT TABLE 5>>

Since we expect that the relationship between bank's profits and shareholder value with their determinants may be different across the countries analysed and the bank's type and some of control variables used in model (1) have been found statistically significant, we run model (1) for various homogenous sub-samples according to the bank's nationality[24]. Regarding the bank's ROA, we found that cost and profit efficiency have a statistically significant (at the 1% confidence level and with cost efficiency coefficients larger than profit efficiency coefficients) in France and Germany, but not in Italy and U.K. The bank's specialisation is found to be statistically significant in Germany where it is found an advantage for commercial banks in generating profits and a slight disadvantage for cooperative banks. In Italian banking, we find that the operational risk exposure has a positive relationship with bank's ROA (i.e. not really surprising since the Basle simple approach for measuring the operational risk exposure is based on the bank's gross income), while the bank's financial leverage at time t and t-1 has a negative impact on ROA supporting that banks with lower level of capital (i.e. risky banks) are not more profitable than other banks. Commercial banks seems to have a slight advantage in generating profits. In the U.K., few of the determinant of bank's ROA are found statistically significant and, namely, the credit risk losses (having a negative impact on bank's profits), the market risk exposure (positive impact) and the fact to be publicly listed (positive impact).

[24] Namely: a) French banks; b) German banks; c) Italian banks; d) British banks

<< INSERT TABLE 6>>

The relationship between the set of determinants analysed and shareholder value is again substantially different than the one above discussed for bank's profits. Profit efficiency seems to be the main driver in the shareholder value creation (in France, Germany and Italy), while cost efficiency is statistically significant in France. Regarding the relationship between banking risks and shareholder value, only the estimated coefficients for operational risk exposure at time t is positive and statistically significant in Italy and U.K. confirming that there are no substantial difference in the way these risks were managed by banks so that these did not have statically significant impact on bank shareholder value. We also found that the bank's financial leverage at time t and t-1 has a negative impact on the EVA in Italy and the U.K. supporting that banks with higher level of capital have an advantage in creating shareholder value. Differently from the analysis at the European aggregate level, market structure features of the domestic banking market do not display a clear statistically significant role in influencing the bank's EVA. We also find that quoted banks do better at creating shareholder value than their non-quoted counterparts in all countries analysed, especially France and Italy.

4. Conclusions

This paper examines the determinants of profits and shareholder value creation in European banking between 1997 and 2002. It extends the established literature by examining whether various factors (e.g. market structure, bank efficiency, financial structure and the main banking risks) impact on profits and shareholder value creation in banking. We also

investigate whether there are differences in bank's performance generation between publicly quoted and unlisted banks, and also between banks of different ownership type (commercial, savings and co-operative banks), across countries and over time.

Overall, we find that bank's cost and profit efficiency have a positive influence on bank's profits, while only profit efficiency display a positive impact on shareholder value creation. Liquidity and Credit risk do not seems to influence bank's profits and shareholder value suggesting that there are no substantial difference in the way these risks are managed by banks. Instead, we found a larger market risk exposure (measured by investing securities on total assets) supply a positive contribution on bank's profit, while the operational exposure is positively linked to the shareholder value: this result is not surprising since the proxy used to measure the operational risk exposure (following the Basle simple approach) is based on the bank's gross income. Nevertheless, it is surprising that the operational risk exposure is statistically significant linked to the bank's EVA and not to the bank's ROA suggesting that the relationship between bank's operational risk and bank's performance need further investigation. Leverage is also found to be inversely related to shareholder value creation (especially in Italy and U.K) suggesting that highly capitalised banks are more likely to generate profits and value for their owners compared with lowly capitalised counterparts. We also found that banks with a larger market share at time t-1 have a substantial advantage in creating shareholder value, especially if these banks operate in less concentrated banking industries. We also find that quoted banks do better at creating shareholder value than their non-quoted counterparts, especially in France and Italy.

