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## Article

# Exploring the success of regional bank mergers: Financial versus non-financial performance

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# Exploring the Success of Regional Bank Mergers: Financial Versus Non-Financial Performance

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**Abstract:** This study examines effects of mergers between Austrian banks from 2005 to 2018. Using matching techniques, we assess consequences for bank profitability and financial efficiency, as well as the impact on loan growth and a measure of social efficiency. Significant effects are observed in naive comparisons to non-merging banks, which almost entirely disappear after balancing with bank-level and environmental factors. This indicates that the average bank merger is neither value-decreasing nor value-enhancing. However, variation in individual merger success is huge and associated with several organizational and strategic factors, such as pursued cuts in personnel expenses or changes in market power.

**Keywords:** bank mergers; savings banks; cooperative banks; bank performance; merger success; matching technique

**JEL Classification:** G21; G34; R51

## 1 Introduction

For many years, the banking system has experienced intense consolidation driven by technological, financial, and regulatory changes (DeYoung, Evanoff, and Molyneux 2009). The high number of mergers has sparked the interest of academics, who examine which banks are merging, why banks are merging, and the

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overall success and specific factors contributing to successful bank mergers. However, the existing evidence on these questions is inconclusive (Behr and Heid 2011; Coccorese and Ferri 2020), and the results largely depend on the country analyzed, the time period under investigation, or the type of bank of interest. Despite extensive research in this area, several research gaps remain. First, although the U.S. market has been extensively investigated, studies on European bank mergers remain limited. Second, the existing literature predominantly focuses on examining the impact of mergers on profitability and efficiency (from a shareholder perspective), assuming that (textbook) motives, such as economies of scale and the desire to grow and increase market power, drive merger activity. However, many banking markets primarily experience mergers between small and regionally close banks for which the above presumption may not apply. In such cases, the more apparent motives may stem from concerns about sustainability owing to declining profitability, increasing regulatory requirements and costs, evolving customer demand, and heightened competition from non-bank institutions (Braun, Parise, and von Nitzsch 2013; Huhtilainen, Saastamoinen, and Suhonen 2022; Kobayashi and Bremer 2022; Thompson 2019). In addition, regional banks may feel pressured by banking and political authorities, as there is widespread opinion that further consolidation is needed to maintain or improve the efficiency and stability of the banking system (Cardillo, Gallo, and Guarino 2021; Figueiras et al. 2021). Consequently, regional banks may be forced to reorganize or merge (Kobayashi and Bremer 2022). These regional bank mergers, which differ from the more frequently examined mergers of large or listed banks, warrant further investigation and detailed analysis. Third, many regional banks are cooperative or savings banks (hereafter referred to as stakeholder banks), which do not only focus on shareholder interests (i.e. increasing bank value by increasing sales or decreasing costs), but attempt to balance the interests of a wider group of stakeholders (Kalmi 2017). Further analysis is required to understand mergers of stakeholder banks, including their non-financial performance. Finally, the selectivity problem remains a prominent methodological challenge in numerous studies, and requires closer attention and scrutiny (Behr and Heid 2011; Egger and Hahn 2010).

To address these issues, we examine the Austrian market for bank mergers. We aim to determine the success of these mergers by analyzing their financial and non-financial performance, while also investigating the main drivers of merger success. The Austrian banking market is of particular interest because of the significant presence of small stakeholder-oriented banks with a regional market demarcation, which presents a unique context for investigating our research questions. Our final analysis focused on 121 bank mergers that occurred between 2005 and 2018. We examine five indicators of merger success: the return on assets (ROA), the cost-income ratio (CIR), the growth rate of loans to non-financial customers, financial

efficiency, and a measure of social efficiency. Efficiency scores were derived using Data Envelopment Analysis (DEA). To address the selectivity problem, we employed matching analysis using entropy balancing. Merger targets are found to perform worse than acquirers *ex ante* with respect to ROA, CIR, and loan growth. In a naive comparison of merged entities (acquirer and target(s) combined) with non-merging banks from one year before to three years after the merger, we observe immediate negative consequences of the average merger across all five indicators of merger success in the merging year. However, three years after consolidation, the average merger seems successful with regard to ROA, CIR, and both efficiency measures. Nevertheless, when matching techniques are employed, significant average merger success remains evident only in terms of social efficiency (though only at the 10 % level), highlighting the necessity of considering the specific objectives of stakeholder banks through performance analysis. Relative to the control group, merging banks close more branches and cut costs more in the post-merger period, which, among other factors, also helps dissect the variation in individual merger success.

Our study contributes substantially to the literature on bank mergers through various avenues. First, we provide new evidence by applying recent data to the Austrian market for bank mergers. The data used in previous research (Egger and Hahn 2010; Hahn 2007) extend only until 2002, although the banking environment has undergone significant changes since then (Girardone and Ricci 2023). Furthermore, the Austrian banking industry is still deemed overbanked with small, locally operating, and unprofitable entities. An analysis of consolidation taken place so far thus provides an outlook on the potential results of mergers to be expected in the future. Second, we extend the analysis of merger outcomes beyond profitability and financial efficiency and incorporate a performance indicator that facilitates the understanding of stakeholder banks. Given that these banks operate with a double bottom line, it is pertinent to measure their performance relative to an objective function that encompasses nonprofit objectives. Thus, we acknowledge that bank mergers may have substantial consequences for regional economies and societies. Finally, we followed previous research calling for sophisticated approaches, using efficiency scores from frontier estimation and matching methods to account for selectivity bias and confounding environmental factors.

The remainder of this paper is organized as follows. Section 2 reviews the literature focusing on mergers of regional banks in European markets. Section 3 outlines the data and methodology employed and Section 4 presents the results. In Section 5, we summarize and discuss the findings, identify limitations, highlight our contributions, and propose future avenues for research.

## 2 Literature Review

### 2.1 Effects of Mergers on Bank Performance

M&As' success in the banking industry has been of academic interest for decades. Many empirical results have been generated since and provide mixed evidence regarding success and determinants of success (see the reviews by Amel et al. 2004; DeYoung, Evanoff, and Molyneux 2009; Kolaric and Schiereck 2014). Approaching these questions, the first challenge is to define 'M&A performance' (Zollo and Meier 2008, 55), revealing a wide range of methods. Kolaric and Schiereck (2014), for example, categorize the most prominent ways to measure success into analyses of shareholder reactions (event studies of stock returns), bank efficiency (preferably frontier methods), and operating (accounting) performance (performance studies).

Due to the regulatory and structural differences between the U.S. and European banking markets, we focus on the success of European bank mergers. The corresponding results are inconclusive and highly sensitive to the time period under investigation (Kolaric and Schiereck 2014) and the geographical focus of the study. A pan-European sample of bank mergers has, for example, been analyzed by Hagedorff and Keasey (2009), who find small performance gains in the post-merger period, and provide evidence that banks follow a cost-cutting strategy in the years following a merger. Many of the respective (cross-country) studies, such as Ismail, Davidson, and Frank (2009), Lozano-Vivas et al. (2011), and Galariotis et al. (2021), cover only large, mostly listed banks, which can hardly be compared to the stakeholder-oriented regional banks in this study.

