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## WORKING PAPER

# Cross-border mergers in European banking and bank efficiency <sup>1</sup>

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# **Cross-border mergers in European banking and bank efficiency<sup>1</sup>**

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## **1. Introduction**

As in most developed economies, the European banking sector is going through a process of restructuring, mainly caused by pervasive trends such as deregulation, disintermediation, technological progress and intensified competition. The most visible manifestation of the restructuring is the enhanced pace of mergers and acquisitions among banks and other financial services providers across the European banking markets. Following the single market program (1992) and the introduction of the euro (1999) the expectation was that consolidation in banking would take a pan-European dimension. However, the track record of bank merger activity over the 1990s displays a different picture. Over the period 1995 to the first half of 2000, ECB (2000) records 2153 mergers and acquisitions (M&As) of credit institutions in the European Union, of which 1807 are do-

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<sup>1</sup> Comments by Claudia Buch, Heinz Herrmann (the editor) and Reint Gropp (the discussant) are gratefully acknowledged.

mestic deals. The large majority of the remaining 346 cross-border transactions were acquisitions of credit institutions outside Europe. This raises a series of questions. Why are cross-border bank mergers in Europe so infrequent? What are the motives behind those cross-border deals that are executed? Do cross-border bank mergers improve the efficiency of the banking industry? Does the performance effect of bank M&As differ across domestic and cross-border transactions?

Cross-border bank takeovers may be motivated by a complex nexus of considerations. An obvious motive would be the desire to diversify the country risk inherent in many bank activities. Geographical diversification may produce more stable profits, assuming that the correlation between the geographically dispersed income flows is not perfect. However, due to the macroeconomic convergence in the Eurozone, caused by a common monetary policy and the consolidation of government budgets induced by the Stability and Growth Pact, it can be expected that geographical diversification in Europe may yield little benefits. Moreover, Danthine et al. (1999) argue that bank diversification across European (and especially across Eurozone) countries may provide little diversification benefits that cannot also be obtained within the countries. Since most Eurozone countries exhibit a considerable sectoral diversification, domestic banks are already well diversified, provided they are able to operate on a national scale. This may partly explain the dominance of domestic mergers observed in most European countries during the

1990s and the emergence of very large ‘national’ banks as a result of a series of megamergers. Nevertheless, it is unclear whether EMU will lead to a full convergence of the macroeconomic bank risk exposures and, hence, banks may be induced to optimize their return/risk profile through cross-border M&As.

This paper focuses on the efficiency explanations for cross-border bank M&As. The most standard hypothesis to explain mergers and acquisitions is that they allow the consolidating banks to enhance their efficiency and profitability. Bank M&As may be geared to exploit economies of scale or scope, improve the X-efficiency of the consolidating banks or may enable the merged banks to exercise increased market power. The alternative hypothesis for these value maximization explanations is that corporate control mechanisms are failing and that bank managers may simply be motivated by their desire for increased size or suboptimal diversification, e.g., to hedge their unemployment risk. Consequently, bank mergers may entail diverging effects on cost and profit efficiency. 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 are different.

This paper therefore focuses on cross-border European bank mergers over the period 1990-2001.

Ceteris paribus, the efficiency hypothesis of M&As also applies to cross-border bank takeovers. Since the hypothesized efficiency gains from mergers may be related to both the cost and the revenue side, any analysis has to take into account the combined effects of operational and profit efficiency. The estimation of cost and profit efficiency allows the distinction between improvements in operational efficiency, improvements in the profit-generating capacity, and market power effects, something which is impossible to accomplish with simple cost and profit ratios. From an antitrust point of view, 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. Therefore we investigate both the cost and profit efficiency associated with cross-border bank M&As. If cost efficiency improves following the merger, the takeover may entail beneficial effects for the customers. If, on the other hand, profit efficiency improves without an accompanying increase in cost efficiency, this would constitute evidence that the consolidated bank is able to obtain a more optimal output/input combination or is able to exercise increased market power.

This paper investigates (1) the role of cost and/or profit efficiency as a motive for cross-border bank M&As in Europe and (2) the impact of cross-border bank takeovers on the postmerger cost and

profit efficiency of the banks involved. We investigate the motivations for bank M&As by analyzing the ex ante characteristics of the banks involved. In this exercise we focus on the efficiency differences between acquiring and acquired banks and we use a multinomial logit model to detect the ex ante efficiency characteristics that predict merger involvement. The ex post effect of takeovers on the performance of the banks is analyzed by assessing the impact of the M&A event on a series of standard bank performance indicators. In principle, the consequences should be consistent with the motivations; any mismatch may provide information about possible barriers to performance improvements.

The results indicate that European cross-border bank mergers and acquisitions could be driven by the elimination of operational or profit X-inefficiency, since the typical deal is characterized by the takeover of a poorly performing bank by a relatively efficient foreign bank. This is comparable to the findings in most studies of domestic bank mergers. Yet, we find that the potential gains are partly realized in terms of profit efficiency, but not in terms of operational efficiency, at least not in the short run. This finding is consistent with the hypothesis that different types of efficiency barriers may prevent the full exploitation of synergies in cross-border bank M&As. We find evidence consistent with the low efficiency hypothesis, in the sense that relative underperformance by both consolidation partners prior to the M&A is a good predictor of post-merger performance improvements. The positive impact on

profitability may be caused by revenue-based scale and scope economies, brand-based advantages or an increase in market power. The rest of the paper is organized as follows. Section 2 reviews the extant literature on the relationship between bank mergers and efficiency, with a focus on cross-border bank M&As. Section 3 describes the sample of cross-border deals over the 1990-2001 period. Section 4 contains the empirical setup and the main results. Section 5 draws a number of conclusions and outlines some potential avenues for further research .