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Table 1 – Number of banks in samples used for estimating shareholder value drivers in European banking

		1997	1998	1999	2000	2001	2002	Total
France	Commercial banks	199	208	213	218	235	227	1300
	Cooperative banks	95	97	101	100	111	98	602
	Savings banks	25	25	25	29	31	28	163
	Total	319	330	339	347	377	353	2065
Germany	Commercial banks	140	149	151	167	170	170	947
	Cooperative banks	832	930	1102	1220	1371	1381	6836
	Savings banks	568	587	600	609	616	604	3584
	Total	1540	1666	1853	1996	2157	2155	11367
Italy	Commercial banks	87	106	117	127	132	144	713
	Cooperative banks	132	262	386	464	505	520	2269
	Savings banks	63	64	64	66	64	66	387
	Total	282	432	567	657	701	730	3369
U.K	Commercial banks	68	76	84	85	88	85	486
	Cooperative banks	0	0	0	0	0	0	0
	Savings banks	0	0	0	0	0	0	0
	Total	68	76	84	85	88	85	486
Listed banks	Commercial banks	44	51	58	68	73	70	364

Source of data: Bankscope

Table 2 Descriptive statistics of variables used to analyse the sample of European listed and non-listed banks over the period 1999-2002 (6714 observations)

	Minimum	Maximum	Mean	Std. Deviation
EVA on Invested capital	-0.1339	0.1363	-0.0110	0.0281
Cost efficiency	0.0459	1.0000	0.7690	0.1015
Profit efficiency	0.0010	1.0000	0.6468	0.1627
Credit risk provision	-136.50000	1608.00000	10.16622	51.01009
Operational risk exposure	0.13500	5140.95000	30.31747	187.49932
Investment securities	0.9000	35515.4000	215.5145	1267.5296
Financing gap (i.e. Average loans – average deposits)	-235487.0000	33191.4000	-675.6491	7046.5081
Financial Leverage (i.e. total amount of liabilities and equity capital)	0.0930	123.1460	18.8930	7.0595
Asset Market share	0.0001	0.2279	0.00218	0.0113
Concentration Ratio (Herfinadal Index)	20.8	3012.1	264.0	442.8

Source of data: Bankscope

Table 3 -The multiple-variable relationship between profits and its determinants in European banking *[The dependent variable (ψ) is the Return on Asset]*

$$\psi_{i,t} = \partial + \sum_{k=1}^{3} \alpha_k T_k + \sum_{j=0}^{2} \beta_j x - eff_{i,t-j} + \sum_{j=0}^{2} \chi_j \pi - eff_{i,t-j} + \sum_{j=0}^{2} \delta_j CR_{i,t-j} + \sum_{j=0}^{2} \phi_j OR_{i,t-j} + \varphi MR_{i,t} + \gamma LR_{i,t} + \sum_{j=0}^{2} \omega_j LEV_{i,t-j} + \sum_{j=0}^{2} \iota_j MS_{i,t-j} + \sum_{j=0}^{2} \kappa_j CONC_{i,t-j} + \sum_{k=1}^{9} \lambda_k Z_k + \mu L_{i,t} + e_{i,t}$$

Variable		Observed coefficient	Bootstrap Std. err.
(Constant)	∂	0.00618	0.00345
Dummy variable for the year 2000 (T_1)	α_1	-0.00028	0.00018
Dummy variable for the year 2001(T_2)	α_2	-0.00025	0.00021
Dummy variable for the year 2002(T_3)	α_3	-0.00103***	0.00034
Cost efficiency estimates at time t (x-eff_t)	β_0	0.00511***	0.00128
Cost efficiency estimates at time t-1(x-$effff_{t-1}$)	β_1	-0.00113	0.00118
Cost efficiency estimates at time t-2(x-eff_{t-2})	β_2	-0.00028	0.00140
Profit efficiency estimates at time t (π-eff_t)	χ_0	0.00275***	0.00080
Profit efficiency estimates at time t-1(π-$effff_{t-1}$)	χ_1	0.00156*	0.00086
Profit efficiency estimates at time t-2(π-eff_{t-2})	χ_2	-0.00047	0.00080
Credit risk exposure at time t (CR_t)	δ_0	-0.00054	0.00063
Credit risk exposure at time t-1(CRf_{t-1})	δ_1	0.00078	0.00069
Credit risk exposure at time t-2(CR_{t-2})	δ_2	-0.00011	0.00062
Operational risk exposure at time t (OR_t)	ϕ_0	0.05274	0.03367
Operational risk exposure at time t-1(ORf_{t-1})	ϕ_1	-0.01793	0.02944
Operational risk exposure at time t-2(OR_{t-2})	ϕ_2	-0.02529	0.01730
Market risk exposure at time t (OR_t)	φ_0	0.00023***	0.00008
Liquidity risk exposure at time t (LR $_t$)	γ	0.00000	0.00000
Bank's financial leverage at time t (LEV_t)	ω_0	-0.00004	0.00006
Bank's financial leverage at time t-1 (LEV_{t-1})	ω_1	-0.00001	0.00003
Bank's financial leverage at time t-2 (LEV_{t-2})	ω_2	-0.00005	0.00004
Bank's market share at time t (MS_t)	ι_0	-0.03950	0.05226
Bank's market share at time t-1 (MS_{t-1})	ι_1	-0.09192	0.11726
Bank's market share at time t-2 (MS_{t-2})	ι_2	0.11684	0.11612
Domestic market concentration at time t ($CONC_t$)	κ_0	0.00000	0.00000
Domestic market concentration at time t-1 ($CONC_{t-1}$)	κ_1	0.00000	0.00000
Domestic market concentration at time t-2 ($CONC_{t-2}$)	κ_2	0.00000	0.00000
Dummy variable for Italian commercial banks (Z_1)	λ_1	-0.00299	0.00194
Dummy variable for Italian cooperative banks(Z_2)	λ_2	-0.00039	0.00186
Dummy variable for Italian savings banks (Z_3)	λ_3	-0.00241	0.00185
Dummy variable for French commercial banks (Z_4)	λ_4	-0.00613***	0.00122
Dummy variable for French cooperative banks (Z_5)	λ_5	-0.00698***	0.00113
Dummy variable for French savings banks (Z_6)	λ_6	-0.00847***	0.00115
Dummy variable for German commercial banks (Z_7)	λ_7	0.00064	0.00295
Dummy variable for German cooperative banks (Z_8)	λ_8	-0.00242	0.00288
Dummy variable for German savings banks (Z_9)	λ_9	-0.00224	0.00288
Dummy variable for publicly listed banks (L)	μ	0.00084	0.00062
Log likelihood =	27314.73159		
AIC = -	7.444796		
BIC =	-64885.7		