Merger analyses of individual countries with a significant share of stakeholder-oriented banks are more directly relevant. For example, for savings banks in Spain, Bernad, Fuentelsaz, and Gómez (2013) report significant post-merger profitability increases. More recently, Coccoresse and Ferri (2020) found no average efficiency gains from the mergers of Italian cooperative banks; only banks merging for the third time (at least) were reported to be able to improve efficiency. For the German market, the results tend to be neutral and potentially positive. For a sample of cooperative banks, Lang and Welzel (1999) observed efficiency gains if (but only if) branches closed in the wake of the merger. Koetter (2008) uses profit and cost efficiency estimates of German savings and cooperative banks. The results indicate that every second merger is a success, whereby, "on average, profit efficiency improvements are larger than those of cost efficiency" (Koetter 2008, 258). Auerbach (2009) employs a dynamic panel regression methodology to examine the impact of bank mergers on savings and cooperative banks. Focussing on cost-income ratios and profitability to assess post-merger effects, the author concludes that, on

average, the cost-income ratio is higher for merging banks in the year of the merger than for non-merging banks. However, this ratio gradually improves over time, and by the third and fourth years following the merger, the average cost-income ratio for merging banks surpasses that for non-merging banks. Regarding mergers' profitability effects, Auerbach (2009) reports inconclusive results. Behr and Heid (2011) employ a matching strategy and find a neutral, potentially positive effect of German bank mergers on profitability (return on assets) and cost efficiency (cost-income ratio).

Finally, the Austrian market was analyzed by Hahn (2007), who reported significant gains in productive efficiency for mergers between 1996 and 2002. Similarly, the results of Egger and Hahn (2010) indicate the positive effects of bank mergers on banking performance, especially cost performance.

Empirical findings on the factors associated with merger success are also diverse. Following Kolaric and Schiereck (2014), the determinants can be categorized into the characteristics of partner companies, transaction characteristics, and environmental factors. Koetter (2008) observes that larger differences in pre-merger efficiency indicate more successful mergers. The relatively higher efficiency of the acquirer signals that management skills and cost-saving potential are more easily identified if the target's position is relatively worse *ex ante*. Likewise, Auerbach (2009) proposes that mergers with small banks with weak financial profiles are particularly successful. Kolaric and Schiereck (2014) also list merger experience among success-driving factors, which is somewhat confirmed by Coccorese and Ferri (2020). Lang and Welzel (1999), as mentioned above, argue that, in their sample, efficiency gains only emerge if branches are closed. Many studies, such as Drees, Keisers, and Schiereck (2006), Braun, Parise, and von Nitzsch (2013), and Gindele et al. (2019), have highlighted the importance of 'soft' factors for mergers to be successful. In practice, mergers often suffer from a lack of clear communication and strategy or an underappreciation of necessary efforts and costs, such as technical and personnel integration or customer retention.

The variation in the results of merger success might be due to country-specific differences and changes over time, but methodological problems also play a role. Merging banks non-randomly self-select into treatment for (perhaps unobserved, strategic) reasons, and not accounting for this, for example, by comparing with the average non-merging bank, may lead to simultaneity bias in the results (Egger and Hahn 2010). Interestingly, only a few studies have used matching methods, such as Behr and Heid (2011) and Egger and Hahn (2010). In addition, Yu (2019) used propensity score matching (PSM) to examine more than 2000 credit union mergers in the USA, with no observable improvement in profitability and cost efficiency. Additionally, Coccorese and Ferri (2020) checked their results for robustness using PSM.

The mixed results could also be explained by the different motives for bank mergers. The common opinion is that merging banks strive for efficiency gains and market share, broaden their customer base, enhance revenue, and diversify or alter their risk profiles (Huhtilainen, Saastamoinen, and Suhonen 2022). In reality, other motives may dominate, especially for small non-listed banks in regional markets. These banks may consider a merger as a possible solution for management succession, to exit declining markets and avoid financial problems (Elsas 2007), or to avoid necessary (pending) investments in compliance systems, IT, and workforce training (Braun, Parise, and von Nitzsch 2013; Dunaway 2023; Thompson 2019). This pressure drives banks with lacking or exhausted internal optimization potential to seek consolidation (Braun, Parise, and von Nitzsch 2013), and smaller inefficient units with modest growth prospects merge into larger banks that operate in more favorable business environments (Huhtilainen, Saastamoinen, and Suhonen 2022). However, obtaining hands-on evidence is difficult. Kjellman, Tainio, and Kangas (2014), for example, propose that a loss of confidence of Finnish bank managers in being able to successfully run the bank in the future may have led them to seek a merger. Additionally, a survey of 29 managers of German cooperative banks by Gindele et al. (2019) provided valuable insights. Manager retirement (often without replacement) was the main motive or trigger, which was stated about twice as often as the economic situation. Long-term sustainability is the main strategic goal that mergers should support, increased productivity comes second, and synergies rank seventh (only stated twice). Additionally, the institutional environment must be considered. In Austria, bank mergers are not possible across sectors (or ‘pillars’), and, due to regional principles applied, most mergers are among locally near banks (as in Germany, see Braun, Parise, and von Nitzsch 2013). The performance potential of bank mergers that are defensive and restricted in nature may not be huge, which might explain some common empirical findings.

The paper at hand focusses on stakeholder-oriented banks, namely credit cooperatives and savings banks, which constitute an important and integral part of European banking systems (Kalmi 2017). Unlike shareholder-oriented banks, which focus on maximizing shareholder interests, stakeholder-oriented banks have broader business objectives and balance the interests of a wider group of stakeholders (including employees, customers, the regional economy and society). For savings banks and credit cooperatives, improving non-financial objectives (such as providing local access to financing or community engagement) may represent an additional goal of a merger. Furthermore, because bank performance should be evaluated against pursued objectives (Ahn and Le 2014; Brown 2006), measures of merger success should also consider the consequences for stakeholders.

## 2.2 Consequences of Bank Mergers for Stakeholders

As diverse study findings are on performance effects, DeYoung, Evanoff, and Molyneux (2009) argue that it seems equally difficult to reach a conclusion on whether customers benefit from bank mergers or on how consolidation affects societal risks. They also report growing evidence that mergers may adversely affect a variety of borrowers, depositors, and other external stakeholders (DeYoung, Evanoff, and Molyneux 2009). Mergers are often feared to result in the possible loss of (former) banks' regional ties (Drees, Keisers, and Schiereck 2006). Coccorese and Ferri (2020) argue that increased consolidation might harm borrowers that are more likely served by small banks, with potential negative impact on regional development and equality. Such a development may violate (cooperative) banks' ethics and the mission of favoring the financial inclusion of marginal customers and countering the credit rationing of small businesses (Coccorese and Ferri 2020).

