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Efficiency Effects of Bank Mergers and Acquisitions in Europe

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Abstract

Next to technological progress and deregulation, the introduction of the euro is widely considered to be an important catalyst for bank consolidation in Europe. In order to assess the public policy issues surrounding bank mergers, this paper analyzes the efficiency effects of 52 horizontal bank mergers over the period 1994-1998, i.e. the period immediately preceding the start of EMU. We find evidence of substantial unexploited scale economies and large X-inefficiencies in European banking. The dynamic merger analysis indicates that the cost efficiency of merging banks is positively affected by the merger, while the relative degree of profit efficiency improves only marginally. We do not find any evidence that merging banks are able to exercise greater market power in the deposit market. Hence, the bank M&As in this study appear to be socially beneficial.

1. Introduction

The introduction of the euro potentially has a major impact on European banking markets. The elimination of the uncertainty and the costs associated with the existence of different currencies is expected to lead to fiercer bank competition, at least in several market segments. To compete effectively in the European banking markets, banks may choose to consolidate through mergers and acquisitions (M&As). Before EMU, there was a lot of speculation about the impact of the introduction of the euro on the structure of European bank markets, and more specifically about the possible creation of large pan-European banks (ECB, 1999; Danthine et al., 1999). However, even in 1999 and 2000, domestic bank mergers in the euro area have continued to dominate cross-border mergers and international mergers (i.e., those involving banks headquartered in non-eurozone countries). Nevertheless, the numbers recorded in ECB (2000) indicate that the pace of consolidation activity in European banking has remained high in the run-up to EMU. The expectation is that EMU, through further deregulation, financial market integration, and disintermediation, will help to sustain M&A activity (see Danthine et al., 2000).

Consolidation may be an efficient way to eliminate the widely documented excess capacity in European banking markets (see Davis and Salo, 1998). In the presence of excess capacity, some banks are below efficient scale, have an inefficient product mix, or may be inside the efficient frontier. M&As may help solve these problems more efficiently than outright bankruptcies because they preserve the franchise values of the merging firms. Moreover, there are several reasons to suspect that the efficiency effects of M&As in the 1990s may differ from those in the 1980s. Gradual deregulation, technological innovations and the associated increase in competition have induced banks to adapt their strategies. The resulting focus on an optimal organizational design and improved efficiency tends to predict more pronounced merger gains in the 1990s. On the other hand, consolidation also leads to increased concentration, which may entail negative consequences for different bank customer segments. Therefore, bank regulators and competition authorities, among others, are interested in gaining a better understanding of the potential consequences of enhanced bank consolidation.

As surveyed by Berger et al. (1999), a substantial literature investigates the causes and consequences of bank mergers. Bank M&As may be geared to exploit economies of scale or scope, improve the X-efficiency of the consolidating banks, may enable the merged banks to exercise increased market power, or may simply be motivated by the management's desire for increased size. Consequently, bank mergers may entail diverging effects on cost and profit efficiency, as well as on loan and deposit pricing. To date, most of the available knowledge on the performance effects of bank M&As comes from scrutiny of the US market (see Piloff and Santomero, 1998). European bank mergers have attracted less attention, partly caused by the methodological difficulties in studying the fragmented European bank markets. However, the US experience cannot be automatically applied to the European environment since the regulation and the structure of European banking markets is different.

This paper examines the performance effects of European bank M&As in the 1990s. The sample consists of 52 bank mergers over the period 1994-1998, i.e. the period immediately preceding the introduction of the euro. We first investigate the existence of economies of scale in European banking, since scale benefits are often invoked as a motivation for mergers. Next, we estimate the level of operational and profit efficiency for the European banking sector and for the banks involved in M&As. The estimation of X-efficiency is particularly important for the study of bank M&As because it is the only way to determine whether these mergers may be in the public interest. A merger is potentially beneficial to society if it improves cost and/or profit efficiency. The estimation of cost and profit efficiency allows the distinction between improvement in efficiency versus market power effects, something which is impossible to accomplish with simple cost and profit ratios. Operational efficiency gains, if they occur, have to be weighed against any social losses that may occur from an increase in the exercise of market power. Moreover, we use the efficiency analysis to discover information about the ex ante conditions that predict whether a particular merger is likely to yield significant efficiency gains. Finally, we investigate whether or not merging banks are able to reap benefits from an increased use of market power on the deposit market.

Our findings indicate that there remain significant unexploited economies of scale in European banking, also for the very large banks. Moreover, we report that the cost efficiency of European banking systems, as well as the relative efficiency of those banks which engaged in mergers, varies considerably. Comparing merging banks with their non-merging peers, we find that large merging banks exhibit a lower degree of profit efficiency than average, while small merging banks exhibit a higher level of profit efficiency than their peer group. In the dynamic M&A analysis, we find that the cost efficiency of large and small banks improves after mergers. We find only partial support for the relative cost efficiency hypothesis stating that the increase in the merged banks' cost efficiency is positively related to the difference in the ex ante cost efficiencies of the merging banks. Most of the evidence is consistent with the low cost efficiency hypothesis stating that the increase in cost efficiency is likely to be larger when both banks have relatively poor pre-merger cost efficiency levels. With respect to profit efficiency, we find that mergers tend to reduce profit efficiency for the large banks, while profit efficiency rises for the set of small banks. No clear support is found for either the relative profit efficiency hypothesis or the low profit efficiency hypothesis. Finally, we find that deposit rates tend to increase following a merger, which indicates that the merging banks are unable to exercise greater market power.

The remainder of this paper is organized as follows. Section 2 briefly surveys the extant literature on the efficiency and pricing effects of bank mergers. Section 3 describes the merger and bank data used in this study. Section 4 presents estimates of the returns to scale for a large sample of European banks and for particular categories of banks. Section 5 presents estimates of the cost efficiency of the national banking systems in Europe. Section 6 examines how mergers affect the cost efficiency, the profit efficiency and the deposit interest rates of the merging European banks. Section 7 concludes.

2. Efficiency consequences of bank M&As

Over the past decade, substantial research has been devoted to the question whether M&As in the banking industry improve the efficiency of the consolidating firms. The

effects of bank M&As have been investigated using two basic types of methodology: event studies and comparisons of pre-merger and post-merger performance. Event studies examine the impact of merger announcements on share prices[1]. Changes in the combined market value for the acquiring and the acquired banks, adjusted using a market model for changes in the overall stock market evolution, provide an estimate of the anticipated effect of M&As on the future profits of the consolidated institutions. The results for the US are mixed, but most studies fail to find any significant value increases (Houston and Ryngaert, 1994; Piloff, 1996; Kwan and Eisenbeis, 1999). In Europe, based on a sample of 54 very large deals over the period 1988 to 1997, Cybo-Ottone and Murgia (2000) document that the capital market performance of the bidder and the target institutions are statistically significant at the announcement time. It should be noted that the sample also contains 18 cross-product deals in which banks expand into insurance or investment banking. Yet, although the results show a great deal of cross-sectional variation, the abnormal returns associated with domestic bank to bank deals are significantly positive, on average. These findings are consistent with an efficiency explanation of bank mergers. The authors ascribe the fact that their results differ from those reported for US bank mergers to the different structure and regulation of EU banking markets.