## **2. Cross-border bank M&A and bank efficiency**

A key driver of the consolidation process in banking is deregulation, both geographically and functionally. In the USA, the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 effectively eliminated the barriers to cross-state banking. This constituted the final step in the process of gradual de facto deregulation of interstate banking in the years before 1994. In the European Union, the geographical restrictions were abolished by the Second Banking Directive of 1989 (implemented in all member countries by 1993) through the introduction of a single banking license and the principle of home country control. In addition, progress in information and telecommunication technology has further contributed to blurring the geographical and functional borders in the financial services in-

dustry worldwide. However, while regulatory changes are a necessary condition to observe cross-border bank takeovers, they do not constitute a sufficient condition.

In fact, different studies have identified remaining obstacles that may hinder cross-border mergers among banks (Heinemann and Jopp 2002). The identified obstacles are of different natures. First, a number of regulatory barriers, such as different legal and tax systems, may prevent the full exploitation of any potential gains associated with cross-border bank servicing. Second, different systems in terms of corporate governance, especially those linked to takeover rules and practices, may prohibit some types of cross-border bank takeovers. Third, reference is also made to efficiency barriers to the cross-border consolidation of financial services in Europe. Berger et al. (2000) assert that the limited scope of cross-border M&As in European banking may reflect the existence of efficiency barriers to operating across border, including distance, differences in language, culture, regulatory/supervisory structures, and explicit or implicit rules against foreign competitors. If these barriers offset most of the potential efficiency gains, they would constitute effective economic obstacles to cross-border consolidation. Buch and DeLong (2001) explain the relative absence of international cross-border bank consolidation by regulatory barriers and information costs related to distance and cultural factors. Finally, a number of theoretical papers have explored the influence of asymmetric information on the structure of bank markets. Dell’Ariccia (2001), e.g., shows that the

existence of informational asymmetries may limit the number of banks in a given market and may lead to blockaded entry in some cases.

If these barriers are important, they may limit, or even offset, the potential efficiency gains from cross-border bank M&As. A review of the extant empirical literature may provide partial answers to this problem. The US banking market is considered as the benchmark case because the regulatory and efficiency barriers can be assumed to be relatively less important than in the European case. Therefore, an analysis of the performance effects registered in US interstate bank takeovers may provide useful information about any potential efficiency gains in European cross-border mergers. It is also useful to confront the findings on cross-border bank takeovers with those reported for domestic mergers and acquisitions. In any case, it has to be noted that European empirical evidence on cross-border banking is very scarce.

Over the past decade, substantial research has been devoted to the question whether or not 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. 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. If financial markets are efficient, the stock market reaction should be a good indicator of the anticipated performance consequences of the merger. In a second approach, performance indicators based on balance sheet data or calculated with stochastic frontier methodologies are used to compare the performance of the merging banks with that of a control group. The relative merits of the two methods have been discussed by Piloff and Santomero (1998).

The results of event studies of US bank mergers are mixed, but most studies fail to find any significant value increases. Houston and Ryngaert (1994) demonstrate that the overall gains (the weighted average of gains to the bidder and target firms) from a sample of US bank mergers in the 1980s are statistically indistinguishable from zero. This lends support to studies which fail to find any significant cost savings resulting from bank mergers. They also show that high prior levels of profitability for the bidder and considerable operations overlap between the target and the bidder are valued by the stock market. Kwan and Eisenbeis (1999) replicate this type of analysis for a sample of 94 large US bank mergers in the 1990s. They find insignificant announcement effects and conclude that there is only weak evidence that the market viewed these bank acquisitions with favor. Among the US event studies that explicitly focus on interstate bank mergers, Toyne and Tripp (1998) examine

interstate bank mergers over the 1991-95 period. Their findings indicate that returns to targets have been significantly positive while returns to bidders have been significantly negative, leading to a combined negative stock market revaluation of the announced merger deals. 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 significantly positive at the announcement time. These findings differ from the bulk of the empirical merger research in the US bank market. However, this finding only holds for domestic bank mergers. For a very small subsample of 15 cross-border transactions (some of which are cross-product deals) they fail to detect any positive market revaluation. This finding would be consistent with the existence of efficiency barriers to cross-border bank takeovers. For a sample of 98 large M&As in the European financial sector over the last two decades, Beitel and Schiereck (2001) report similar evidence. On average, financial mergers create value. However, they also report that acquiring banks have experienced significant negative cumulative abnormal returns since 1998 and, in particular, that cross-border transactions of European banks seem to be value destroying. Because of the limited number of listed banks involved in European cross-border bank takeovers, I prefer not to perform event studies. This problem is especially severe for target banks, precluding any useful analysis of the presence of ex ante efficiency motivations.