Few studies have dealt with stakeholder perceptions of mergers. In telephone interviews, Urban and Pratt (2000) find that U.S. consumers' expectations of service quality differ according to several socio-economic variables<sup>1</sup> and that there is much uncertainty about prospective impacts before mergers, which must be addressed through appropriate communication. According to Mylonakis (2006b), bank employees in Greece consider mergers a threat to their jobs and benefits, which is confirmed to some extent by Mylonakis (2006a). Álvarez-González and Otero-Neira (2020) polled bank employees in Spain about their opinion on merger consequences for customers to infer about effects on bank-client relationships. They report improvements in the products and services offered but also that bank mergers negatively affect prices and branch proximity. Álvarez-González and Otero-Neira (2023) discuss results from a customer survey on factors being decisive for their loyalty to the merged bank. Managers of credit cooperatives interviewed by Gindele et al. (2019) reported that customers feared branch closures in the wake of a merger, while municipal officials would have to face the associated tax revenue losses. Furthermore, a deterioration in close relationships with the bank is surmised for the cooperative members, customers, and employees.

Most empirical studies on the post-merger consequences for stakeholders focus on the impact on small business lending (SBL), starting with the presumption that small local banks (still) may have some competitive advantage in soft information collection and formation of strong relationships (Berger, Bouwman, and Kim 2017; Mkhaimer and Werner 2021; Nguyen and Barth 2020). However, increased

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1 Interestingly, female respondents and individuals with higher education and income levels appear to be more pessimistic about the impact of bank acquisitions on the quality of bank services.

regulatory costs and technological burdens impair small banks' ability to maintain SBL levels (Hughes et al. 2019). Mergers might negatively affect bank lending to local small and medium-sized enterprises through branch closures or centralized decision making. The latter possibility spurs fear that mergers might disrupt relationship lending, for example, when large banks acquire community banks, as argued by Jagtiani, Kotliar, and Maingi (2016). However, their results did not confirm this perception or common sense. Minton, Taboada, and Williamson (2021) even find relatively more small business lending originations (in counties where the target bank is located) when acquirers are small and from the same (U.S.) state as the target. Avery and Samolyk (2004) also report a positive effect of (U.S.) community banks' consolidation activity on SBL.

However, other studies have reported a decline in SBL after consolidation activity that is partly offset by other banks or non-bank institutions (Berger et al. 1998; Bonaccorsi di Patti and Gobbi 2007; Craig and Hardee 2007).<sup>2</sup> Empirical studies often provide evidence that mergers negatively affect the ties between banks and their customers (Allen, Damar, and Martinez-Miera 2016) because relationships, especially with the borrowers of target banks, may be disrupted or terminated (Degryse, Masschelein, and Mitchell 2011; Karceski, Ongena, and Smith 2005). According to Jagtiani, Maingi, and Dolson (2022), SBL is often redirected towards the acquirer's areas of operation (counties), particularly in mergers involving banks with non-overlapping networks. Credit gaps in counties where only the target was present before the merger may have resulted from this, and Jagtiani, Maingi, and Dolson (2022) find no evidence of other banks making up for these gaps.

If passed on, the merger-induced cost savings may lead to lower lending rates. For commercial bank mergers in the USA, Erel (2011) reports such an effect, which is the more reduced the higher the increase in market power for the consolidated entity is. Barros et al. (2014) also find more favorable loan rates after bank mergers, whereas Yu (2019) does not. For a sample of corporate customers of savings banks whose mergers were forced by county reforms in Germany, Koetter et al. (2018) report reductions in the cost of borrowing, leading to more investment and employment in these firms. Dunaway (2023), on the other hand, argues that the trend of U.S. community banks merging into larger entities has mostly harmed consumers by increased pricing and reduced credit supply.

Bank mergers may also negatively affect financial access and inclusion by amplifying branch closures. Mergers reduce branch density in the U.S., especially in rural areas (Calzada, Fageda, and Martínez-Santos 2023), with the potential to

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<sup>2</sup> According to Ely and Robinson (2009), credit unions extend their lending to the U.S. banking markets affected by merger activities. However, when credit unions merge, their loan supply decreases for at least two years (Yu 2019).

negatively affect access to financing, as suggested by Nguyen (2019) and Jagtiani, Maingi, and Dolson (2022).

Bank customers may also experience changes in their deposit rates after bank mergers. Lower rates of deposits in U.S. markets where significant (local) mergers have taken place have been reported, for example, by Prager and Hannan (1998). Dinger (2015) confirms mostly negative effects of consolidation for U.S. depositors. Bord (2018) argues that with banks becoming larger through mergers, fees and minimum required balances increase, driving off especially low-income households.

After consolidation, regional banks may also alter their risk attitudes and behaviors, with potential effects on financial stability. However, studies of these effects at the banking level are scarce. Knapp and Gart (2014) report that the variability of loan charge-offs and rates of non-performing loans of U.S. bank holding companies significantly increase after mergers, due to changes in the loan mix. Yu (2019) also reports a post-merger shift towards more risky loan categories for U.S. community banks, leading to increased credit risk. For German savings banks forced to merge due to county reforms, Koetter et al. (2018) observe increased risk-taking (lower capital, more non-performing loans, and fewer loan loss provisions).

Literature on merger-related reductions in personnel is also scant, with the exception of Mylonakis (2006a), who reports significant job losses in merged or acquired institutions in the Greek banking market. Sherman and Rupert (2006) argue that merging banks may keep personnel necessary for customer retention. If additional personnel are required during the integration process, employment may increase temporarily. The emergence of merger-induced workforce expansion is confirmed for the European sample of Hagedorff and Keasey (2009).

Academic assessments of whether consolidation changes banks' local support activities through sponsorship and donations are, to the best of our knowledge, nonexistent.

Francis, Hasan, and Wang (2008) report a positive effect of bank mergers on new business formation, although branch closures (confirmed to occur increasingly after mergers) are generally presumed to impair start-up activity (see, e.g. Ho and Berggren 2020, or Prieger 2023). Firms in the acquirer's region are found to reduce their investments if the respective banks experience a distressed merger (Dinger, Schmidt, and Theissen 2021).

### 3 Data, Variables and Methodological Approach

Information on the merger activity of Austrian banks, their branch distribution, and unconsolidated financial statements is provided by the Austrian National Bank

(Oesterreichische Nationalbank; OeNB). Indicators describing the regional environment were calculated from municipality-level data obtained from Statistics Austria, and, in case of start-up intensity, from the Austrian Economic Chambers (Wirtschaftskammer Österreich, WKO). To adjust for inflation, all monetary values are converted to millions of 2015 euro using the Harmonized Index of Consumer Prices (HICP) published by Statistics Austria and Eurostat. The analysis does not consider private banks, asset managers, or special-purpose banks (including severance funds, investment companies, and real estate funds), disbursement societies, online brokers, direct banks, building and loan associations, and European member-state credit institutions. Banks in the dataset can be categorized into five sectors (bank types according to the statistical categorization used by the OeNB): commercial (joint stock) banks, savings banks, Raiffeisen credit cooperatives, Volksbank credit cooperatives,<sup>3</sup> and state mortgage banks.