Where:

*/**/***indicate that estimated coefficients are statistically significance at the 10%, 5%, and 1% significance level, respectively

The combined dummy effects for 1999 and UK commercial banks are incorporated in the constant term. Because of the two period lag, only dummy variables for 2000 to 2002 are included in the reported estimates.

Table 4 - The multiple-variable relationship between shareholder value and its determinants in European banking *[The dependent variable (ψ) is the ratio between EVA_{bkg}, and the invested capital at time t-1]*

$$\psi_{i,t} = \partial + \sum_{k=1}^{3} \alpha_k T_k + \sum_{j=0}^{2} \beta_j x-eff_{i,t-j} + \sum_{j=0}^{2} \chi_j \pi-eff_{i,t-j} + \sum_{j=0}^{2} \delta_j CR_{i,t-j} + \sum_{j=0}^{2} \phi_j OR_{i,t-j} + \varphi MR_{i,t} + \gamma LR_{i,t} + \sum_{j=0}^{2} \omega_j LEV_{i,t-j} + \\ + \sum_{j=0}^{2} \iota_j MS_{i,t-j} + \sum_{j=0}^{2} \kappa_j CONC_{i,t-j} + \sum_{k=1}^{9} \lambda_k Z_k + \mu L_{i,t} + e_{i,t}$$