The examination of pre-merger and post-merger performance can take various formats. Berger et al. (1999) make a distinction between static and dynamic analyses. Static analyses are defined as studies that relate the potential consequences of consolidation to certain characteristics of financial institutions that are associated with consolidation, such as institution size. Static analyses do not use data on M&As and, hence, do not provide direct information on the effects of M&As, but they may nonetheless be useful in predicting the consequences of M&As, e.g. in terms of realizable scale and scope economies. Dynamic analyses are defined as studies that compare the performance of financial institutions before and after M&As or compare the behavior of recently

[1] The interpretation of event studies is subject to a number of well known problems (see Berger, 1998). It is possible that information may have leaked to the stock market prior to the M&A announcement, a problem which may be especially severe during merger waves. M&A announcements may also incorporate signals unrelated to the merger. Finally, it is impossible to determine whether changes in market values are caused by changes in market power or changes in efficiency.

consolidated institutions with other institutions that have not engaged in M&As. A number of studies analyze the impact of M&As with performance ratios based on accounting variables. Others investigate the evolution of the cost and profit efficiency relative to a shifting industry benchmark for merging and non-merging banks.

The literature suggests that there is a substantial potential for efficiency improvements from mergers of banks. Most recent analyses find unexploited scale economies even for fairly large bank sizes, both in the US (Berger and Mester, 1997; Berger and Humphrey, 1997) and in Europe (Allen and Rai, 1996; Molyneux et al., 1996; Vander Vennet, 2001). The prospects for scale efficiency gains appear to be greater in the 1990s than in the 1980s. This finding is usually ascribed to technological progress, regulatory changes and the beneficial effect of lower interest rates (Berger et al., 1999). In addition, there is evidence that the banking industry exhibits substantial X-inefficiencies, on the order of about 20-25% of total costs (see Berger and Humphrey, 1997). This evidence suggests that M&As may substantially improve the cost efficiency when relatively efficient banks acquire relatively inefficient banks.

Yet, a lot of studies conclude that the potential efficiency gains are seldom realized. Studies on US bank mergers find little or no cost X-efficiency improvements on average (DeYoung, 1997; Peristiani, 1997; Berger, 1998). Apparently, the potential gains from consolidating branches, computer operations, etc., may have been offset by managerial inefficiencies or problems in integrating systems. Case study evidence suggests that the cost efficiency effects of M&As may depend on the motivation behind the mergers and the consolidation process (Rhoades, 1998). Haynes and Thompson (1999) explore the productivity effects of acquisitions for a panel of 93 UK building societies over the period 1981-1993. In contrast to much of the existing bank merger literature, the results indicate significant and substantial productivity gains following acquisition. These gains were not the result of economies of scale, but are found to be consistent with a merger process in which asset are transferred to the control of more productive managements. Resti (1998) reports increased levels of efficiency for Italian bank M&As, especially when the deals involved relatively small banks with considerable market overlap. Some

of the dynamic studies also examine the extent to which the efficiency consequences of individual M&As could be predicted ex ante. If the conditions that make a specific M&A very likely to improve the ex post efficiency can be identified, this may provide valuable information to policy makers in their assessment of the social value of the proposed deal. Akhavein et al. (1997) and Berger (1998) find that substantial efficiency gains were predicted if either or both of the consolidating banks were less efficient than a group of peer banks. These results are consistent with the hypothesis that the mergers have woken up entrenched managers.

A number of studies compare bank profitability ratios, such as the return on assets or the return on equity before and after M&As relative to peer groups of banks that did not engage in M&As. Some found improved profitability ratios associated with M&As (Cornett and Tehranian, 1992), although others found no improvement (Piloff, 1996; Akhavein et al, 1997). Vander Vennet (1996) uses cost and profit ratios to examine the performance effects in a sample of 492 European bank takeovers over the period 1988-1993. Domestic mergers of equal-sized partners are found to improve the profitability of the consolidated banks. Domestic takeovers are characterized by the absence of performance improvements following the acquisition, although the target banks exhibit inferior performance prior to the takeover. A problem with drawing conclusions from profitability ratios is that they incorporate both changes in market power and changes in operational efficiency, which cannot be disentangled without controlling for efficiency. This can be accomplished by examining the profit efficiency effect of M&As. Akhavein et al (1997) and Berger (1998) found that US bank mergers from the 1980s and early 1990s improved profit efficiency. This gain could be linked to improved diversification of risks, since the consolidating banks were found to shift their asset portfolios from securities to loans.

Given the evidence that bank M&As often fail to upgrade cost efficiency, improved profitability may be caused by increased market power. Dynamic market power analyses examine the effects of bank M&As on prices and profits, incorporating any changes in organizational focus or managerial behavior. Akhavein et al. (1997) found very small

price changes in a study of large US bank mergers. Simons and Stavins (1998) examine the effect of mergers among relatively large banks on their deposit pricing strategy and the reaction of rival banks for a sample of 499 mergers of US banks over the period 1986-1994. They find that a bank's own merger in its main market reduces its deposit interest rate during the first and the second years of the merger, but raises it in the third year. The combined three-year effect is slightly positive but of negligible magnitude and not statistically significant. In some cases, competitors of a merged bank are more successful in exercising market power by lowering deposit rates than the merged banks themselves. This finding is consistent with the hypothesis that the merger process may deteriorate service quality, so that the merged institution is prevented from lowering its interest rates. Possible alternative explanations include the increased competition from nonbank financial services companies or the shifting technology of bank service delivery.

3. Merger and bank data

The individual bank data are retrieved from the Bankscope database maintained by Fitch/IBCA, the London-based credit rating agency. This database contains the balance sheet and income statements for a large number of European banks. We include the following types of banks in our analysis: (1) commercial banks, (2) cooperative banks and savings banks, (3) mortgage and real estate banks, and (4) medium and long term credit banks and specialized governmental credit institutions (called 'other banks' hereafter). We concentrate our analysis on horizontal M&As, which are assumed to offer a broad potential scope for cost and profit efficiency improvements. In order to be included in the sample, the bank data has to fulfill a number of accuracy criteria. More specifically, we eliminate banks with zero or negative interest expenses or operating expenses and zero or negative off-balance sheet activities or equity capital[2].

The sample of European bank mergers and acquisitions consists of 52 M&As consummated during the period 1994-1998, the period immediately preceding the launch

[2] This data is not necessarily wrong, but it may severely distort the regression results.

of the euro. In order to be included in the sample, the following criteria are imposed : (1) The merger involves banks headquartered in one of the EU countries, (2) the M&A deal is a full merger of two banks or entails the transfer of control from the target to the acquiring bank, (3) the merger is between unaffiliated banks, and (4) at least one year of pre- and post-merger data for the consolidating banks is available in Bankscope. Especially the application of the last criterion eliminated a large number of mergers between very small banks[3]. For 6 of the 52 mergers, data are available for both entities after the merger. An overview of the M&As in the sample is provided in table 1.