As demonstrated in Table 1, 292 mergers occurred during the entire data range (2000–2021), with 386 banks merging into larger entities. Because regional data are available only from 2004 onward, and due to three years of post-merger evaluation, the final sample period ranges from 2005 to 2018. For this period, we observed 181 events involving 137 acquirers and 242 targeted institutions. To avoid blurred results due to overlapping operations, further evaluation is restricted to cases in which all parties involved were not part of another merger three years before and three years after the year of consolidation. This left 127 events to begin. In six cases, the merged banks themselves are acquired during the evaluation window; thus, 121 banks are observable until the end of the three-year post-merger period. As in Egger and Hahn (2010), the control group consists of all regional banks that never participated in a merger during the entire period (2000–2021, in our case), which applies to approximately 240 banks each year.

Five indicators are used to measure merger success: the return on assets (ROA), the cost-income ratio (CIR), the growth rate of loans to non-financial customers (LG), and financial (FE) and social efficiency (SE). ROA represents the profit from ordinary activities (before tax) in % of total assets, and CIR is operating expenses

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<sup>3</sup> Two kinds of credit cooperatives evolved in Austria, following the ideas of Friedrich Wilhelm Raiffeisen and Hermann Schulze-Delitzsch (Volksbanken), respectively. While the historical origins of the Volksbank type lie in (economic) self-help of manufacturers and tradesmen, Raiffeisen credit cooperatives were founded to rather support the rural poor, often farmers and workers. At present, they differ in size (with the Raiffeisen sector being the largest in terms of total assets, employees, branches, etc.) and market coverage, but also with respect to organizational aspects. Volksbanken have different network structures and federations, belong to another deposit guarantee scheme, and about half of them operate in the legal form of a corporation. For more information on the Austrian cooperative banking sectors, see Ayadi et al. (2010, 42–56), Brazda, Blisse, and Schediwy (2016), and Poli (2019, 97–145).

**Table 1:** Mergers of regional banks in Austria per year. The total number of mergers over the period from 2000 to 2021 amounts to 292, with 386 banks acquired. The number of banks in the sample (for which data on financial statements is available) is reduced from 791 (in 1999) to 407 (in 2021).

Year	Number of mergers	Number of banks taken	Year	Number of mergers	Number of banks taken
2000	15	25	2011	10	12
2001	14	16	2012	9	10
2002	10	11	2013	14	15
2003	9	13	2014	14	17
2004	10	16	2015	11	18
2005	8	9	2016	37	58
2006	7	13	2017	23	32
2007	7	11	2018	17	21
2008	8	9	2019	18	19
2009	8	8	2020	19	26
2010	8	9	2021	16	18

divided by operating income. Frontier efficiency scores are obtained by use of data envelopment analysis (DEA).

The financial efficiency (FE) scores represent technical efficiency oriented toward the intermediation approach to bank production (see, for example, Ahn and Le 2014). The chosen inputs are personnel expenses, other administrative expenditures (including depreciation), and interest expenses. Banks' outputs consists of total loans, other earning assets, and non-interest income.

A second measure considers social efficiency (SE) to evaluate performance against the objectives that banks with a double bottom line actually pursue and to account for outcomes valued by their regional stakeholders. Ahn and Le (2015), for instance, select output variables that represent benefits to several stakeholder groups. Following their example, we chose loans plus deposits as an output and considered credit risk as an input. Further outputs include the share of branches in less populated areas (less than 10,000 inhabitants) to measure the provision of regional access to financial services (as in Martínez-Campillo and Fernández-Santos 2017; Martínez-Campillo, Fernández-Santos, and Sierra-Fernández 2018; Sierra-Fernández, Martínez-Campillo, and Fernández-Santos 2019), and the z-score as an indicator of bank stability (e.g. San-Jose, Retolaza, and Lamarque 2018; San-Jose, Retolaza, and Torres Pruñonosa 2014, also use a stability measure to calculate efficiency). The z-score is calculated following Lepetit and Strobel (2013) using the mean and standard deviation for the ROA with a five-year window (the current plus four in the past). The input factors were personnel

expenses, other administrative expenditures, and net loan revaluations (including write-downs).<sup>4</sup>

The efficiency scores are calculated using DEA by applying the Benchmarking package for R (Bogetoft and Otto 2015), and corrected for inherent bias due to the true frontier being unknown, using the bootstrap procedure of Simar and Wilson (1998) with 2,000 replications. The FE scores are from an input-oriented model, and the SE scores assume an output orientation. Table A.1 reports descriptive statistics of all variables used to calculate financial and social efficiency, as well as the obtained scores, for the full sample of banks and for the time period 2004 to 2021. More details on the DEA methodology can be found in Section B.1 in the Appendix.

Table 2 reports the means of all five variables for acquirers and targets (plus bank size) in the year before the merger, as well as for all banks in the control group observed from 2004 to 2017.<sup>5</sup> It also features results from tests on group differences which, in this context, are evaluated by regressing the variable of interest on a suitable group indicator and year dummies.<sup>6</sup> The profitability, CIR, and financial efficiency of both acquirers and targets are significantly worse than those in the control group, and the loan growth of targets is susceptible low in the year before the merger. Regarding social efficiency, the differences between groups appeared rather modest, although the difference between the SE of the acquirers and the control group was statistically significant. As reported by Behr and Heid (2011), for bank mergers in Germany, acquirers, on average, are larger than targets, but also larger than non-merging banks. Similarly, the targets in the Austrian case are smaller, less profitable, and inefficient (if proxied by the CIR, but not regarding frontier efficiency measures).

As in Egger and Hahn (2010) and others, the merger evaluation considers artificially consolidated entities in the pre-merger year. The efficiency scores of the acquirers and targets were size-weighted in this aggregation. In Section 4, we first show the raw development of all ‘dependent’ variables from the pre-merger year up to three years after the merger, followed by a naive comparison to the control

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4 Further potential measures of stakeholder benefits comprise municipal tax payments or expenses for regional sponsorships; however, no data are available for these for such a long period. We did not consider interest earned or spent on our calculations, despite stakeholder banks often being proposed to grant benefits to customers in the form of favorable interest rates (see, e.g., Bergendahl and Lindblom 2008; Brown 2006). Anecdotal observations lead us to believe that such practices are not followed strongly by regional banks, which is partly supported by Busch and Memmel (2021), who examine German bank deposit rates. As interest expenses may not be presumed to be minimized in banks with a social mission, they are also not considered inputs.

5 Respective details and full descriptive statistics are given in Table A.2 in the Appendix.

6 The coefficients of the employed time dummies are not reported in Table 2.

**Table 2:** Means of the dependent variables (and bank size) for acquirers (A) and targets (T) in the respective pre-merger year, and for the control group (CG). Columns  $A - T$ ,  $A - CG$  and  $T - CG$  report results of  $t$ -tests on differences in the mean between bank groups from regressions on according group (and also time) dummies. The  $p$ -values from these tests are given in parentheses.