Variable		Observed coefficient	Bootstrap std. err.
(Constant)	∂	0.00559	0.03109
Dummy variable for the year 2000 (T_1)	α_1	0.01175***	0.00302
Dummy variable for the year 2001(T_2)	α_2	0.01823***	0.00294
Dummy variable for the year 2002(T_3)	α_3	0.00651**	0.00306
Cost efficiency estimates at time t (x-eff_t)	β_0	-0.02373	0.01898
Cost efficiency estimates at time t-1(x-eff_{t-1})	β_1	0.01755	0.01458
Cost efficiency estimates at time t-2(x-eff_{t-2})	β_2	0.01946	0.01585
Profit efficiency estimates at time t (π-eff_t)	χ_0	0.04251***	0.01052
Profit efficiency estimates at time t-1(π-eff_{t-1})	χ_1	0.00267	0.00964
Profit efficiency estimates at time t-2(π-eff_{t-2})	χ_2	0.00461	0.00879
Credit risk exposure at time t (CR_t)	δ_0	0.00117	0.00455
Credit risk exposure at time t-1(CRf_{t-1})	δ_1	-0.00094	0.00508
Credit risk exposure at time t-2(CR_{t-2})	δ_2	-0.00003	0.00518
Operational risk exposure at time t (OR_t)	ϕ_0	0.32407**	0.13826
Operational risk exposure at time t-1(ORf_{t-1})	ϕ_1	-0.01742	0.25792
Operational risk exposure at time t-2(OR_{t-2})	ϕ_2	-0.29028	0.25535
Market risk exposure at time t (OR_t)	φ_0	0.00083	0.00113
Liquidity risk exposure at time t (LR_t)	γ	0.00000	0.00000
Bank's financial leverage at time t (LEV_t)	ω_0	0.00000	0.00077
Bank's financial leverage at time t-1 (LEV_{t-1})	ω_1	0.00005	0.00069
Bank's financial leverage at time t-2 (LEV_{t-2})	ω_2	-0.00034	0.00055
Bank's market share at time t (MS_t)	ι_0	-0.59985	0.51438
Bank's market share at time t-1 (MS_{t-1})	ι_1	1.23750**	0.63918
Bank's market share at time t-2 (MS_{t-2})	ι_2	-0.71445	0.56908
Domestic market concentration at time t ($CONC_t$)	κ_0	-0.00007**	0.00003
Domestic market concentration at time t-1 ($CONC_{t-1}$)	κ_1	-0.00012**	0.00006
Domestic market concentration at time t-2 ($CONC_{t-2}$)	κ_2	-0.00011***	0.00003
Dummy variable for Italian commercial banks (Z_1)	λ_1	-0.05836***	0.01327
Dummy variable for Italian cooperative banks(Z_2)	λ_2	-0.03124**	0.01280
Dummy variable for Italian savings banks (Z_3)	λ_3	-0.05567***	0.01357
Dummy variable for French commercial banks (Z_4)	λ_4	0.00032	0.01298
Dummy variable for French cooperative banks (Z_5)	λ_5	-0.00833	0.01036
Dummy variable for French savings banks (Z_6)	λ_6	-0.00471	0.01157
Dummy variable for German commercial banks (Z_7)	λ_7	-0.05263**	0.02163
Dummy variable for German cooperative banks (Z_8)	λ_8	-0.04514**	0.01982
Dummy variable for German savings banks (Z_9)	λ_9	-0.03601*	0.01954
Dummy variable for publicly listed banks (L)	μ	0.01780***	0.00600
Log likelihood = 8271.830345			
AIC = -2.245659			
BIC = -64900.32			

Where:

*/**/***indicate that estimated coefficients are statistically significance at the 10%, 5%, and 1% significance level, respectively

The combined dummy effects for 1999 and UK commercial banks are incorporated in the constant term. Because of the two period lag, only dummy variables for 2000 to 2002 are included in the reported estimates.

Table 5 - The multiple-variable relationship between profits and its determinants in domestic European banking industries *[The dependent variable (ψ) is the Return on Assets]*

$$\psi_{i,t} = \partial + \sum_{j=0}^{2} \beta_j x - eff_{i,t-j} + \sum_{j=0}^{2} \chi_j \pi - eff_{i,t-j} + \sum_{j=0}^{2} \delta_j CR_{i,t-j} + \sum_{j=0}^{2} \phi_j OR_{i,t-j} + \varphi MR_{i,t} + \gamma LR_{i,t} + \sum_{j=0}^{2} \omega_j LEV_{i,t-j} + \\ + \sum_{j=0}^{2} \iota_j MS_{i,t-j} + \sum_{j=0}^{2} \kappa_j CONC_{i,t-j} + \sum_{k=1}^{2} \lambda_k Z_k + \mu L_{i,t} + e_{i,t}$$