== Table 1 ==

Table 1 shows the distribution of the European bank M&As by year of execution, by type of banks involved and by country of origin. Of the 52 M&As, 38 refer to intra-type M&As, i.e. 15 mergers among commercial banks (C-C), 21 among savings and cooperative banks (S-S), and 2 among mortgage banks (M-M). The other 14 are inter-type M&As (2 S-O, 10 C-S, 1 C-O, and 1 C-M). If we define large banks as those with total assets exceeding 5 billion euro, 25 M&As can be classified as small and 27 as large. The majority of the small mergers are deals between German banks and savings or cooperative banks. The analysis of the efficiency effects of bank consolidation will therefore be executed for both subgroups of large and small bank mergers in order to detect any differences in terms of performance consequences or merger motivation.

4. Economies of scale

Economies of scale are often invoked by consolidating banks as one of the main motivations behind mergers. As noted in section 2, the literature has generally concluded that potential scale economies are more pronounced in the 1990s than in previous decades, both in the US and the European banking markets, although X-inefficiencies are

[3] The basic sample contains more than 900 M&As completed during the sample period. However, the large majority of these deals involve very small banks, especially German savings or cooperative banks, for which no annual account information is available in the Bankscope database. Since these very small banks

still found to dominate scale inefficiencies. Consequently, we first investigate whether European banks are characterized by the existence of unexploited scale benefits and whether large X-inefficiencies persist in the 1990s. For this purpose we use a non-homothetic functional form of the translog type (see Lang and Welzel, 1996) to estimate the cost structure of banks and to derive measures of efficiency:

$$\begin{aligned} ln(C) = {} & \alpha_0 + \alpha_1 ln(w_1) + \alpha_2 ln(w_2) + \beta_1 ln(y_1) + \beta_2 ln(y_2) + \beta_3 ln(z_1) + \\ & \tfrac{1}{2} \alpha_{11} ln(w_1) ln(w_1) + \alpha_{12} ln(w_1) ln(w_2) + \tfrac{1}{2} \alpha_{22} ln(w_2) ln(w_2) + \\ & \gamma_{11} ln(w_1) ln(y_1) + \gamma_{12} ln(w_1) ln(y_2) + \gamma_{13} ln(w_1) ln(z_1) + \\ & \gamma_{21} ln(w_2) ln(y_1) + \gamma_{22} ln(w_2) ln(y_2) + \gamma_{23} ln(w_2) ln(z_1) + \\ & \tfrac{1}{2} \beta_{11} ln(y_1) ln(y_1) + \beta_{12} ln(y_1) ln(y_2) + \beta_{13} ln(y_1) ln(z_1) + \\ & \tfrac{1}{2} \beta_{22} ln(y_2) ln(y_2) + \beta_{23} ln(y_2) ln(z_1) + \tfrac{1}{2} \beta_{33} ln(z_1) ln(z_1) + \\ & \upsilon_1 v_1 + \upsilon_2 ln(v_2) + ln\, u_C + ln\, \varepsilon_C \qquad (1) \end{aligned}$$

In this cost function, C are total (interest and operating) costs. The input factors are deposits and labor, with their respective prices w_1 and w_2. Since information with respect to the number of employees is unavailable for most banks, we are not able to calculate the personnel expenses per employee. As an alternative, we use the personnel expenses as a fraction of total assets.[4] The outputs are loans (y_1) and securities or other earning assets (y_2). The fixed netput quantities included are off-balance sheet items (z_1) and equity (z_2). The environmental variables v_1 (equity as a proportion of total assets) and v_2 (non-interest costs as a proportion of total costs) have been included in order to measure possible

account for a minor part of European bank assets, they are not representative for the potential productivity gains that can be realized through consolidation among European banks.

[4] Also, information with respect to the number of branches is almost completely lacking.

differences in risk and output quality. Dummy variables for the bank's size are included in the efficiency estimations. Off-balance sheet activities generate non-interest income. For that reason we include fees and trading expenses in the variable costs and the net fee and trading income in the profits (see below). The error term has been obtained using the distribution-free approach: u_C is an inefficiency factor that may raise costs above the best-practice level, and ε_C a random error incorporating measurement error and luck that may temporarily result in high or low costs. In equation (1), total costs C and the variables y_1, y_2 and z_1 are divided by equity capital (z_2) to control for heteroskedasticity, for scale biases in the estimation, and to give the models a better economic interpretation. From an economic point of view, return on equity, instead of the level of profits as such, is the relevant factor in the objective function of bank management.

For the profit efficiency analysis, we formulate the profit function analogously. Following the justification of Berger and Mester (1997), we apply the alternative profit function instead of the standard profit function. The alternative profit function uses the same variables as the cost function, which implies that output prices are free to vary and affect profits. The dependent variable now becomes $ln[(\pi / z_2) + |(\pi / z_2)^{min}| + 1]$, where $|(\pi / z_2)^{min}|$ is the absolute value of the minimum value of (π / z_2) over all banks. Since the minimum profits in a large sample are typically less than zero, the constant $|(\pi / z_2)^{min}| + 1$ is added to every bank's dependent variable in the profit functions so that the natural log is taken from a positive number. Consequently, for the bank with the lowest value of (π/z_2), the dependent variable equals ln(1)=0. The average adjusted R^2 of the cost and alternative profit functions across the six years and four types of banks are 0.98, respectively 0.21. These statistics are in line with the findings of, e.g., Berger and Mester (1997) who report a corresponding R^2 of 0.93 and 0.33.

We apply two measures to calculate economies of scale: ray scale elasticity (RSCE) and expansion path scale elasticity (EPSCE). RSCE is the relative cost increase caused by a proportionate increase in all outputs. As an alternative, Berger et al. (1987) proposed the EPSCE measure. Two firms A and B which are immediate neighbors in the size distribution, but do not necessarily have the same output structure, are compared. EPSCE

can be interpreted as a measure indicating whether the 'natural' growth of firms results in cost advantages or disadvantages. In this way, RSCE captures the impact of marginal changes in the output level, and EPSCE the impact of changes in output levels that correspond with the 'average' bank in successive size classes.

== tables 3-5 ==

The results are shown in tables 3 to 5. They cover bank data for 14 European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom) over the period 1993-98, subdivided into eight size classes. Table 3 reports the RSCE by type of bank and size group based on the specification with loans and other earning assets as the outputs, whereas the estimations in table 4 also include off-balance sheet activities. Table 5 presents the EPSCE results for the specification with loans and other earning assets. The number of banks, pooled over the sample period per size group and by type of bank, is reported in parentheses.

For the specifications with loans and other earning assets as the relevant outputs, all groups, with the exception of mortgage banks with total assets above 10 billion euro, exhibit economies of scale. The presence of scale economies is most pronounced for small mortgage banks. Furthermore, it appears that commercial banks have a greater potential to realize scale-related cost gains than cooperative and savings banks. However, the larger the size of the commercial bank, the smaller the advantage : the RSCE amounts to 0.81 for the smallest group of commercial banks and 0.89 for the group of large banks. On the other hand, cooperative and savings banks hardly show any differences across size groups, with the exception of the smallest and largest one. All intermediate size groups show a value in the 0.91 to 0.93 range. The picture for 'other banks' is less straightforward. All size groups exhibit economies of scale but, in contrast to the other bank types, we do not find a continuous increase. The inclusion of off-balance sheet activities as an output item affects the results for the commercial and cooperative and savings banks only to a limited extent, as a comparison of tables 3 and 4 reveals. The off-

balance sheet items increase the potential for scale economies for cooperative and savings banks for all size groups. For the commercial banks, this only holds for banks with total assets up to 5,000 million euro. The group of 'other banks' shows considerably larger economies of scale, with the exception of the smallest size group. The larger mortgage banks now also exhibit economies of scale.