A second type of methodology is the examination of pre-merger and post-merger performance. In this respect, 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. The literature suggests that there is a substantial potential for scale 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 Venet 2002). 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). However, it remains an open question whether cross-border bank mergers can be expected to entail significant scale advantages. Due to the lack of geographical and operational overlap, cost scale economies are far more difficult to realize than in domestic in-market deals. Other types of scale advantages related to enhanced revenues (such as revenue-related scope economies or brand-based scale economies, see Dermine 1999) may be achievable, however.

Dynamic analyses are defined as studies that compare the performance of financial institutions before and after M&As or compare the behavior of recently consolidated institutions with other institutions that have not engaged in M&As (Berger et al. 1999). 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. It is generally concluded that bank mergers offer a substantial potential for X-efficiency gains since the typical M&A can be described as the acquisition of a poorly performing target bank by a relatively well performing acquiring bank. 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. 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 most recent studies tend to find no improvement (Piloff 1996, Akhavein et al. 1997) or even a deterioration (Kwan and Eisenbeis 1999). Vander Venet (1996) uses cost and profit ratios to examine the performance effects

in a large sample of European bank takeovers over the period 1988-1993. Domestic mergers of equal-sized partners are found to improve the profitability of the consolidated banks. For a subsample of 70 cross-border acquisitions, he finds that operational efficiency is positively affected by the M&A, while profitability exhibits a limited positive effect. 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 tended to improve the level of profit efficiency but not the level of cost 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.

The overall picture that emerges from this selective literature survey is that, although bank mergers and acquisitions have the potential to generate substantial efficiency gains, the overall performance improvement following a merger is limited. The lack of significant positive abnormal stock returns around the announcement of such deals tends to confirm this conclusion, although the stock market revaluations recorded in European bank mergers appear to be somewhat larger than in US transactions. Cross-border bank M&As are generally viewed by the market as non-positive net present value deals. The preferred approach in this paper is to analyze the impact

of European cross-border bank M&As on bank performance with the use of cost and profit efficiency measures calculated against a stochastic frontier benchmark. This enables us to disentangle the effect of the M&A event on cost and profit efficiency.

### **3. The sample of European cross-border bank M&As**

The sample contains 62 cross-border mergers and acquisitions executed by banks headquartered in the European Union, Norway and Switzerland between 1990 and 2001. The deals were obtained from press coverage, lists compiled by national bank supervisors and from the Thompson Financial Securities Database<sup>2</sup>. The period under scrutiny is of particular interest because it immediately follows the deregulation associated with the completion of the single market program in the EU and it also covers the periods preceding and immediately following the introduction of the euro. Both the single market program and the EMU are expected to be catalysts for cross-border M&A activity in banking. All the deals are horizontal takeovers that can either be classified as mergers (involving the de jure combination of the consolidating partners) or acquisitions (in which the acquiring bank buys a controlling equity stake in the target bank, although both banks remain legally separate entities). Since the legal differences between various institutional bank types have been

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<sup>2</sup> I am indebted to Gayle DeLong for granting access to this data source.

abolished, the sample contains a mixture of commercial banks, savings and cooperative banks, and (previously) government-owned banks. In three cases the acquiring bank made more than one acquisition in a given year; all deals are present in the sample in order to avoid loss of information. 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, Norway or Switzerland, (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 M&A transaction is between unaffiliated banks, and (4) at least one year of pre- and/or post-merger data for the consolidating banks is available. The individual bank data are retrieved from the Bankscope database maintained by Fitch/IBCA, the London-based credit rating agency, and annual statements accessible through a large number of bank websites (to obtain the most recent annual account information). We concentrate our analysis on horizontal M&As, which are assumed to offer a broad potential scope for cost and profit efficiency improvements. Other types of transactions, such as banks acquiring an insurance company, or vice versa, are excluded because they may be motivated by a different set of considerations.

The final sample contains 62 cross-border bank-to-bank mergers and acquisitions completed over the period 1990-2001 with detailed accounting information on both the acquiring and the acquired banks. The distribution of the deals over the sample period is as follows (number of M&As in parenthesis): 1990 (4), 1991 (10), 1992

(3), 1994 (2), 1995 (4), 1996 (1), 1997 (5), 1998 (2), 1999 (13), 2000 (12), 2001 (6). The deals, although small in number, appear to be concentrated around the completion of the single market program (early 1990s) and the EMU (1999). The country coverage of the sample is as follows (with the number of acquiring banks and the number of acquired banks over the full period in parentheses): Austria (1,2), Belgium (11,8), Denmark (2,5), Finland (2,0), France (10,14), Germany (5,6), Italy (5,3), Luxemburg (3,1), Netherlands (4,7), Norway (1,4), Portugal (3,3), Spain (3,6), Sweden (5,2), Switzerland (2,2), and UK (5,1). Most of the deals are between banks in neighboring countries, consistent with the rationale behind distance and cultural affinity as enabling factors. All the regional mergers are present in the sample. For example ING-BBL and Fortis Bank (Benelux), MeritaNordbanken-Christiana Bank-Unidanmark (Scandinavia), BSCH-Banca Totta-Credito Predial (Iberian peninsula). The acquiring banks are on average 5.5 times larger in terms of assets than the target banks.