Variable		Observed coefficients			
		France	Germany	Italy	U.K.
(Constant)	∂	-0.03595***	-0.00476*	-0.01373	-0.01217
Cost efficiency estimates at time t (x-eff_t)	β_0	0.03641***	0.00667***	0.00170	-0.00300
Cost efficiency estimates at time t-1(x-eff_{t-1})	β_1	0.00249	0.00040	-0.00086	-0.00077
Cost efficiency estimates at time t-2(x-eff_{t-2})	β_2	-0.00098	0.00169	-0.00433**	0.00388
Profit efficiency estimates at time t (π-eff_t)	χ_0	0.01949**	0.00274***	-0.00093	-0.00521
Profit efficiency estimates at time t-1(π-eff_{t-1})	χ_1	-0.00793	0.00170**	-0.00103	-0.00530
Profit efficiency estimates at time t-2(π-eff_{t-2})	χ_2	0.01480*	-0.00011	-0.00080	-0.00547
Credit risk exposure at time t (CR_t)	δ_0	0.00021	-0.00499	0.00459	-0.00450**
Credit risk exposure at time t-1(CR_{t-1})	δ_1	-0.00346	0.00522	-0.00509	-0.00539*
Credit risk exposure at time t-2(CR_{t-2})	δ_2	0.00062	0.00061	0.00285	0.00287
Operational risk exposure at time t (OR_t)	ϕ_0	0.45912	0.16135	0.85240*	0.04907*
Operational risk exposure at time t-1(ORf_{t-1})	ϕ_1	0.31229	0.28065	-0.24902	-0.02457
Operational risk exposure at time t-2(OR_{t-2})	ϕ_2	0.20633	0.01564	-0.12835	-0.01199
Market risk exposure at time t (OR_t)	φ_0	0.00053	0.00000	0.00055**	0.00254***
Liquidity risk exposure at time t (LR $_t$)	γ	0.00000	0.00000	0.00000	0.00000
Bank's financial leverage at time t (LEV$_t$)	ω_0	0.00002	-0.00007	-0.00107***	0.00018
Bank's financial leverage at time t-1 (LEV$_{t-1}$)	ω_1	0.00002	0.00013	-0.00055**	-0.00023
Bank's financial leverage at time t-2 (LEV$_{t-2}$)	ω_2	-0.00001	-0.00011	0.00003	-0.00022
Bank's market share at time t (MS$_t$)	ι_0	0.03080	-0.30571	-0.00248	-0.20527
Bank's market share at time t-1 (MS$_{t-1}$)	ι_1	-0.32591	0.70162	-0.01062	0.05455
Bank's market share at time t-2 (MS$_{t-2}$)	ι_2	0.26648	-0.46770	0.01069	0.02448
Domestic market concentration at time t (CONC$_t$)	κ_0	0.00001	0.00000	0.00000	-0.00006
Domestic market concentration at time t-1 (CONC$_{t-1}$)	κ_1	0.00000	-0.00019	0.00000	0.00011
Domestic market concentration at time t-2 (CONC$_{t-2}$)	κ_2	0.00000	-0.00014	0.00006	-0.00001
Dummy variable for commercial banks (Z_1)	λ_1	-0.00087	0.00259***	0.00244***	N/A
Dummy variable for cooperative banks (Z_2)	λ_3	0.00108	-0.00043***	0.00073	N/A
Dummy variable for publicly listed banks (L)	μ	0.00105	-0.00061	0.00123	0.00612***
Log Likelihood =		2057.8	23966.5	3516.6	1100.9
AIC=		-5.9	-8.9	-7.4	-6.1
BIC=		-4258.8	-45773.7	-62263.8	-1924.1

Where:

*/**/***indicate that estimated coefficients are statistically significance at the 10%, 5%, and 1% significance level, respectively

The combined dummy effects for 1999 and UK commercial banks are incorporated in the constant term. Because of the two period lag, only dummy variables for 2000 to 2002 are included in the reported estimates.

Table 6 - The multiple-variable relationship between shareholder value and its determinants in domestic European banking industries *[The dependent variable (ψ) is the ratio between EVA_{bkg}, and the invested capital at time t-1]*

$$\psi_{i,t} = \partial + \sum_{j=0}^{2} \beta_j x - eff_{i,t-j} + \sum_{j=0}^{2} \chi_j \pi - eff_{i,t-j} + \sum_{j=0}^{2} \delta_j CR_{i,t-j} + \sum_{j=0}^{2} \phi_j OR_{i,t-j} + \varphi MR_{i,t} + \gamma LR_{i,t} + \sum_{j=0}^{2} \omega_j LEV_{i,t-j} + \\ + \sum_{j=0}^{2} \iota_j MS_{i,t-j} + \sum_{j=0}^{2} \kappa_j CONC_{i,t-j} + \sum_{k=1}^{2} \lambda_k Z_k + \mu L_{i,t} + e_{i,t}$$