As a consequence of its definition, EPSCE cannot be calculated for the smallest size group. The EPSCE values in table 5 confirm the existence of economies of scale. In general, the EPSCE values for the commercial and cooperative and savings banks are in line with the RSCE values. Thus, we can conclude that both RSCE and EPSE indicate the existence of economies of scale for commercial banks, cooperative and savings banks, mortgage banks with total assets up to 10 billion euro and for all but one size group of 'other' banks. These findings at least partly contradict the wide consensus based on data from the 1970s and 1980s that only very small banks have a potential to achieve scale economies. Our results confirm the findings by Berger and Mester (1997), Berger et al. (1999), and Vander Vennet (2001) who also observe economies of scale for large banks using 1990s data. The finding of potential scale economies provides a rationale for the occurrence of bank mergers. In fact, mergers, as opposed to internal growth, may be the fastest way to realize the associated cost benefits.

5. Cost and profit efficiency

M&As may not only be undertaken to exploit the benefits of increased size, but may also be motivated by the desire to improve the level of cost and profit efficiency. Consequently, next to scale economies, we investigate the existence of cost and revenue (X-)efficiency in European banking. We start from the cost function in equation (1) in which the inefficiency and random terms u_C and ε_C are multiplicatively separable from the cost kernel (see Berger and Mester, 1997):

$$ln\ C \equiv g(w,y,z,v) + ln\ u_C + ln\ \varepsilon_C, \qquad (2)$$

The cost efficiency of a bank *b* is defined as the estimated cost needed to produce bank *b*'s output vector if the bank were as efficient as the best-practice bank in the sample, having the same exogenous variables *(w,y,z,v)*, divided by the actual cost of bank *b*, adjusted for random error. This means:

$$Cost\ EFF^b = \hat{C}^{min} / \hat{C}^b$$

$$= exp[\hat{g}(w^b,y^b,z^b,v^b)] * exp[ln\ \hat{u}_C{}^{min}] / exp[\hat{g}(w^b,y^b,z^b,v^b)] * exp[ln\ \hat{u}_C{}^b] = \hat{u}_C{}^{min} / \hat{u}_C{}^b \quad (3)$$

where $\hat{u}_C{}^{min}$ is the minimum $\hat{u}_C{}^b$ across all banks in the sample. The cost efficiency varies over the interval (0,1] and equals one for a best-practice firm within the sample. Hence, we usually do not consider any true minimum costs, as the underlying technology is unknown. Instead, the efficiency of a bank is measured proportionally to that of the best-practice bank observed in the data. The (alternative) profit efficiency is the quotient of predicted actual profits and the predicted maximum profits for a best-practice bank, net of random error:

$$Alt\ \pi\ EFF^b = a\hat{\pi}^b / a\hat{\pi}^{max} =$$

$$\{exp[\hat{g}(w^b,y^b,z^b,v^b)] * exp[ln\ \hat{u}_{a\pi}{}^b] - \theta\} / \{exp[\hat{g}(w^b,y^b,z^b,v^b)] * exp[ln\ \hat{u}_{a\pi}{}^{max}] - \theta\} \quad (4)$$

For the best-practice bank the alternative profit ratio amounts to one. In contrast to cost efficiency, there is no lower limit as a bank can have infinite losses.

Although we assume that random error averages out to zero over time, we should be aware that extreme values of the efficiency estimates might still reflect substantial random components. We therefore apply truncation with respect to the extreme values. To that extent, each bank in the top and bottom 5% of the distribution of the average residuals is assigned the value of the bank located at the 5th or 95th percentile, respectively. The resulting (truncated) estimates of the inefficiency terms $ln\ \hat{u}^b_C$ and $ln\ \hat{u}^b_{a\pi}$ are substituted in equations (3) and (6). As in Berger and Mester (1997), this

truncation is found to remove most of the random error which was not already eliminated by the averaging over time. For our analysis, the problem is also less important, since we will use the efficiency rank instead of its absolute value.

== tables 6-7 ==

The resulting average cost and profit efficiency for the countries and types of banks is presented in tables 6 (cost efficiency) and 7 (profit efficiency). The first table also reports the number of banks in each category. We find that the average cost efficiency of European banks is around 91%, which is comparable to the results obtained by Berger and Mester (1997) for US banks in the 1990s. The degree of inefficiency is lower than was observed in the 1980s, suggesting that technological progress and increased competition may have moved the average bank towards the efficient frontier (see Allen and Rai, 1996; Vander Vennet, 2001). However, there are considerable differences across the types of banks. Cooperative banks exhibit a higher degree of cost efficiency than commercial banks (96% versus 82.2%). Also, mortgage banks and other banks are found to be more efficient, on average, than commercial banks. When the estimates are compared across countries, the Greek and Portuguese banks appear to be the least efficient ones. One should, however, bear in mind that for some of the countries, the numbers in specific bank types are relatively small. The average profit efficiency is estimated at 64.2%, which is considerably lower than the average cost efficiency level. This finding is consistent with the results reported in Berger and Mester (1997) for US banks and Vander Vennet (2001) for European banks. Mortgage banks are found to be more profit efficient than commercial and cooperative banks. The findings for cost efficiency suggest a role for mergers to enhance the X-efficiency of the consolidating banks. The impact may be even more pronounced for profit efficiency. Following the static analysis of the potential impact of mergers on efficiency, we next investigate the effect of actual mergers on the observed degree of cost and profit efficiency of the consolidating banks.

6. Impact of mergers on cost and profit efficiency and on deposit rates

6.1 Cost efficiency

The first method to examine the impact of bank M&As is to compare the pre-merger and post-merger efficiency rank of the merging banks. Since the estimated level of efficiency may depend on the number of banks included in the analysis and changes in the economic environment (e.g., related to technology), we do not use the absolute efficiency measure, but the efficiency rank. This enables us to capture the change in efficiency due to the merger in relation to the measured changes for a relevant peer group of non-merging banks. The peer group is defined as the group of banks that belong to the same type and are comparable in terms of size, measured by total assets. The pre- and post-merger ranks for the merging banks (one year before and one year following the merger) and the peer group banks are shown in table 8. All ranks are weighted by total assets. On average, the pre-merger efficiency rank of the acquiring banks is lower than that of the target banks, a finding that was also reported by Resti (1998) for Italian mergers. We find that the post-merger rank considerably improves following a merger. For the full sample, and relative to the peer group, the efficiency improvement amounts to 18.3 percentiles. However, this finding can almost completely be attributed to the subsample of large bank mergers. For the small bank mergers, the recorded relative efficiency improvement is only 5.5 percentiles.