## **5. Empirical methodology and results**

The main hypothesis of the paper is that cross-border bank M&As will improve the operational and/or profit efficiency of the banks involved. I perform three types of analysis. First, a multinomial model is estimated to detect the ex ante bank characteristics that af-

fect the probability of cross-border M&A involvement. Consistent with the research question, the examination focuses on a number of variables intended to capture the premerger cost and profit efficiency of the consolidating banks. Second, I relate the post-M&A change in cost and profit efficiency rank to a set of ex ante cost and profit characteristics to test whether postmerger efficiency enhancement can be predicted from ex ante conditions. Finally, regression analysis is used to investigate whether the cross-border M&A has any effect on the post-M&A performance of the consolidating banks.

(1) The ex ante analysis is conducted through a logit model that allows us to investigate the variables that affect the probability of taking part in a cross-border bank M&A, either as the acquiring bank or as the acquired bank. Since this probability is unobservable, we follow the approach used by Focarelli et al. (1999) and construct a discrete dependent variable  $M$  which can take three values : 1 if the bank is the acquiring bank in an M&A in the year following the observation, 2 if the bank is the target bank and 0 if the bank is not involved in an M&A in the following year. The multinomial logit regression has the following form :  $\text{Prob}(M = 0, 1, 2) = F(\beta_i X_i)$  where  $F(\cdot)$  is the logistic distribution,  $X$  is a vector of bank characteristics and  $\beta$  is a vector of estimated coefficients capturing the impact of the variables on the likelihood of M&A involvement. The different coefficients  $\beta_i$  measure the effect of a unit change of the associated independent variable on the odds ratio of acquisition involvement.

The variables included in the regression capture the possible efficiency motivations for cross-border M&As. If cross-border bank mergers are motivated by efficiency considerations, the expectation is that the acquiring banks would exhibit a relatively high degree of operational efficiency and profitability, whereas the acquired banks are expected to be relatively bad performers. Different efficiency and profitability indicators are used to capture the various dimensions of bank performance. COSTINC is the cost/income ratio, calculated as interest and operational costs divided by total (interest and non-interest) revenues. ROAbt is the return on assets before taxes. LABOR is the proportion of personnel cost in total expenses. Next to the performance indicators, the estimation includes a series of control variables. LSIZE is the log of size and is included to capture scale-related merger motivations. DSDEP is the proportion of demand and savings deposits in total deposits and serves as a proxy for the banks' funding mix. Since demand and savings deposits are generally the least expensive funding sources, a large proportion of these liabilities may constitute an attractive feature in an M&A. The loan-to-assets ratio LTA is a proxy for the degree of penetration of the local lending market. Finally, I include the proportion of non-interest income (largely fees and commissions) in total revenues (NONINT) as an indicator of income diversification. Due to data limitations, the variables one year before the M&A used in the logit model can be calculated for 43 acquirers and 42 target banks. The control group consists of a sample of approximately 800 European banks that were

not involved in a cross-border M&A and for which the dependent variable takes the value of zero in the logit (for more details on the sample, see Vander Venet 2002). Banks involved in a cross-border M&A in a specific year may be in the control sample in the years in which they were not active in cross-border deals.

The results are in table 1. Two models are reported because the ROA variable and the cost/income ratio are, as expected, highly correlated; they are entered separately in two different specifications. The explanatory power of the logit regression is relatively limited, the pseudo  $R^2$  is slightly above 20%. In order to assess the efficiency and profit explanation of cross-border bank M&As, the cost/income ratio, the labor cost variable and the return on asset variable are of particular interest. Consistent with previous studies in the US and Europe, the results of both models indicate that the acquiring banks are characterized by a relatively low cost/income ratio and a relatively high ROA. Hence, the acquiring banks outperform their industry peers in terms of operational efficiency and overall profitability. The labor cost variable has a negative sign but the coefficient is insignificant. The acquired banks, on the other hand, appear to be relative underperformers although this conclusion has to be qualified since some of the coefficients on the performance variables are not significant. In the second model, the ROA coefficient is significantly negative, while the labor cost variable is positive and marginally significant, indicating a relatively weak profitability and relatively high personnel costs. For a sample of 41 deals we rerun the analysis

with the average of the variables over the two years preceding the M&A; the results were almost identical, although the coefficient of the labor cost variable for the acquired banks becomes insignificant.

The coefficients on the control variables indicate that acquiring banks are very large (the size variable is positive and highly significant) and well diversified (the non-interest-income variable is positively associated with the odds of being an acquirer). The acquired banks are relatively small relative to their industry peers, the negative size coefficient is significant. Both the acquiring and acquired banks display a positive relationship between M&A involvement and the proportion of demand and savings deposits in total deposits, indicating their solid local market penetration. The acquiring banks also have relatively high loan-to-asset ratios. Hence, the acquirers in European cross-border bank M&As can be described as large, diversified and well managed universal banks. The acquired banks are relatively poor performers. Combined, and comparable to most analyses of domestic bank consolidation, these results suggest large potential efficiency and profit gains from cross-border M&As, assuming that the superior managerial skills of the acquiring banks can effectively be transferred to the target institutions. This issue is the object of the next exercise.