Variable	Acquirers (A) in $t - 1$	Targets (T) in $t - 1$	Control group (CG)	$A - T$	$A - CG$	$T - CG$
Return on assets (ROA)	0.557	0.273	0.700	0.286* (0.07)	-0.135* (0.08)	-0.417** (0.00)
Cost-income ratio (CIR)	73.210	80.165	70.571	-6.813** (0.00)	1.521 (0.14)	8.412** (0.00)
Loan growth (LG)	3.001	0.673	2.857	2.472** (0.00)	-0.155 (0.84)	-2.599** (0.00)
Financial efficiency (FE)	0.716	0.715	0.751	0.001 (0.96)	-0.021** (0.04)	-0.020** (0.02)
Social efficiency (SE)	0.593	0.604	0.608	-0.011 (0.49)	-0.023** (0.05)	-0.013 (0.20)
Size (total assets)	1,308.77	237.02	1,082.46	960.83* (0.06)	256.72 (0.65)	-816.59* (0.09)

One asterisk marks significance at the 10 % level, while two asterisks indicate significance at the 5 % level.

group. Subsequently, a matching analysis was performed to address the selectivity problem.<sup>7</sup> Standard approaches such as propensity score matching (PSM) seek a control group of non-merging banks that have the closest ex-ante propensity to merge (Behr and Heid 2011).<sup>8</sup> PSM, however, may produce biased results, because it often does not succeed in increasing the balance between the treated and control units (King and Nielsen 2019). Proposed alternatives such as coarsened exact matching (CEM) may also be problematic (Black, Lalkiya, and Lerner 2020). Thus, we opted for entropy balancing (Hainmueller 2012), which was performed using the `ebalance` routine in STATA (Hainmueller and Xu 2013). Entropy balancing reweights the control group data such that its moments (mean, variance, and even skewness) match those of the treatment group. The set of weights generated in this process is then used to test for differences between the treated and control units for

<sup>7</sup> An evaluation of developments for three years post merger seems sensible according to previous assessments. Hagendorff and Keasey (2009), for example, argue that it takes two years to streamline processes, as well as for savings in personnel costs and branch closings. However, some studies (e.g., Sherman and Rupert 2006) report longer periods for the effects to materialize, so a post-merger period of five years is also considered when checking the results for robustness (see Section 4.2).

<sup>8</sup> PSM is applied by Egger and Hahn (2010), Behr and Heid (2011), Yu (2019), and Mamun, Tannous, and Zhang (2021), respectively. Coccoresse and Ferri (2020) use it to test for selection bias.

the merger evaluation period, for example, in a weighted regression on a merger (treatment) dummy. For further details on entropy balancing, see Section B.2 of the Appendix.

To generate the matched or balanced control group, we employed both (standard) bank-level characteristics (calculated from financial statements data), as well as selected environmental variables. The bank characteristics used were size (the log of total assets), share of loans to non-bank customers in total assets, equity ratio, share of interest income in total income, and Lerner index.<sup>9</sup> The features of the regional environment are available at the municipal level (except where indicated), and describe the market and competitive circumstances banks operate in. They comprise measures of municipality size, market structure and economic activity, but ultimately should proxy the attractiveness of the respective markets and the associated earnings potential. Our matching procedure applies population, the percentage share of inhabitants aged 60 years and older, the average yearly income of employed residents (in thousand euro per capita), municipal tax revenue of the community (100 euro per capita), bank office density (offices per 1,000 capita), and business registration intensity (start-ups per 1,000 inhabitants, observed at the district level). For each bank and year, we calculate the population-weighted average of the municipality characteristics for all local areas in which the bank operates a branch. Descriptions and standard statistics for all matching variables can be found in Table A.4, for notionally merged entities in the pre-merger year, and for the control group.

The individual measures of merger success obtained from the matching procedure are further examined in Section 4.3. In this analysis, the question of which measures are associated with differing levels of post-merger performance shall be assessed. However, some conclusions may be drawn from the exercise about the characteristics, practices, and strategic actions that distinguish successfully merging banking institutions.

## 4 Results

### 4.1 Basic Results on (Average) Merger Success

Table 3 reports the results of the average development of the five variables of interest, from the pre-merger year to three years after consolidation (as also in Behr and Heid 2011). The first panel shows basic evolution. For the second panel (naive

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<sup>9</sup> Details on the estimation procedures used to calculate marginal cost and, subsequently, the Lerner index are given in the Appendix, Section B.3. Table A.3 in the Appendix reports descriptive statistics for all variables involved.

**Table 3:** Merger success. This table shows the development of the ROA, the CIR, loan growth, financial and social efficiency, from the pre-merger year to the third year after the merger. Panel A exhibits the raw evolution, Panel B compares these figures to the respective values in the control group. Panel C reports results from the matching procedure. The number of examined merger cases is 127, but reduces to 121 until the end of the post-merger period due to merging banks being taken over themselves.

	ROA	CIR	LG	FE	SE
Panel A: Raw development					
Pre-merger year	0.503	74.720	2.502	0.714	0.596
Merger year	0.404	77.827	-5.430	0.697	0.582
Post-merger year 1	0.498	74.022	3.029	0.724	0.630
Post-merger year 2	0.522	72.591	4.251	0.729	0.639
Post-merger year 3	0.574	71.870	4.522	0.724	0.650
Merger success	0.050	-2.486	1.822	0.004	0.048
Panel B: Naive comparison					
Pre-merger year	-0.118*	3.046**	-0.681*	-0.022**	-0.021**
Merger year	-0.222**	5.563**	-8.465**	-0.030**	-0.037**
Post-merger year 1	-0.112**	1.876*	-0.459	-0.010	-0.004
Post-merger year 2	-0.079**	0.473	0.306	-0.004	-0.005
Post-merger year 3	-0.010	-0.506	0.035	-0.001	0.004
Merger success	0.105*	-3.225**	0.566	0.017**	0.019**
Panel C: After matching					
Pre-merger year	-0.070	0.536	-0.415	-0.001	-0.011
Merger year	-0.161**	3.370**	-8.855**	-0.009	-0.023
Post-merger year 1	-0.052	0.179	-1.216	0.010	0.009
Post-merger year 2	-0.051	-1.064	-0.233	0.015	0.008
Post-merger year 3	-0.016	-1.669	0.035	0.017	0.016
Merger success	0.034	-1.808	0.289	0.013	0.021*

One asterisk marks significance with standard  $t$ -tests at the 10 % level, while two asterisks indicate significance at the 5 % level.

comparison), we deduct the mean of the respective variables from the control group (in the respective year). The third panel presents the matching procedure outcomes. The term ‘merger success’ is used for the average change in banks’ performance variables from the pre-merger year to the end of the evaluation period.