== table 8 ==

Second, we examine the ex ante conditions that may explain any observed efficiency improvements following M&As. The dependent variable is the change in the relative cost efficiency rank, $\Delta(C^0/C)$. Following Akhavein et al. (1997), we test two hypotheses. The *Relative Cost Efficiency Hypothesis* assumes that a merger is likely to produce cost benefits when a relatively efficient bank acquires a poorly performing competitor. The combined banks' performance can be improved, e.g., by transferring successful managerial policies and operating procedures to the acquired bank. This effect is

measured by the variable W2(EFF1-EFF2), which is the difference in terms of cost efficiency between the acquiring bank (EFF1) and the acquired bank (EFF2), weighted by the proportion of the combined pre-merger total assets accounted for by the acquired bank (W2=TA2/(TA1+TA2)). The larger the difference between the efficiency of the consolidating banks, the more room for an improvement of the performance of the acquired bank should exist. The weight W2 is applied because the efficiency improvement has to be related to the relative size of the acquired bank. The coefficient on this variable is expected to be positive and can be interpreted as the proportion of the ex ante observed potential improvement that has been realized ex post. As an alternative, the *Low Cost Efficiency Hypothesis*, states that it is more likely that efficiency can be improved if both banks are poor performers prior to the merger. According to Berger (1998), the merger might "wake up" the management or the merger may be an "excuse" to restructure both banks. This effect is measured by the variables W1(EFF1) and W2(EFF2), the weighted efficiency ranks of the acquiring and the acquired bank. Under this hypothesis, the estimated coefficients should be negative. The results in table 8 suggest that this hypothesis will be most relevant, since the samples of both small and large merging banks exhibit a relatively low pre-merger efficiency rank.

A number of explanatory variables are added in order to control for other possible ex ante explanations for efficiency improvements caused by the merger. The relative size of the acquired bank is included to account for possible positive efficiency effects in mergers undertaken by firms of about equal size. The findings of Vander Vennet (1996) indicate that cost savings are more pronounced in mergers of equal-sized banks, e.g., through the elimination of overlapping operational and managerial resources. To control for the business cycle environment in which the merger is concluded, we include the average growth rate of per capita GDP. When a country exhibits a high growth rate, the ex ante conditions for efficiency improvements are more favorable than in a less dynamic economic environment. We also include the Herfindahl market concentration index at the country level and the weighted average deposit market share of the merging banks since firms in highly concentrated markets may be less cost efficient due to a lack of competition. The relative focus of the merging banks on the retail market is approximated

by the proportion of total assets funded by deposits. This variable can be of importance in measuring potential cost savings via branch closings. Finally, the change in total loans as a proportion of total assets is added, since loans are considered to be more cost-intensive than, e.g., securities or interbank transactions[5]. However, it turns out that none of the control variables is significant in the different specifications. We therefore only report the estimation results for the variables EFF1 and EFF2 associated with the two main hypotheses.

== table 9 ==

The estimation results are shown in table 9. The first column examines the *Relative Cost Efficiency Hypothesis*. For the full sample, we find that the pre-merger difference in relative efficiency ranks has a positive impact on the change of the relative efficiency rank of the consolidating banks. The point estimate for the full sample is 0.43, implying that 43% of the ex ante efficiency rank differential is translated into a post-merger efficiency improvement. However, since table 8 shows that the acquiring banks exhibit a lower efficiency rank than the acquired banks, the post-merger efficiency improvement cannot be ascribed to positive spill-over effects from the acquirers. This finding holds for both subsamples of large and small bank mergers. The test of the *Low Efficiency Hypothesis* is shown in the second column. The coefficients have the expected sign and are significant for the full sample. However, only the coefficient for the acquired bank remains significant when we estimate the equation separately for the large and small bank mergers. In the last column of table 9, both hypotheses are tested jointly. The results indicate that the *Low Efficiency Hypothesis* holds in particular for the large mergers since the coefficients on the relative efficiency variable are negative and significant for both the acquiring and the acquired banks. In the case of small mergers, and for the full sample, there is only partial evidence supporting this hypothesis, since only the coefficient for the acquiring banks is significant. The derivatives of the dependent variable with respect to EFF1 and EFF2 support the *Low Cost Efficiency Hypothesis*. The

[5] A number of other variables are not included due to lack of data. It could, e.g., be informative to investigate the influence of the overlap in local deposit markets of the merging banks.

former equals –0.33 at the mean values for the large bank mergers, while the partial derivative for EFF2 is -1.05. For the small banks, the corresponding numbers are –0.19 and –0.72, respectively. There is no evidence supporting the *Relative Cost Efficiency Hypothesis*. The resulting adjusted R^2 of the regressions is rather low; about 25% of the variance of the ex post cost efficiency changes can be explained with the ex ante variables in the cases of large and small bank mergers. These observations are in line with earlier findings by, e.g., Peristiani (1997).

6.2. Profit efficiency

Profit efficiency is measured as the ratio of predicted profits to optimal profits on the frontier (π/π^0). It appears that the banks involved in M&As have on average a relatively low profit efficiency level compared to the group of non-merging peer banks. The large merging banks are responsible for this observation. They exhibit a pre-merger profit efficiency of 0.39 (weighted by total assets) against 0.63 for the peer group. The differences between the acquired and acquiring banks are negligible. In the case of small bank mergers, the pre-merger profit efficiency is 0.54, whereas the average for the peer group amounts to 0.51. Acquiring banks have a somewhat lower efficiency level than their peer group (0.49 against 0.51), whereas the acquired banks are characterized by a considerably higher profit efficiency than the peer group average (0.66 against 0.52). The change in the pre-merger (year t-1) and post-merger (year t+1) ranks for the merging banks relative to the banks in their peer group is shown in table 10. Following the mergers, there is no evidence of improved profitability since the efficiency rank deteriorates by 1.15 percentile points. This effect is entirely caused by the large banks. M&As in which large banks are involved show a deterioration of 1.18 percentile points, whereas small banks record an improvement of 1.94 percentile points. Table 8 also shows the impact of the merger on ROA and ROE. The picture is similar; the ROA rank decreases by 8.07 percentile and the ROE rank by 2.69 percentiles, relative to the peer group. This confirms the absence of any observable merger gains in terms of overall profitability. However, the results contain a lot of cross-sectional variation, since some mergers result in efficiency improvements, whereas others produce a loss of efficiency.

== table 10 ==

For reasons of antitrust policy it is important to investigate whether we can identify any ex ante conditions that are reliable predictors of efficiency improvements or changes in the exercise of market power in setting prices. We first concentrate on the prediction of efficiency improvement. Next, in section 6.3 the effect of mergers on pricing behavior is examined.

The estimations regarding profit efficiency include the same variables that were used to predict cost efficiency changes. EFF1 and EFF2 now refer to profit efficiency instead of cost efficiency. Analogous to the two cost efficiency hypotheses tested before, we test the *Relative Profit Efficiency Hypothesis* and the *Low Profit Efficiency Hypothesis*. The results are shown in table 11.