Variable		Observed coefficients			
		France	Germany	Italy	U.K.
(Constant)	∂	0.24853*	0.00113	-0.17841	0.22817
Cost efficiency estimates at time t (x-eff_t)	β_0	0.28680***	-0.02152	-0.00820	-0.01220
Cost efficiency estimates at time t-1(x-eff_{t-1})	β_1	0.07604	0.00654	-0.01923	0.01154
Cost efficiency estimates at time t-2(x-eff_{t-2})	β_2	-0.03733	0.00546	0.05760***	0.00869
Profit efficiency estimates at time t (π-eff_t)	χ_0	0.18224***	0.05253***	-0.00327	0.10385***
Profit efficiency estimates at time t-1(π-eff_{t-1})	χ_1	-0.04041	0.01324	-0.00164	0.07018**
Profit efficiency estimates at time t-2(π-eff_{t-2})	χ_2	-0.04868	-0.01183	-0.00007	0.08443***
Credit risk exposure at time t (CR_t)	δ_0	-0.04304	-0.01237	-0.04406	-0.01437
Credit risk exposure at time t-1(CR_{t-1})	δ_1	0.20897	0.01454	0.05072	0.00767
Credit risk exposure at time t-2(CR_{t-2})	δ_2	-0.02543	0.00249	0.00592	0.00338
Operational risk exposure at time t (OR_t)	ϕ_0	-1.65005	1.16758	-9.26016**	-0.12420**
Operational risk exposure at time t-1(ORf_{t-1})	ϕ_1	-3.58035	-5.53510	2.25349	-0.06500
Operational risk exposure at time t-2(OR_{t-2})	ϕ_2	0.78556	2.21177	1.94956	0.22666
Market risk exposure at time t (OR_t)	φ_0	-0.00068	0.00264	-0.00084	-0.00326
Liquidity risk exposure at time t (LR_t)	γ	0.00000	0.00000	0.00000	0.00000**
Bank's financial leverage at time t (LEV_t)	ω_0	-0.00062	0.00132	-0.00555*	-0.00653***
Bank's financial leverage at time t-1 (LEV_{t-1})	ω_1	0.00005	-0.00621	-0.00779**	0.00125
Bank's financial leverage at time t-2 (LEV_{t-2})	ω_2	-0.00029	0.00434	-0.00135	0.00204
Bank's market share at time t (MS_t)	ι_0	-0.77809	0.10898	-0.53979	0.36698
Bank's market share at time t-1 (MS_{t-1})	ι_1	1.73646	5.14305	0.77764	0.09170
Bank's market share at time t-2 (MS_{t-2})	ι_2	-0.99109	-4.31379	-0.40079	-0.00800
Domestic market concentration at time t ($CONC_t$)	κ_0	-0.00005	-0.00001	-0.00012	0.00125**
Domestic market concentration at time t-1 ($CONC_{t-1}$)	κ_1	0.00002	0.01234**	0.00026**	-0.00219**
Domestic market concentration at time t-2 ($CONC_{t-2}$)	κ_2	-0.00005	0.02168***	0.00051	0.00041*
Dummy variable for commercial banks (Z_1)	λ_1	0.02462*	-0.01432	0.00119	N/A
Dummy variable for cooperative banks (Z_2)	λ_3	0.01119	-0.00658***	-0.01534**	N/A
Dummy variable for publicly listed banks (L)	μ	0.01907*	0.00577	0.01929**	0.02157
	Log Likelihood =	463.3	6840.6	1204.4	385.4$
	AIC=	-1.3	-2.5	-2.513	-2.04
	BIC=	-4293.4	-45749.4	-6222.6	-1921.9

Where:

*/**/***indicate that estimated coefficients are statistically significance at the 10%, 5%, and 1% significance level, respectively

The combined dummy effects for 1999 and UK commercial banks are incorporated in the constant term. Because of the two period lag, only dummy variables for 2000 to 2002 are included in the reported estimates.

Annex

The annex briefly describes methods used to estimate: 1) bank operational and credit risk measurement; 2) cost efficiency; 3) profit efficiency.

1. Credit and operational risks measurement

Regarding bank's exposure to credit risk, the bulk of the established literature focuses on the estimation of expected credit losses (obtained by the product of the probability of default, loss given default rate and the exposure at default). In the literature there are several methods for estimating expected credit losses and it is reasonable to assume that European banks can accurately forecast expected credit losses. Since these losses are usually taken into account by banks and their impact on bank performance can be assessed relatively easily, our focus is on the non-expected credit losses, i.e. all losses exceeding those expected by the bank. As a proxy for these unexpected losses, we focus on the annual provision to loan loss reserves, i.e. the reserve that covers future unexpected loan losses[25].