(2) Second, I assess the impact of the merger event on the degree of operational efficiency and profit efficiency of the banks involved by calculating the post-M&A change in the cost and profit efficiency rank. Next I relate the observed efficiency change to ex ante

efficiency indicators to investigate whether or not ex post efficiency improvements are predictable ex ante. For the calculation of the efficiency rank, I use a non-homothetic functional form of the translog type (see Lang and Welzel 1996) to estimate the cost structure of European banks and to derive measures of efficiency:

$$\begin{aligned} \ln(C) = & a_0 + a_1 \ln(w_1) + a_2 \ln(w_2) + \beta_1 \ln(y_1) + \beta_2 \ln(y_2) + \\ & \beta_3 \ln(z_1) + \frac{1}{2} a_{11} \ln(w_1) \ln(w_1) + a_{12} \ln(w_1) \ln(w_2) + \frac{1}{2} a_{22} \ln(w_2) \\ & \ln(w_2) + \gamma_{11} \ln(w_1) \ln(y_1) + \gamma_{12} \ln(w_1) \ln(y_2) + \gamma_{13} \ln(w_1) \ln(z_1) + \\ & \gamma_{21} \ln(w_2) \ln(y_1) + \gamma_{22} \ln(w_2) \ln(y_2) + \gamma_{23} \ln(w_2) \ln(z_1) + \frac{1}{2} \beta_{11} \\ & \ln(y_1) \ln(y_1) + \beta_{12} \ln(y_1) \ln(y_2) + \beta_{13} \ln(y_1) \ln(z_1) + \frac{1}{2} \beta_{22} \ln(y_2) \\ & \ln(y_2) + \beta_{23} \ln(y_2) \ln(z_1) + \frac{1}{2} \beta_{33} \ln(z_1) \ln(z_1) + \gamma_1 v_1 + \gamma_2 \ln(v_2) + \\ & \ln u_C + \ln e_C \quad (1) \end{aligned}$$

In this cost function, C is 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. 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 differences in risk and output quality. The error term is obtained using the distribution-free approach:  $u_C$  is an inefficiency factor that may raise costs above the best-practice level, and  $e_C$  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 calculation of the relative profit efficiency, we express the profit function analogously. Following the justification of Berger and Mester (1997), we apply the alternative profit function, which uses the same variables as the cost function, implying that output prices are free to vary and affect profits. The dependent variable now becomes  $\ln[(p/z_2) + |(p/z_2)^{min}| + 1]$ , where  $|(p/z_2)^{min}|$  is the absolute value of the minimum value of  $(p/z_2)$  over all banks. Since the minimum profits in a large sample are typically less than zero, the constant  $|(p/z_2)^{min}| + 1$  is added to every bank's dependent variable in the profit function so that the natural log is taken from a positive number. Consequently, for the bank with the lowest value of  $(p/z_2)$ , the dependent variable equals  $\ln(1)=0$ . The average adjusted  $R^2$  of the cost and alternative profit functions estimated for the different years are 0.96 and 0.36, respectively. 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.

In order to investigate the cost and profit efficiency consequences of cross-border European bank M&As, we need efficiency estimates

for each individual bank. In the cost function (1) the inefficiency and random terms  $u_C$  and  $e_C$  are multiplicatively separable from the cost kernel (see Berger and Mester 1997):

$$\ln C = g(w,y,z,v) + \ln u_C + \ln e_C \quad (2)$$

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:

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

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 ratio of predicted actual profits and the predicted maximum profits for a best-practice bank, net of random error:

$$Alt\ p\ EFF^b = ap^b / ap^{max} = \{exp[g(w^b, y^b, z^b, v^b)] * exp[\ln \hat{u}_{ap}^b] - ?\} / \{exp[g(w^b, y^b, z^b, v^b)] * exp[\ln \hat{u}_{ap}^{max}] - ?\} \quad (4)$$

For the best-practice bank the alternative profit ratio amounts to one.

Although we assume that random error averages out to zero over time, one should be aware that extreme values of the efficiency estimates might still reflect substantial random components. As in Berger and Mester (1997), we 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 5<sup>th</sup> or 95<sup>th</sup> percentile, respectively. The resulting (truncated) estimates of the inefficiency terms  $\ln u^b_C$  and  $\ln \hat{u}_{ap}^b$  are substituted in equations (3) and (4).

In order to examine the impact of bank M&As, the cost and profit efficiency of all the banks in the European bank sample is estimated, whether or not they were involved in a takeover. Next, I compare the pre-merger and post-merger efficiency rank of the merging banks relative to the full control sample. 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), I do not use the absolute efficiency measure, but the efficiency rank. This enables us to capture the change in efficiency caused by the merger in relation to the measured changes for a relevant peer

group of non-merging banks. The cost and profit frontiers are calculated based on a sample of approximately 800 European banks (see Vander Venet 2002 for further details on the sample). The use of a cross-country sample implies the hypothesis of a common technology in European banking. Next to the full control group against which the efficiency ranks of the M&A banks are calculated, I construct limited peer groups which share the institutional characteristics of the acquiring and the acquired banks involved in cross-border M&As. For each acquiring and acquired bank in the M&A sample in the year the M&A was executed, we select four banks headquartered in the same country, belonging to the same size decile and with the same institutional form (commercial bank, savings/cooperative bank, government bank), resulting in limited peer groups of 164 to 172 credit institutions. The motivation is that it may be useful to compare the evolution of the efficiency rank of banks involved in mergers with that of a narrowly constructed subsample of banks which share a number of relevant characteristics. The pre- and post-merger ranks for the banks involved in M&As (one year before and one year following the merger) and the efficiency ranks of the limited peer group banks (both relative to the full bank sample) are shown in table 2. The table contains rank data for 42 (38) pre-M&A acquiring (acquired) banks and 43 (41) post-M&A acquiring (acquired) banks. When a two-year window pre/postmerger window is used (results not shown) the corresponding differences and changes are slightly lower. In those cases where the acquiring and the acquired bank remain legally separated entities after the acquisition,

the pre- and post-merger efficiency rank can be evaluated for both consolidating parties. In the cases in which the takeover partners effectively merge, the change in efficiency is calculated as the efficiency rank of the consolidated bank after the merger less the weighted average rank of the acquiring and the acquired banks before the merger. The ranks are weighted by total assets to take the different economic weight of acquiring and acquired banks into account.