The immediate negative consequences of the average merger (in the consolidation year) can be observed from all variables in (the naive) comparison with never-merging banks. An initial worsening of profitability, cost-income ratio, and loan growth is also observable in the results of the matching procedure. Until the end of the examined post-merger period, however, profitability and efficiency improved

significantly in the naive comparison to the control group. Yet, from matching, we infer that these effects are much smaller and statistically insignificant. This also applies to the estimated final merger success after three post-merger years, except for the (weakly significant) improvement in social efficiency.

Although a merger-induced increase in social efficiency (SE), in principle, would represent a desired effect, it pays to take a closer look at the evolution of individual components. SE seems to improve mainly owing to decreases in operating costs overcompensating increased branch closings (which represent a reduction in the proposed benefits). Even though we are not able to evaluate the qualitative nature of these changes – personnel reduction may be ‘only’ attrition, and other cost reductions do not necessarily negatively affect the service quality or local suppliers, caution should be exercised when interpreting an increase in social efficiency as an improvement in regional stakeholder welfare.

Thus, there is no significant average improvement in profitability and efficiency in the post-merger period when selection is considered. Nevertheless, the reduction in the cost-income ratio seems non-negligible (there seems to be some success in cutting costs, on average). Regional bank mergers in Austria appear to have no negative consequences for bank loan growth. However, there is huge variation in the success of mergers. Although the average consolidation does not lead to a significant improvement in profitability, there are many successful mergers. After investigating the robustness issues, we seek to uncover the factors connected to the diversity of merger outcomes in Section 4.3.

## 4.2 Further Analysis and Robustness of Results on Average Merger Success

Using the same procedure, we examine which strategic variables are altered after an average merger. The (non-exhaustive) list of associated indicators evaluated contains the number of bank offices, ratios from the balance sheet and income statement, market power, average interest rates in the form of interest income (expenses) as a fraction of interest-earning (interest-bearing) assets (liabilities), ratios of personnel and administrative expenses, interest income, and income from fees and commissions (all relative to total assets) and, finally, the ratio of loan revaluations (including direct write-offs). After balancing merging and non-merging banks on the same variables as before, two significant differences emerged. First, consolidated banks in our sample close more branches than the control group (up to three years following the merger); second, they reduce the administrative expense ratio more strongly. Corresponding results can be found in Table A.5 in the Appendix.

However, these activities do not seem sufficient to improve profitability significantly (see the results above). While this seems to confirm the focus on cost reductions (as in Hagendorff and Keasey 2009), post-merger enhancements in income generation seem less pronounced. In addition, we did not observe significantly stronger reductions in personnel expenses or increases in (exercised) market power compared with the control group. In summary, the consequences affecting stakeholders are ambiguous. On the one hand, the welfare-reducing effects related to personnel and market power do not seem to be strongly forced by merging banks, at least in the short and medium run. There are also no adverse effects on loan growth, but relatively more branches are closed, and administrative expenses are cut, which may potentially hurt local suppliers.

Two exercises were conducted to test the robustness of the results.<sup>10</sup> First, the respective outcome variable is used to balance the treatment and control groups in the pre-merger year. Behr and Heid (2011), for example, argue that assignment to the group of merging banks is not independent of merger outcomes if the average merging bank underperforms, leading to biased estimates. While further reducing selection problems, all differences in, for example, pre-merger profitability or efficiency, are levelled out. For all variables evaluated, the results of merger success do not seem to be qualitatively affected. No significant changes in dependent variables are observable on average three years after the merger also in this setting, as also the effect on social efficiency loses the weak significance it had.

Second, we measure whether the results change when considering a five-year evaluation period for merger cases observable until 2016. Sherman and Rupert (2006), for example, argue that merger benefits may not be realized even after four years if integration and cost-saving procedures are delayed. However, the number of mergers that can be traced for such a long period reduces to 91 (out of the 99 cases observable for the truncated period, eight merged entities are taken over during the post-merger term). With this reduced sample but a longer evaluation period, the estimates of matched merger success increase, with loan growth and financial efficiency as exceptions. The average matched merger success in the form of ROA increases to 0.135, which is not significantly different from zero. Social efficiency is 0.042 higher after five years, the CIR is 2.901 points lower, and the latter effect becomes significant at the 10 % level (if the control group is not balanced on the prior CIR). Thus, certain cost savings, as expected, seem to be realized only after some time.

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<sup>10</sup> Results are not presented in tabular form, but are available upon request.

### 4.3 Factors Associated with Merger Success

Several factors, practices, and strategies may explain why some regional banks improve strongly after a merger, whereas others stagnate. The matching procedure considers the characteristics (and environmental factors) of the pre-merger year; however, these bank attributes may change with and after consolidation. Thus, we sought to explore the information from our dataset to find out which attributes are correlated (most) with merger success.<sup>11</sup> Environmental data was not used at this stage because of its expected relative constancy.

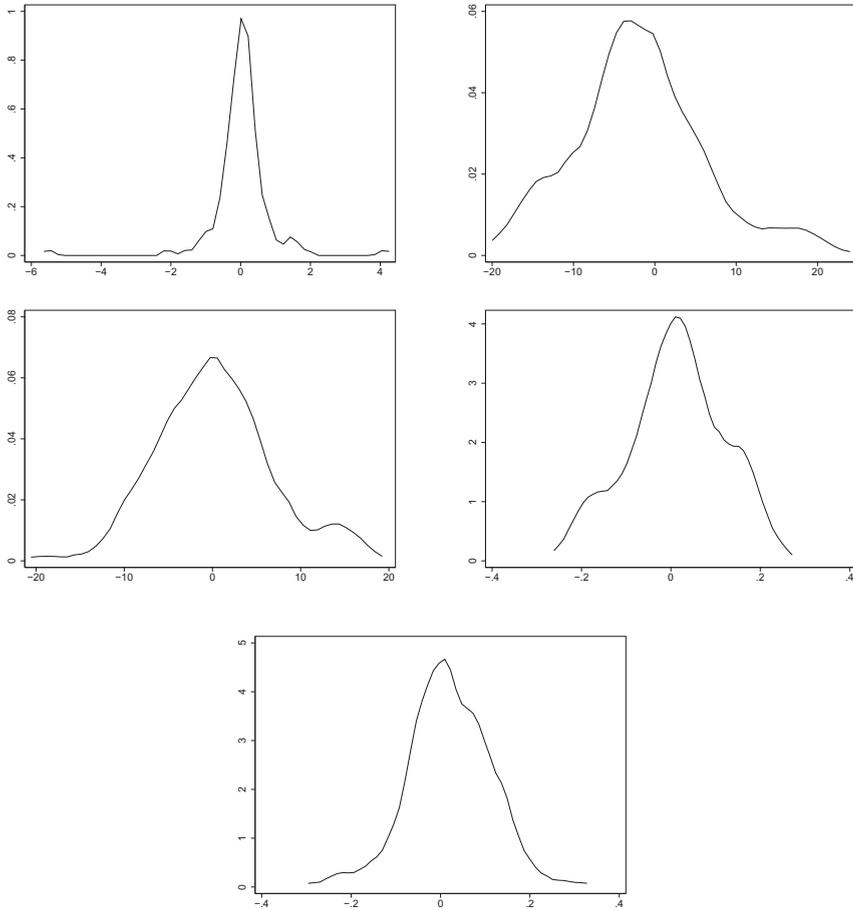
Figure 1 depicts merger success in all five variables of interest (their change three years after consolidation compared to the pre-merger level) graphically. Out of 121 cases of consolidation that are still present three years later, rates of improvement range from approximately half of the banks (with loan growth) to 65 percent (with respect to the cost-income ratio).