== table 11 ==

The regression in the first column examines the *Relative Profit Efficiency Hypothesis*, which states that mergers will be more successful when the ex ante difference in efficiency between the acquiring and acquired bank is larger. We do not find a significantly positive impact. For the full merger sample, the point estimate is 0.17, suggesting that the average acquiring bank brings the acquired part of the consolidated bank 17% towards its own pre-merger efficiency rank. This effect is small and insignificant. This aggregate finding, however, masks a substantial difference between large and small bank mergers. In the case of large banks, the impact is positive, whereas the sign is negative in the sample of small bank mergers, although the samples are too small to obtain significant results. The latter finding can be explained by the fact that the profit efficiency of acquired small banks is larger than that of the acquiring small banks. Hence, if the merger were to produce a positive efficiency effect, it would require that the combined profit efficiency would shift towards that of the acquired banks. In this situation, acquiring banks in the small size segment of the mergers would ‘import’

instead of 'export' the managerial structure and policies of the more efficient bank. The *Low Profit Efficiency Hypothesis*, which predicts larger efficiency gains when either or both of the acquiring and acquired banks are inefficient, is examined in the second column of table 11. There is evidence supporting the *Low Profit Efficiency Hypothesis*, since both the coefficients for the acquiring and the acquired banks are negative and significant. For small mergers, only the coefficient with respect to the acquiring banks has the right sign and is significant. The third column of table 11 combines the two hypotheses. For the full merger sample and the subsample of large bank mergers, there is evidence that both hypotheses partly explain the efficiency effect, be it that the *Low Profit Efficiency Hypothesis* only holds for the acquiring banks. The combination of both hypotheses produces inconclusive evidence for the small mergers.

6.3 The impact of mergers on deposit prices

Changes in profit efficiency may be caused by variations in the cost efficiency of the merging banks, or they can be attributable to changes in price setting behavior, e.g. caused by market power considerations. Therefore, this section analyzes the deposit price effects due to the mergers and their effect on bank profits. We use the same variables and test hypotheses similar to those used for the examination of the efficiency changes. In this way, the market power and efficiency implications can be compared. It has to be noted that the analysis is restricted to the effect of bank mergers on deposit prices in a broad sense[6]. The variable of interest are the interest payments with respect to customer and market funding.

We start by investigating the pre- and post-merger deposit price premium. As interest rates and risk conditions change over time, we calculate the deviation of the interest expense ratio of the merging banks from the mean price of the peer group (p-μ_p). Table 12 shows that the acquiring banks in our sample offer a deposit interest rate which is 45

[6] Due to data limitations we are not able to include the effects via the loan price premiums, because the data do not allow us to distinguish between the returns from loans and the returns from other earning assets. For that reason, we only consider possible market power effects via deposit prices.

basis points lower than the banks in the peer group. The corresponding difference for the acquired banks is 22 basis points. After the merger or acquisition the new entities apply a higher deposit rate than their competitors; the difference amounts to 12 basis points. This implies that we observe a small positive deposit premium relative to the peer group following the merger, against a deposit premium deficit before the merger. This behavior is favorable for the banks' consumers and contradicts the presence of a market power effect, which would raise bank margins. There may be alternative explanations for the observed deposit pricing behavior. One possible alternative is that the consolidated banks raise their deposit rates in order to compete more aggressively for deposit market shares. Or the deposit premium may reflect a deterioration in post-merger service quality (see Simons and Stavins, 1998).

== table 12 ==

The lower panels of table 12 show the evolution of deposit pricing in large and small M&As, respectively. We observe that the higher deposit premium (in comparison to the peer group) only holds for large M&As, although the deposit premium deficit for small M&As also decreases and actually reaches the level previously applied by the acquired small banks. Since the acquiring banks offer a proportionally higher deposit rate, overall profits will decrease. These results contradict the market power hypothesis for bank mergers. However, other influences may interfere. Only small market power effects can be expected if (1) the merging banks have little or no local market overlap or (2) antitrust policy results in divestitures. Nevertheless, the results strongly suggest that it cannot be concluded that merger activity results in an increased use of market power in setting deposit prices. We again underline that the analysis is restricted to the deposit market and does not include the possible market power effects via loan premiums.

A relevant issue is whether changes in the price setting behavior can be predicted. This is an important question for antitrust policy purposes. We follow the analysis used to investigate the efficiency improvements. The dependent variable is the change in profits due to price changes normalized by potential profits, $\Delta p.q/\pi^0$. The ex ante variables used

to predict the price-related changes in profits include the same variables that were used to predict efficiency changes. Hence, we can test two price-based theories : the *Relative Price Hypothesis* and the *Low Price Hypothesis*. The *Relative Price Hypothesis* states that the prices of the acquired bank are adjusted towards the acquiring bank's price level. The variable $V2(P1\text{-}P2)_{Dep}$ is the weighted price difference for deposits, where the weight is the relative importance of the acquired bank's deposits ($V2_{Dep}$ = (Deps2/(TA1+TA2)). Since the interest payments on deposits are expenses for the banks, the variable is included in the regression with a minus sign. Hence, a positive coefficient is expected. Under the *Low Price Hypothesis*, acquiring or acquired banks may be able to lower their deposit rates following the merger, probably as a consequence of higher market concentration. Since mergers might also induce bank managers to exploit their market power, we use the weighted prices $-V1(P1)_{Dep}$ and $-V2(P2)_{Dep}$ to measure this effect. The coefficients should be negative, because banks with higher deposit prices ex ante may be able to reap the largest profits gains.

The regression results for the relevant parameters can be found in table 13. The results do not support the *Relative Price Hypothesis* nor the *Low Price Hypothesis*. The explanatory power is very weak for the full sample; the adjusted R^2 is below 0.1. This also holds for the subsample of small bank mergers. The estimations for the large bank M&As is better in terms of explanatory power, but the significant coefficients have the wrong sign. This means that we can reject both hypotheses and that the evidence contradicts the market power explanation for bank M&As. Our findings differ from those reported by Akhavein et al. (1997), who find some evidence of non-competitive pricing associated with megamergers in the US. However, their results may partly be explained by the fact that the mergers occurred in local markets characterized by non-competitive pricing behavior.

7. Conclusions

Academics and practitioners agree that the ongoing consolidation in European banking will continue in the foreseeable future, predominantly spurred by technological progress, deregulation, and the need to remove excess capacity. The introduction of the euro is

widely considered to be an additional catalyst. In order to assess the public policy issues surrounding bank mergers, this paper analyzes the efficiency effects of 52 horizontal bank mergers over the period 1994-1998, i.e. the period immediately preceding the start of EMU, in various European countries. Bank M&As may be geared to exploit economies of scale or scope, improve the X-efficiency of the consolidating banks, may enable the merged banks to exercise increased market power, or may simply be motivated by the management's desire for increased size. In order to assess the importance of these motivations, we conduct a series of static analyses (scale economies, X-efficiency), a dynamic analysis of pre- and post-merger performance, and an investigation of the deposit pricing behavior of the merging banks.

In line with most recent empirical studies in the US and Europe, we find evidence of substantial unexploited scale economies in European banking across different institutional types of credit institutions, also for the largest banks. These potential productivity gains are probably related to technological progress and may constitute a powerful incentive to merge for banks that operate below the optimal scale. This finding may largely explain the substantial consolidation recorded among small and medium-sized banks, especially in Germany and Italy, over the last decade. In terms of X-efficiency, our results are indicative of large cross-sectional variations in the operational efficiency and the profit efficiency of European banks. Again, increased competition in European banking markets, and the resulting shift of the strategic focus of banks towards improved efficiency, may explain the occurrence of mergers motivated by the elimination of inefficient management and suboptimal operational procedures and systems.