The efficiency rank should be interpreted as follows: an efficiency rank of 0.70 indicates that the efficiency of the bank under scrutiny is higher than 70% of the banks in the entire control group. With this convention in mind, table 2 shows that the cost efficiency rank of the acquiring banks in the year before the M&A is 0.74 and that of the acquired banks is 0.66, relative to the full sample. The difference of 8 percentage points is significant at the 10% level. The efficiency ranks for the limited peer groups are 0.68 and 0.72, respectively. Hence, when the M&A partners are evaluated relative to their limited peer groups, the acquiring banks are 6 percentiles more cost efficient, while the target banks are 6 percentiles less cost efficient. The difference of 12 percentage point is significant (p-value of 0.07). These results confirm the conclusion from the logit estimations in that acquiring banks are found to be relatively good performers, while the target banks exhibit a somewhat lower operational efficiency level than their industry peers. However, the expected upgrading of the cost efficiency of the acquired banks

through the transfer of managerial and operational resources from the new parent bank is not realized in the short run. The one-year post-M&A cost efficiency rank of the acquired bank does not increase; in fact it records a small decrease of 2 percentage points relative to the full sample. They also remain relative underperformers vis-à-vis the limited group of industry peers (-5 percentage points). For the merging banks that effectively integrate, the consolidated cost efficiency rank amounts to 0.71, which is a fraction below the pre-merger efficiency rank of the acquiring bank. The corresponding values for the exercise with two years of post-M&A data are 0.62 for the post-M&A cost efficiency rank of the acquired banks and 0.72 for the post-M&A efficiency rank of the consolidated banks. Apparently, there are a number of efficiency barriers that prevent banks involved in cross-border M&As to reap any potential cost efficiency benefits. One hypothesis is that more time is needed to observe any tangible operational gains and that integration costs are non-negligible. Another explanation may be that scale economies are difficult to realize because of the lack of full operational integration and the limited operational overlap of the geographically dispersed M&A partners.

A somewhat different picture emerges for the profit efficiency ranks. Prior to the M&A, the acquiring banks are considerably more profit efficient than the acquired banks (the difference of 22 percentage points is significant, both relative to the full sample), consistent with the results of the logit analysis. They also outperform the lim-

ited peer group (the difference of 10 percentage point is significant at the 10% level). In the year following the M&A the profit efficiency rank of the acquired banks improves by 13 percentiles, lifting their efficiency to that of the comparable peer group. (The corresponding improvement over a two-year post-M&A period is 11 percentage points). A similar results is obtained for the merged banks with a weighted improvement of 8 percentage points. These results suggest that the M&A event produces a discernable improvement in terms of profit efficiency, although no such effect is found for the cost efficiency measure. The source of the profit enhancement, however, cannot be identified from the present analysis. One possible explanation is that the acquired banks change their pricing behavior, consistent with a market power story. Alternatively, they may be able to realize revenue scope economies, e.g., through the cross-selling of new financial products and services, or they may reap brand-based economies related to their solid local market penetration. In any case, it has to be noted that the profit efficiency enhancement brings the acquired banks to the peer level, thereby eliminating the considerable underperformance.

Second, we examine the ex ante conditions that may explain any observed efficiency changes following M&As. The dependent variable is the change in the relative cost efficiency rank,  $\Delta(C^0/C)$  of the consolidated banks based on actual or pro forma combined annual account data one year before and one year after the M&A and relative to the full European bank control sample. Following Akhavin

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. This effect is measured by the variable  $W2(EFF1-EFF2)$ , which is the pre-M&A 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.

A number of explanatory variables are added in order to control for other possible ex ante explanations for efficiency improvements.

The relative asset size of the acquired bank is included to account for size-related effects. To control for the business cycle environment in which the M&A is undertaken, we include the average growth rate of GDP in the target country over the sample period. When a country exhibits a high growth rate, the 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 since banks 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. 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. However, it turns out that almost none of the control variables are significant in the different specifications (only the loan-to-asset ratio in the test of the low cost efficiency hypothesis and the economic growth variable in the test of the relative profit efficiency hypothesis are significant at the 10% level). We only report the estimation results for the variables EFF1 and EFF2 associated with the two main hypotheses.

The estimation results are shown in table 3. The first column examines the *Relative Cost Efficiency Hypothesis*. The insignificant coefficient (point estimate 0.13) indicates that the pre-merger difference in relative efficiency has no impact on the change of the relative efficiency rank of the consolidated banks. The test of the

*Low Efficiency Hypothesis* is shown in the second column. The coefficients have the expected negative sign and are significant for both the acquiring and the acquired banks' pre-M&A cost efficiency. This evidence is consistent with the hypothesis that a merger or acquisition 'wakes up' the management and that banks with a relatively poor operational efficiency use the event to implement policies to improve their efficiency. However, only the coefficient for the acquired banks remains significant when both hypotheses are tested jointly, indicating that the relatively poor operational performance of the target bank is the most reliable ex ante M&A predictor. The adjusted  $R^2$  of the regressions is rather low; only 14 to 21% of the variance of the ex post cost efficiency changes can be explained with the ex ante variables. These observations are in line with earlier findings by, e.g., Peristiani (1997).