The merger success variables are then regressed (including time dummies) on a uniform set of factors consisting of the differences in the characteristics of the acquirers and targets in the pre-merger year (those not applied in the matching procedure), and for the consolidated entity, changes in these factors during the merger period. Personnel and other administrative expenses are entered in the form of their percentage ratio of total assets (%), and value adjustments are relative to total loans to customers. A merger experience dummy is also applied, which takes the value of 1 if the bank (acquirer only) had a merger before (but after 2000 only). Furthermore, there are dummies for mergers in the Raiffeisen sector, for multi-bank mergers (consolidations with two or more acquired banks) and merging banks targeted later in the examination period (more than three years after the evaluated merger).

For each performance variable evaluated, its (consolidated) pre-merger level is statistically significant. For example, the worse the CIR in the year before the merger, the more it improves during the evaluation period. An influential ex-ante difference in the dependent variable between acquirers and targets appears only for the CIR, with banks struggling to improve the CIR if targets were much more inefficient than the acquirer before the merger. This seems to contradict the result of Koetter (2008) or may suggest that there is a threshold that indicates problems with the target that are not easily resolved. The dummy for later takeover is significantly related to the change in the CIR, suggesting that those taken over are banks that are unsuccessful in decreasing the CIR in the post-merger period. Merging banks in

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<sup>11</sup> There is no direct information available, however, on strategic behavior in terms of product and service expansion, changes in lending possibilities and technologies, and organizational changes. Furthermore, it is not possible to assess customer loyalty or personnel commitment using our data.



**Figure 1:** Distribution of changes in the ROA (top left), the CIR (top right), loan growth (mid left), financial efficiency (mid right), and social efficiency (bottom) from the pre-merger year to three years after the merger.

the Raiffeisen sector experience higher post-merger loan growth than do consolidated savings banks or Volksbank credit cooperatives. Merger experience positively affects both efficiency variables.

Other ex-ante differences between acquirers and targets (combined targets, if there are two or more) are hardly significantly connected to the dependent variables' post-merger development. For example, the higher the difference in the administrative expense ratio, the lower the success of CIR reduction, which might hint at poorer results emerging with inefficient acquirers. However, cost-income ratios appear to be increasingly pushed downwards if the market power of the

acquirer is higher than that of the targeted bank or banks. Contrary to expectations, the differences in size were never significant.

Table 4 shows how the changes in potential strategic variables and merger outcomes (both from the pre-merger year to three years after the merger) are inter-related, Table A.6 in the Appendix reports the underlying regression results. Some of these interrelations occur naturally, such as higher post-merger loan growth being associated with an increasing loan ratio in the balance sheet, or that increasing interest income ratios indicate improvements in financial efficiency (given that noninterest income is one of the outputs applied). From these results, it can be reasoned that bank mergers with improved profitability are those that succeeded in reducing administrative costs more strongly. However, personnel expenses and market power seem to be levers for improvements in the cost-income ratio. At least in the sample at hand, banks that increasingly reduced personnel expenses or obtained relatively more pricing power also experienced greater improvements in the CIR. Post-merger improvements in financial efficiency are also related to personnel expenses, and, as argued before, expense cuts and branch closures affect social efficiency outcomes. In addition, more pronounced increases in market power seem to indicate adverse social efficiency developments.

Developments in bank equity ratios have also been examined, although it is not entirely clear whether these are strategic adjustments. Nevertheless, strong drops in the equity ratio are observable for some institutions in the sample (up to 3pp), and this group of banks appears to drive the connection between equity ratio changes and post-merger profitability, CIR, and loan growth (see Table 4). The combined size of these institutions is rather low, and they start with a rather high capitalization level (so there is no need to further improve it by merging)

**Table 4:** Post-merger analysis. This table shows whether and how changes (decreases or increases) in certain strategic variables from the pre-merger year up to three years after consolidation are related to merger success over the same time frame.

	ROA	CIR	LG	FE	SE
	Improves (+) or deteriorates (–)				
Decrease in bank offices					–
Increase in loans ratio			+		
Decrease in equity ratio	–	+	+		
Increase in interest income ratio				+	
Increase in market power		+			–
Decrease in personnel expenses ratio		+		+	+
Decrease in administrative expenses ratio	+				+
Decrease in value adjustments ratio					

and good profitability. They seem to pursue a credit expansion strategy (as loan growth over the merger evaluation period is much larger than that for the remaining merging banks) and are successful in cutting costs (bringing the CIR down). By contrast, profitability remains low and significantly behind pre-merger levels after the three post-merger years. Further examination of the characteristics of merging banks with falling equity ratios reveals no slump in operating income. Delayed value adjustments to the credit portfolio (with a peak in the second post-merger year) and high write-downs of other financial assets (bonds, stocks, participations, and shares in affiliated enterprises) reduce the evolution of the ROA. Thus, there seems to be a cluster of banks that potentially drives some of our main results, which are expanding the traditional loan business (while coping with charge-offs, especially in financial assets), and ambitiously downscaling administrative costs.

## 5 Conclusions

The existing literature on bank mergers exhibits noteworthy limitations, particularly a scarcity of studies on the European market and the consolidation activities of small, unlisted banks, or of financial institutions with a double bottom line. In addition, little attention has been paid to selectivity problems. To address this research gap, we analyze 121 Austrian bank mergers that occurred between 2005 and 2018. The Austrian market is characterized by small and very close regional mergers of stakeholder-oriented banks (cooperative and savings banks) that also pursue non-financial (social) objectives, that is, balance the interests of a wider group of stakeholders.

In a naive comparison with never-merging banks, the average merger was found to be successful three years after execution in terms of ROA, CIR, and financial and social efficiency. However, when accounting for the selectivity problem using a matching approach, no such effect is observable at conventional significance levels. Furthermore, we identify various strategic decisions during the post-merger phase, such as increases in market power and reductions in personnel expenses, which significantly impact individual merger success.

Our results have several implications for future research. They highlight the necessity of considering the selectivity problem in the analysis of bank mergers, that is, selecting an appropriate control group. Austrian bank mergers would be evaluated too positively if only a naive comparison with non-merging banks was made. The results of many previous studies must be considered in light of the fact that acquirers, targets, and control groups differ strongly from each other, and matching approaches are necessary to incorporate that.