In the dynamic M&A analysis we find that the cost efficiency of consolidating banks improves following a mergers, both in subsamples of large and small bank mergers. Although the merger only increases the operational efficiency of the consolidating banks to the average industry level, the economic gains are nevertheless substantial. We find only partial support for the relative cost efficiency hypothesis stating that the increase in the merged banks' cost efficiency is positively related to the difference in the ex ante cost efficiencies of the merging banks. Some of the evidence is consistent with the low cost

efficiency hypothesis stating that the increase in cost efficiency is likely to be larger when both banks have relatively poor pre-merger cost efficiency levels. Hence, the bank M&As in our sample contribute to the gradual upgrading of X-efficiency in the European banking sector. With respect to profit efficiency, we find that mergers tend to reduce profit efficiency for the large banks, while profit efficiency rises for the set of small banks. No clear support is found for either the relative profit efficiency hypothesis or the low profit efficiency hypothesis. Apparently, the merger gains on the revenue side require more time to materialize. Finally, we do not find any evidence that merging banks are able to exercise greater market power by decreasing their deposit rates. On the contrary, relative to the industry peer group, deposit rates tend to rise following the merger. This may indicate that the merging banks seek to increase their deposit market share by offering competitive interest rates. Overall, the bank M&As in this study appear to be socially beneficial, since they have a positive impact on the cost efficiency of the consolidating banks and there is no evidence of rent-seeking behavior on deposit markets.

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Table 1. The sample of European bank M&As

M&As by year											
1994			1995			1996			1997		
4			15			14			19		
M&As by type											
C-C	S-S		C-S		S-O		C-O		C-M		M-M
15	21		10		2		1		1		2
M&As by country											
A	B	DK	F	G	I	NL	P	S	SW	UK	C-B
1	6	2	1	24	1	3	1	2	1	4	6

Type: C = commercial bank; S = cooperative / savings bank; M = mortgage / real estate bank; O = other bank.
Country: A = Austria; B = Belgium; DK = Denmark: F = France; G = Germany; I = Italy; NL = Netherlands; P = Portugal; S = Spain; SW = Sweden; UK = United Kingdom; C-B = cross-border.

Table 2. The number of banks used in the analysis by size class (in millions of euro)

Total Assets	***I***	***II***	***III***	***II+III***
< 100	1212 (8)	-	3 (5)	3 (3)
100 < 300	4093 (26)	4 (8)	12 (20)	16 (14)
300 < 600	2808 (18)	3 (6)	13 (21)	16 (14)
600 < 1,000	1935 (12)	3 (6)	4 (7)	7 (6)
1,000 < 5,000	3813 (24)	15 (29)	10 (16)	25 (22)
5,000 < 10,000	775 (5)	2 (4)	1 (2)	3 (3)
10,000 < 50,000	847 (5)	8 (15)	15 (25)	22 (19)
50,000+	386 (2)	17 (33)	3 (5)	20 (18)
Total	15869	52	61	113

Column I gives the number of banks used to calculate the efficiency levels and group averages (pooling 1993-1998)
Column II contains the number of acquiring banks
Column III presents the number of acquired banks
Between parentheses are the column percentages

Table 3. Ray scale elasticity by type of bank and size group (in millions of euro); period 1993-1998; between parentheses the number of pooled observations. The outputs are loans and other earning assets.

TA / Type	Commercial banks	Cooperative and savings banks	Mortgage banks	Other banks
< 100	0.813 (431)	0.884 (756)	0.655 (15)	0.806 (10)
100 < 300	0.853 (930)	0.912 (3035)	0.719 (85)	0.891 (43)
300 < 600	0.867 (709)	0.914 (1957)	0.790 (107)	0.901 (35)
600 < 1,000	0.869 (560)	0.919 (1290)	0.851 (70)	0.933 (15)
1,000 < 5,000	0.889 (1184)	0.913 (2335)	0.916 (230)	0.915 (64)
5,000 < 10,000	0.890 (350)	0.918 (304)	0.973 (89)	0.971 (32)
10,000 < 50,000	0.891 (393)	0.926 (206)	1.040 (177)	0.879 (71)
50,000+	0.891 (253)	0.946 (49)	1.137 (31)	0.919 (53)

Standard errors are available upon request from the authors.

Table 4. Ray scale elasticity by type of bank and size group; period 1993-1998 (outputs: loans, other earning assets and off-balance sheet items)

TA / Type	Commercial banks	Cooperative and savings banks	Mortgage banks	Other banks
< 100	0.789	0.877	0.746	0.826
100 < 300	0.838	0.908	0.785	0.861
300 < 600	0.855	0.911	0.819	0.806
600 < 1,000	0.866	0.917	0.839	0.851
1,000 < 5,000	0.886	0.912	0.868	0.851
5,000 < 10,000	0.894	0.914	0.912	0.917
10,000 < 50,000	0.905	0.920	0.917	0.879
50,000+	0.908	0.936	0.987	0.914

Standard errors are available upon request from the authors.

Table 5. Expansion path scale elasticity by type of bank and size group; period 1993-1998 (outputs: loans and other earning assets)

TA / Type	Commercial banks	Cooperative and savings banks	Mortgage banks	Other banks
100 < 300	0.877	0.913	0.725	0.849
300 < 600	0.869	0.912	0.782	0.800
600 < 1,000	0.856	0.937	0.781	1.021
1,000 < 5,000	0.868	0.889	0.923	0.995
5,000 < 10,000	0.887	0.902	0.958	0.858
10,000 < 50,000	0.899	0.930	1.050	0.945
50,000+	0.902	0.957	1.167	0.951

Standard errors are available upon request from the authors.

Table 6. Cost efficiency of banks by country and type(numbers of banks in parentheses)

	Commercial banks	*Cooperative Banks*	*Mortgage banks*	*Other banks*	*All banks*
Austria	83.40 (42)	96.95 (31)	91.43 (8)	---	89.35
Belgium	78.67 (40)	95.85 (22)	---	89.49 (15)	85.57
Denmark	84.11 (53)	97.12 (30)	---	---	88.76
Finland	82.08 (6)	---	---	---	84.84
France	82.38 (221)	95.47 (110)	83.23 (4)	91.78 (7)	87.01
Germany	81.92 (215)	95.59 (1435)	90.33 (56)	93.27 (17)	93.69
Greece	80.49 (13)	---	----	---	81.78
Ireland	85.17 (10)	---	----	---	87.75
Italy	86.89 (78)	98.32 (224)	---	87.44 (10)	95.10
Netherlands	82.98 (38)	97.26 (5)	92.33 (3)	---	85.25
Portugal	76.70 (30)	96.52 (5)	---	---	80.24
Spain	80.90 (86)	95.46 (44)	---	---	86.00
Sweden	77.13 (7)	---	95.48 (7)	91.73 (3)	87.26
United Kingdom	81.15 (83)	96.30 (3)	87.82 (62)	----	84.15
All	82.19 (926)	95.96 (1922)	89.36 (147)	90.38 (61)	91.36 (3056)