The estimations regarding profit efficiency include the same variables that are used to predict cost efficiency changes. The dependent variable is the change in the relative profit efficiency rank of the consolidating banks. 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 4. 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 large. The point estimate is

0.38, suggesting that the average acquiring bank brings the acquired part of the consolidated bank 38% towards its own pre-merger profit efficiency rank. This effect is significant and consistent with the findings in table 2. The *Low Profit Efficiency Hypothesis*, which predicts larger efficiency gains when either or both the acquiring and acquired banks are inefficient, is examined in the second column of table 4. The evidence supports the *Low Profit Efficiency Hypothesis*, since both the coefficients for the acquiring and the acquired banks are negative and significant. The third column combines the two hypotheses. There is evidence that both hypotheses partly explain the efficiency effect, be it that the *Low Profit Efficiency Hypothesis* only holds for the acquired banks. This evidence is consistent with the findings of the logit analysis concerning the profitability differential between acquiring and acquired banks. It is also consistent with the estimations of the profit efficiency ranks in table 2. Hence, cross-border M&As seem to be favorable for the enhancement of the profit efficiency of previously underperforming banks. However, the interpretation has to be done carefully. The profitability improvement may also be caused by the favorable macroeconomic environment in the second half of the 1990s (the period of the sample with most M&As). The estimations try to account for this effect by including a business cycle variable, but it is not certain that this variable captures the entire effect. However, since the analysis is based on relative efficiency indicators against a large control sample of banks, we hypothesize that this problem is not too severe.

(3) Finally, the ex post performance effects of bank takeovers can be analyzed by relating a number of efficiency and profit variables to a set of dummy variables identifying takeover involvement. The basic regression takes the form

$$y_{i,t} = a + b_1*MA(0) + b_2*MA(1) + b_3*MA(2) + b_4*SIZE + b_5*GROWTH + u_i + q_t + e_{it}$$

The dependent variables are measures of operational efficiency and profitability. Three indicators are used: return on assets before taxes (ROAbt), the degree of cost efficiency (CEFF), and the degree of profit efficiency (PEFF). The dummy variables MA(0), MA(1) and MA(2) take the value of one in, respectively, the year of the M&A, the first and the second year following the takeover, and zero otherwise. They capture the effect of the M&A on the evolution of the performance of the banks involved. For the years preceding and following the takeover pro forma combined balance sheets and income statements were produced for the banks throughout the sample period. SIZE refers to the size of the consolidating banks and GROWTH is the rate of real GDP growth, intended to account for business cycle effects. Finally,  $u_i$  is an individual bank dummy and  $q_t$  is a time dummy. The analysis is performed over the period 1991-2000 (2001 for a limited number of banks). The reported  $R^2$  and the number of observations in table 5 refer to the first regression based on the full sample of cross-border M&As and in which only the MA(0) and MA (1) dummies are included. The second and third row

contains estimations on more restricted samples of acquiring and acquired banks in order to investigate any differential post-M&A effects.

Table 5 presents the main results for the M&A dummy variables. The explanatory power of the regressions is relatively low and most coefficients are insignificant. All the coefficients for the MA(0) dummy, the year of the merger or acquisition, are negative (and significant for the return on assets and cost efficiency of the acquired banks), indicating the negative performance impact in the year of the execution of the M&A. This is probably related to merger-related cost increases and inefficiencies caused by the legal and operational transition. The only noteworthy finding is the positive and significant coefficients on the post-M&A dummies in the profit efficiency regression for acquired banks. This finding is consistent with the positive post-M&A evolution of profit efficiency reported in table 2.

## **5. Conclusions**

This paper investigates the relationship between cross-border mergers and acquisitions in European banking over the 1990s and bank efficiency. A distinction is made between the effect of M&As on the cost efficiency versus the profit efficiency of the banks involved. The sample contains 62 well publicized cross-border bank M&As in

the EU, Norway and Switzerland executed between 1990 and 2001. Different methodologies are employed to investigate the efficiency consequences of M&As and the ex ante characteristics of the consolidating banks relative to the non-merging industry peers. The main conclusions can be summarized as follows. The acquiring and acquired banks exhibit an economically meaningful pre-M&A difference both in terms of cost and profit efficiency. However, in the short period following the takeover that we are able to analyze, the results are consistent with a partial profit efficiency enhancement, but not with any tangible gains in terms of cost efficiency. This finding may be indicative of the existence of different types of barriers to operational efficiency improvement in cross-border bank takeovers. The profit efficiency improvement may be caused by changes in the pricing behavior of the acquired banks, positive revenue-generating spill-overs from the new parent bank, or increased market power.