Operational risk is also expected to have an impact on value creation in banking. The Basel Committee on Banking Supervision (2005, p.137) defines operational risk as "the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. This definition includes legal risk, but excludes strategic and reputational risk". For measuring the exposure to operational risk, we focus on the first measurement method developed by the Basel Committee on Banking Supervision (2005) for calculating the capital charge (labelled as the "basic indicator approach") since the other two methods (i.e. the standardised approach and the advanced measurement approaches) would require

[25] Expected loan losses are measured by write-downs on loan.

information that is not publicly available[26]. According to this latter method, banks must hold capital for operational risk equal to the average over the previous three years of a 15% (α) of positive annual gross income (model 1)[27]. The regulatory capital charge for operational risk can be calculated as:

$$k_{\mathrm{i}} = \frac{\sum_{\mathrm{i}=0}^{n} (\alpha \, x \, \mathrm{GI}_{\mathrm{i}})}{n} \qquad (2)$$

where K is the capital charge under the basic indicator approach, GI is the annual gross income [i.e. the sum of all net interest and non-interest income (excluding realised profits/losses from the sale of securities in the banking book and extraordinary or irregular items) gross of any provisions and operating expenses], where positive, over the previous three years, n is the number of the previous three years for which gross income is positive, α is 15% (which is set by the Committee, relating the industry wide level of required capital to the industry wide level of the indicator). As such, our proxy for the bank operational risk exposure is the capital charge required under the basic indicator approach.

2. Cost efficiency

Cost efficiency is measured using the Stochastic Frontier (SF) analysis and, namely, the Battese and Coelli's (1995) stochastic frontier model:

$$\mathrm{Ln}\, TC_{it} = x_{it}\beta + (V_{it} + U_{it}) \qquad (3)$$

where $ln\ TC_i$ is the logarithm of the cost of production of the i-th bank, x_i is a $kx1$ vector of standardised input prices and output of the i-th bank, β is a vector of unknown parameters, V_i are

[26] In addition, our sample of European banks mainly comprises small commercial banks, cooperative and saving banks that are likely to employ the basic indicator approach.
[27] Basel Committee on Banking Supervision (2005, p.141)

random variables which are assumed to be i.i.d $N(0,\sigma^2_v)$ and independent of U_i, U_i are non-negative random variables which are assumed to account for the cost inefficiency in production and are assumed to be i.i.d $N(m_{it},\sigma^2_U)$, m_{it} is defined as $m_{it} = z_{it}\delta$, z_{it}, is a *px1* vector of variables which may influence the efficiency of a bank, δ is an *px1* vector of parameters to be estimated. Since our sample is composed of different type of banks (namely, commercial, cooperative and savings banks) and data from a eight year period, the Battese and Coelli (1995) model enables us to control whether a particular time period influences bank efficiency. We use the standard translog functional form and our cost function is the following[28]:

$$\begin{aligned} \ln TC = {} & \alpha_0 + \sum_{i=1}^{3} \alpha_i \ln y_i + \sum_{j=1}^{3} \beta_j \ln w_j + \\ & + \frac{1}{2}\left[\sum_{i=1}^{3}\sum_{j=1}^{3} \delta_{ij} \ln y_i \ln y_j + \sum_{i=1}^{3}\sum_{j=1}^{3} \gamma_{ij} \ln w_i \ln w_j \right] + \\ & + \sum_{i=1}^{3}\sum_{j=1}^{3} \rho_{ij} \ln y_i \ln w_j + \sum_{i=1}^{7} Z_i + \ln u_c + \ln \varepsilon_c \end{aligned} \qquad (4)$$

where TC is the logarithm of the cost of production, y_i (i=1, 2, 3) are output quantities, w_j (j=1, 2, 3) are input prices, Z_i y_i (i=1, 2, …, 7) are dummy variables used to control for the influence of a specific time period over cost efficiency. In order guarantee the linear homogeneity in factor prices (i.e. $\sum_{j=1}^{3} \beta_j = 1$; $\sum_{i=1}^{3} \gamma_{ij} = 0$ and $\sum_{j=1}^{3} \rho_{ij} = 0$), it is necessary (and sufficient) to apply the following restrictions: 1) the standard symmetry: according with this restriction, it is assumed that $\delta_{ij} = \delta_{ji}$ and $\gamma_{ij} = \gamma_{ji}$; 2) linear restriction of the cost function (model 6). In addition, the factor share equations (embodying restrictions imposed by Shephard's Lemma or Hotelling's Lemma) are excluded since these would impose the undesiderable assumption of no allocative inefficiencies [see, for example, Berger and Mester (1997 and 2003)].