Table 7. Profit efficiency of banks by country and type

	Commercial banks	*Cooperative Banks*	*Mortgage banks*	*Other banks*	*All banks*
Austria	58.23	64.68	72.12	---	61.89
Belgium	67.31	73.30	---	59.38	64.85
Denmark	65.09	66.43	---	---	65.14
Finland	50.67	---	---	---	61.46
France	58.02	69.73	75.25	57.45	62.06
Germany	63.60	61.66	76.16	40.23	62.12
Greece	76.30	---	---	---	75.61
Ireland	63.66	54.99	---	---	59.63
Italy	63.54	77.75	---	62.10	73.74
Netherlands	64.79	53.27	71.34	---	63.35
Portugal	60.05	90.04	---	---	64.95
Spain	59.76	72.46	---	---	64.10
Sweden	61.84	---	72.07	25.93	59.72
United Kingdom	69.60	83.72	76.38	---	72.63
All	62.46	64.62	74.79	50.95	64.18

Table 8. Changes in cost efficiency following bank M&As

Cost efficiency rank (weighted by TA)	M&As	Peer group	Difference
All M&As (58)			
Pre-merger acquiring bank	0.374	0.559	-0.185
Pre-merger acquired bank	0.444	0.546	-0.102
Post-merger	0.494	0.470	+0.024
Change (weighted)	+0.098	-0.085	+0.183
Large M&As (33)			
Pre-merger acquiring bank	0.374	0.559	-0.185
Pre-merger acquired bank	0.446	0.547	-0.102
Post-merger	0.496	0.469	+0.027
Change (weighted)	+0.100	-0.086	+0.186
Small M&As (25)			
Pre-merger acquiring bank	0.362	0.554	-0.192
Pre-merger acquired bank	0.333	0.532	-0.199
Post-merger	0.386	0.525	-0.139
Change (weighted)	+0.098	-0.085	+0.055

Table 9. Ex ante sources of merger-related changes in cost efficiency (t-ratios in parentheses)

	$\Delta(C^0/C)$	$\Delta(C^0/C)$	$\Delta(C^0/C)$
All bank mergers			
W2(EFF1-EFF2)	0.43* (1.68)	-	0.55 (1.41)
W1(EFF1)	-	-0.44** (-2.29)	-0.63*** (-2.70)
W2(EFF2)	-	-1.01*** (-3.00)	-0.51 (-1.04)
Adjusted R^2	0.03	0.17	0.19
Num. of Obs.	50	50	50
Large bank mergers			
W2(EFF1-EFF2)	0.67** (2.19)	-	0.35 (0.74)
W1(EFF1)	-	-0.52 (-0.38)	-0.64** (-2.10)
W2(EFF2)	-	-1.52*** (-3.24)	-1.17* (-1.76)
Adjusted R^2	0.19	0.25	0.24
Num. of Obs.	33	33	33
Small bank mergers			
W2(EFF1-EFF2)	0.52** (2.18)	-	0.59 (1.62)
W1(EFF1)	-	-0.30 (-1.60)	-0.50** (-2.25)
W2(EFF2)	-	-0.96*** (-2.97)	-0.41 (-0.88)
Adjusted R^2	0.18	0.25	0.27
Num. of Obs.	25	25	25

* significant at the 10% level, ** at the 5% level and *** at the 1% level.

Table 10. Changes in profit efficiency rank, return on assets and return on equity rank in bank M&As (weighted by total assets)

	All (58)	*Small (25)*	*Large (33)*
Profit efficiency rank	-0.0115	+0.0194	-0.0118
Return on assets rank	-0.0807	-0.0350	-0.0812
Return on equity rank	-0.0269	-0.0076	-0.0271

Table 11. Ex ante sources of merger-related changes in profit efficiency (t-ratios in parentheses)

	Relative Efficiency Hypothesis	***Low Efficiency Hypothesis***	***Both Hypotheses***
		All bank mergers	
W2(EFF1-EFF2)	0.17 (0.71)	-	0.79** (2.17)
W1(EFF1)	-	-0.43*** (-2.69)	-0.73*** (-3.49)
W2(EFF2)	-	-0.39 (-1.15)	0.38 (0.79)
Adjusted R^2	-0.01	0.12	0.18
Num. of Obs.	58	58	58
		Large bank mergers	
W2(EFF1-EFF2)	0.41 (1.36)	-	0.82** (2.17)
W1(EFF1)	-	-0.52** (-2.68)	-0.82*** (-3.58)
W2(EFF2)	-	-1.25** (-2.74)	-0.44 (-0.76)
Adjusted R^2	0.03	0.28	0.36
Num. of Obs.	33	33	33
		Small bank mergers	
W2(EFF1-EFF2)	-0.65 (-1.50)	-	-0.20 (-0.16)
W1(EFF1)	-	-0.53* (-2.07)	-0.46 (-0.87)
W2(EFF2)	-	0.40 (0.73)	0.19 (0.13)
Adjusted R^2	0.05	0.09	0.05
Num. of Obs.	25	25	25

* significant at the 10% level, ** at the 5% level and *** at the 1% level.

Table 12: Changes in deposit prices associated with bank M&As

Deposit price premiums (in %-points)	*M&As*	*Peer group*	*Difference*
All M&As (58 observations)			
Pre-merger deposit price acquiring bank	5.25	5.70	-0.45
Pre-merger deposit price acquired bank	5.53	5.75	-0.22
Post-merger deposit price	5.25	5.13	+0.12
Change in deposit price (weighted)	-0.08	-0.59	+0.50
Large M&As (33)			
Pre-merger deposit price acquiring bank	5.28	5.71	-0.43
Pre-merger deposit price acquired bank	5.55	5.76	-0.21
Post-merger deposit price	5.28	5.14	+0.14
Change in deposit price (weighted)	-0.08	-0.59	+0.50
Small M&As (25)			
Pre-merger deposit price acquiring bank	3.81	5.04	-1.23
Pre-merger deposit price acquired bank	4.06	4.93	-0.87
Post-merger deposit price	3.44	4.29	-0.85
Change in deposit price (weighted)	-0.44	-0.72	+0.28

Table 13: Ex ante sources of merger-related changes in profits (t-ratios in parentheses)

	$\Delta p.q/\pi^0$	$\Delta p.q/\pi^0$	$\Delta p.q/\pi^0$
All bank mergers			
$-V2(P1-P2)_{Dep}$	-32.49 (-0.32)		110.14 (0.63)
$-V1(P1)_{Dep}$		57.41 (0.81)	107.50 (1.01)
$-V2(P2)_{Dep}$		-62.23 (-0.47)	-145.58 (-0.78)
Adjusted R^2	0.03	0.05	0.06
Num. of Obs.	58	58	58
Large bank mergers			
$-V2(P1-P2)_{Dep}$	-187.23*** (-3.18)		2.24 (0.03)
$-V1(P1)_{Dep}$		180.74*** (5.57)	181.87*** (3.55)
$-V2(P2)_{Dep}$		-73.90 (-1.19)	-75.26 (-0.96)
Adjusted R^2	0.29	0.56	0.56
Num. of Obs.	33	33	33
Small bank mergers			
$-V2(P1-P2)_{Dep}$	-1.18 (-0.00)		764.97 (0.98)
$-V1(P1)_{Dep}$		-46.69 (-0.27)	133.92 (0.53)
$-V2(P2)_{Dep}$		-123.37 (-0.45)	-899.81 (-1.07)
Adjusted R^2	0.10	0.11	0.15
Num. of Obs.	25	25	25

* significant at the 10% level, ** at the 5% level and *** at the 1% level.

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