It is clear that much more research is needed to gain a clear understanding of the complex causes and consequences of international bank mergers. It is certainly needed to assess the relative importance of efficiency explanations, the motivations related to diversification of different types of bank risks, and other possible motivations. Another useful extension is to broaden the analysis by also including cross-activity mergers in which bank, insurers, investment banks and/or other types of financial services providers merge. Since the currently available samples of cross-border bank M&As in Europe are relatively small, one could try to analyze similar

deals in other parts of the world in order to detect common patterns and predictions. It is necessary to complement the short term postmerger analysis with a thorough investigation of the longer term performance consequences. The challenge here is to disentangle merger-related changes from influences caused by contaminating events. In this respect, the diverging track record of some of the most active European cross-border bank acquirers (such as ING, Deutsche Bank or BSCH), both in terms of stock market performance and relevant accounting-based risk/return indicators, illustrates the associated difficulties. A series of well-constructed case studies may be helpful to detect some of the underlying causes.

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**Table 1.** Estimation results of the logit model to detect ex ante efficiency characteristics of the acquiring and acquired banks in European cross-border bank M&As

Variables	ACQUIRING BANKS	ACQUIRED BANKS	ACQUIRING BANKS	ACQUIRED BANKS
COSTINC	-0,38 (2,18)	0,47 (1,12)		
ROAbt			0,18 (2,16)	-0,22 (1,94)
LABOR	-0,03 (0,65)	0,06 (1,65)	-0,04 (1,22)	0,04 (1,85)
LSIZE	0,05 (8,11)	-0,07 (2,24)	0,05 (8,89)	-0,08 (2,58)
DSDEP	2,14 (3,22)	1,21 (3,78)	2,21 (3,15)	1,24 (3,89)
LTA	1,45 (3,47)	0,74 (1,31)	1,55 (3,33)	0,84 (0,92)
NONINT	1,81 (2,45)	-0,67 (0,88)	1,62 (2,62)	-0,48 (0,66)
LogL	-468,7	-584,8	-475,6	-477,1
Pseudo R <sup>2</sup>	0,27	0,22	0,26	0,22
Nobs	792	792	792	792

Absolute t-statistics in parentheses

**Table 2.** Changes in the cost and profit efficiency rank of bank involved in cross-border M&As and their industry peer group

<b>Cost efficiency rank</b>	M&A banks	Peer group <sup>1</sup>	Difference
Pre-M&A acquiring banks	0,74	0,68	0,06
Post-M&A acquiring banks	0,72	0,69	0,03
Change	-0,02	0,01	
Pre-M&A acquired banks	0,66	0,72	-0,06*
Post-M&A acquired banks	0,64	0,69	-0,05
Change	-0,02	-0,03	
Post-M&A consolidated banks	0,71		
Weighted change	-0,01		
<b>Profit efficiency rank</b>			
Pre-M&A acquiring banks	0,65	0,55	0,10*
Post-M&A acquiring banks	0,67	0,58	0,09*
Change	0,02	0,03	
Pre-M&A acquired banks	0,43	0,51	-0,08*
Post-M&A acquired banks	0,56	0,55	0,01
Change	0,13**	0,04	
Post-M&A consolidated banks	0,64		
Weighted change	0,08*		

\* Significant at the 10 % level, \*\* significant at the 5 % level

<sup>1</sup> Limited peer group of banks matched with the M&A banks in terms of institutional form, country and size.

**Table 3.** Ex ante sources of changes in cost efficiency

	Relative efficiency	Low Efficiency	Both Hypotheses
W2 (EFF1– EFF2)	0,13 (0,68)		0,11 (0,42)
W1 (EFF1)		-0,44 (2,29)	-0,63 (1,60)
W2 (EFF2)		-0,21 (3,02)	-0,31 (2,24)
R <sup>2</sup>	0,14	0,16	0,21
Nobs	48	48	48

Absolute t-values in parantheses

**Table 4.** Ex ante sources of changes in profit efficiency

	Relative efficiency	Low Efficiency	Both Hypotheses
W2 (EFF1-EFF2)	0,38 (2,21)		0,42 (2,17)
W1 (EFF1)		-0,43 (2,18)	-0,63 (1,64)
W2 (EFF2)		-0,39 (2,41)	-0,42 (2,79)
R <sup>2</sup>	0,08	0,14	0,22
Nobs	48	48	48

Absolute t-values in parentheses

**Table 5.** Effects of cross border M&As on bank performance

VARIABLE		MA(0)	MA(1)	MA(2)
ROAbt	All M&As	-0,09 (1,24)	-0,04 (0,71)	
Nobs 362	Acquiring banks	0,08 (1,12)	-0,02 (0,17)	0,10 (1,17)
R <sup>2</sup> 0,31	Acquired banks	-0,21 (2,26)	0,08 (0,12)	0,11 (1,27)
CEFF	All M&As	-0,18 (0,54)	-0,11 (1,10)	
Nobs 348	Acquiring banks	0,17 (1,28)	0,02 (0,71)	-0,22 (2,06)
R <sup>2</sup> 0,24	Acquired banks	-0,28 (2,08)	-0,16 (1,31)	0,01 (0,12)
PEFF	All M&As	-0,18 (0,92)	0,10 (1,74)	
Nobs 352	Acquiring banks	-0,11 (0,82)	0,09 (0,29)	0,11 (0,64)
R <sup>2</sup> 0,21	Acquired banks	-0,06 (1,35)	0,21 (2,04)	0,12 (1,78)

ROAbt is return on assets before taxes, CEFF is cost efficiency, PEFF is profit efficiency. MA(0, 1, 2) is a dummy for the year of the M&A and the first and second year following the M&A.



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