[28] The choice of the use of translog is motivated by two reasons. First, Altunbas and Chakravraty (2001) identified some problems associated with using the Fourier functional form, especially when dealing with heterogenous data sets. Secondly, Berger and Mester (1997) observe that the translog functional form and Fourier-flexible form are substantially equivalent from an economic viewpoint and both rank individual bank efficiency in almost the same order.

2. *Alternative profit efficiency*

Profit efficiency is estimated using the alternative profit function since prices are often inaccurately measured in banking[29]. We use the standard translog functional form[30]:

$$\ln(\pi+\theta)=\alpha_0+\sum_{i=1}^{3}\alpha_i \ln y_i+\sum_{j=1}^{3}\beta_j \ln w_j+ \\ +\frac{1}{2}\left[\sum_{i=1}^{3}\sum_{j=1}^{3}\delta_{ij} \ln y_i \ln y_j+\sum_{i=1}^{3}\sum_{j=1}^{3}\gamma_{ij} \ln w_i \ln w_j\right]+ \\ +\sum_{i=1}^{3}\sum_{j=1}^{3}\rho_{ij} \ln y_i \ln w_j+\sum_{i=1}^{7}Z_i+\ln u_c+\ln \varepsilon_c \qquad (5)$$

where y_i (i=1, 2, 3) are output quantities, w_j (j=1, 2, 3) are input prices, Z_i (i=1, 2, …, 7) are dummy variables used to control for the influence of a specific time period over cost efficiency. The dependent variable for the profit function replaces the normalised *lnTC* (used to estimate cost efficiency) with $ln\ (\pi+\theta)$, where π is published bank's net income standardised by the average cost of capital (w_3) and θ is a constant, defined by adding 1 to the absolute value of the lowest (π/w_3) in the sample [i.e. $\theta=\left|(PT/w_3)^{\min}\right|+1$], in order to make positive the natural log of bank's profits. The standard Stochastic Frontier (SF) analysis is employed to estimate alternative profit efficiency for each bank: the Battese and Coelli (1995) model of a stochastic frontier function has been adopted since this model enable us to control for different types of bank affects profit efficiency estimates[31].

[29] Berger and Mester (1997, p. 904) notes that "if prices are inaccurately measured –as is likely, given the available banking data – the predicted part of the standard profit function would explain less of the variance of profits and yield more error in the estimation of the efficiency terms $ln\ u_\pi$. In this event, it may be appropriate to try specifying other variables in the profit function that might yield a better fit, such as the output quantity vector, *y*, as in the alternative profit function".

[30] Following the Berger and Mester (1997) findings and considering our research aims, the translog functional form is preferred to the Fourier-flexible since it is substantially equivalent on an economic viewpoint and both rank of individual efficiency banks in almost the same order.

[31] For further details, see Coelli et al., (1997)

In the frontier estimation of cost and profit efficiency, bank inputs and outputs are defined according to the value-added approach, originally proposed by Berger and Humphrey (1992). We posit[32] that labour (measured as personnel expenses), physical capital (expressed as the average value of fixed-tangible assets) and financial capital (measured as loanable funds) are inputs, whereas demand deposits, total loans and other earning assets are outputs. In detail:

For estimating, cost and profit efficiency, we use a cross-section sample by year[33] and country[34] as this is preferred to a panel data set or an international sample[35]. We defined bank inputs and outputs according to the value-added approach, originally proposed by Berger and Humphrey (1992), and we posit[36] that labour (measured as personnel expenses), physical capital (expressed as the average value of fixed-tangible assets) and financial capital (measured as loanable funds) are inputs, whereas demand deposits, total loans and other earning assets are outputs.

[32] This selection of inputs and outputs follows the studies by Sathye (2001) and Dietsch and Lozano (2000), Aly et al. (1990) and Hancock (1986), wherein the author develops a methodology based on user costs to determine the outputs and inputs of a banking firm.
[33] We use a cross-section sample by year since many bank observations would have been lost selecting a balanced panel data set.
[34] We prefer to use a sample of domestic banks for estimating the cost efficiency frontier since banks in the same country are more homogeneous (and comparable) than banks working in different countries.
[35] The descriptive statistics are available from the authors on request.
[36] This selection of inputs and outputs follows the studies by Sathye (2001) and Dietsch and Lozano (2000), Aly et al. (1990) and Hancock (1986), wherein the author develops a methodology based on user costs to determine the outputs and inputs of a banking firm.