Additionally, our study provides novel evidence concerning an alternative measure of merger performance that encompasses the broader objective of stakeholder banks involved in regional bank mergers, that is, social efficiency. Although initial observations suggest that bank mergers primarily improve social efficiency, in line with stakeholder goals, a closer examination of the results provides a more nuanced perspective. Against the expectations of stakeholder banks trying to avoid overly negative consequences for customers, employees, and the region, further analysis shows that the (weak) enhancement in our social efficiency measure primarily arises from reductions in administrative costs more than offsetting the negative effects of bank office closures. While this calls for a more refined definition of social efficiency, we advocate evaluating the effects of stakeholders alongside conventional performance measures in future analyses of bank mergers. Further results of our study that point in a favorable direction concerning bank stakeholders are that loan growth and personnel expenses are not significantly reduced, and that the merging banks, on average, did not substantially increase their exercised market power.

The key takeaway from our investigation is that the average merger of small regional banks does not appear to be value-destroying or value-enhancing. This can be attributed to various factors, including the costs associated with the restructuring and integration processes, which are particularly evident in the merger year. Additionally, smaller banks may possess limited experience with mergers, which further affects their overall performance. Furthermore, obtaining additional revenue opportunities in constrained regional markets may prove challenging. Despite the apparent mixed success of Austrian bank mergers, their inevitability is underscored by the prevailing conditions in the overbanked Austrian market. Small regional banks face mounting pressure, such as regulatory requirements and technological advancements, compelling them to pursue mergers as a coping mechanism. To assist industry practitioners, we identify the factors influencing individual merger success in both the pre-merger and post-merger phases, enabling the prioritization of actions and strategies.

However, our study has some limitations. First, the number of observed merger cases is not excessively high, which means that a few special cases within our sample might have driven some of our results. Second, the temporal scope of our observation periods (three and five years) may be insufficient to capture the full extent of merger effects, as argued by Sherman and Rupert (2006), who suggest that merger benefits may take a longer time to manifest. Third, the restricted focus on the Austrian market, characterized by its unique attributes, poses challenges in generalizing our findings to other markets, particularly beyond Europe. Additionally, the lack of uniform definitions of financial and social efficiencies may contribute to the divergent results of different studies on merger performance analysis.

As a recommendation for future research, we propose expanding the analysis to encompass not only large bank mergers of listed companies, but also mergers involving small and regional banks in other countries. Moreover, investigating longer post-merger phases despite potential confounding events can yield a more comprehensive understanding of the lasting impact of bank mergers. Additionally, qualitative evidence concerning the pre-merger motives and post-merger decision-making processes of small and regional banks may shed light on the heterogeneity of results in the merger context. Finally, exploring potential mission drifts after mergers, where merging entities may adopt behaviors akin to conventional banks, merits further investigation. Banking sector consolidation may jeopardize the business models of small and regional banks, hindering proximity to customers and local informational advantages. Our findings suggest that merging banks increasingly sacrifice proximity, thereby compromising their competitive advantages.

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## A Tables

**Table A.1:** Description and statistics of output and input (benefit and cost) measures in calculating financial (FE) and social efficiency (SE). Statistics are calculated for the period 2004 to 2021 (10,595 observations for 713 banks). Euro values are adjusted for inflation using the Harmonized Index of Consumer Prices (HICP). FE and SE are calculated by DEA assuming variable returns to scale. Efficiency scores are bias-corrected per Simar and Wilson (1998).

Variable	Description	Measurement unit		
<b>Outputs and inputs used to calculate financial efficiency (FE)</b>				
Loans	Claims against credit institutions non-financial customers	Million euro		
Other earning assets	Fixed-income securities, shares, shares and participations in affiliated enterprises	Million euro		
Non-interest income	Net income from fees and commissions, income from securities, participations and financial operations	Million euro		
Personnel expenses	Staff expenses	Million euro		
Administrative expenses	Other administrative expenses, depreciation	Million euro		
Interest expenses	Interest payable and similar charges	Million euro		
<b>Benefits and costs employed to calculate social efficiency (SE)</b>				
Loans plus deposits	Loans plus liabilities to non-financial customers	Million euro		
Bank offices	Number of offices the bank operates in municipalities with less than 10,000 inhabitants	Count		
z-score	Return on assets plus equity ratio, divided by the standard deviation of the return on assets	Score		
Personnel expenses	Staff expenses	Million euro		
Administrative expenses	Other administrative expenses, depreciation	Million euro		
Net write-downs	Net value adjustments of loans (including direct write-offs), net risk provisions for lending	Million euro		
Variable	Mean	Standard deviation	Minimum	Maximum
Loans	918.54	5,644.44	6.36	128,308.70
Other earning assets	203.55	1,517.36	0.00	39,996.76
Non-interest income	11.27	82.82	-0.01	1,969.90
Personnel expenses	9.08	56.50	0.00	2,153.78
Administrative expenses	6.55	39.80	0.03	1,063.44
Interest expenses	18.86	163.33	-27.84	5,411.55
Loans plus deposits	1,455.15	8,320.55	6.36	184,016.40
Bank offices	4.83	7.07	0	97
z-score	60.29	62.87	-3.40	1,499.86
Net write-downs	3.09	27.61	-375.57	1,277.81
Financial efficiency	0.74	0.12	0.19	0.98
Social efficiency	0.61	0.13	0.10	0.97

**Table A.2:** Description and statistics of the dependent variables as well as bank size for acquirers and targets in the respective pre-merger year, and for the control group.

Variable	Description	Measurement unit
Return on assets (ROA)	Profit before tax/total assets	%
Cost-income ratio (CIR)	Operating expenses/operating assets	%
Loan growth (LG)	Growth rate of loans to non-financial customers	%
Financial efficiency (FE)	Measure of technical efficiency from DEA	Score
Social efficiency (SE)	Measure of technical efficiency from DEA	Score
Size	Total assets	Million euro

Variable	Mean	Standard deviation	Minimum	Maximum
<b>Panel A: Acquirers in <math>t - 1</math> (<math>n = 127</math>)</b>				
Return on assets (ROA)	0.557	0.912	-6.015	5.987
Cost-income ratio (CIR)	73.210	13.850	38.535	185.569
Loan growth (LG)	3.001	5.651	-18.511	20.870
Financial efficiency (FE)	0.716	0.128	0.245	0.942
Social efficiency (SE)	0.593	0.133	0.195	0.929
Size	1,308.77	6,465.79	34.25	55,175.24
<b>Panel B: Targets in <math>t - 1</math> (<math>n = 168</math>)</b>				
Return on assets (ROA)	0.273	1.570	-11.174	6.014
Cost-income ratio (CIR)	80.165	12.806	49.286	156.688
Loan growth (LG)	0.673	6.492	-18.997	17.938
Financial efficiency (FE)	0.715	0.131	0.384	0.937
Social efficiency (SE)	0.604	0.124	0.330	0.902
Size	237.02	1,370.32	14.78	17,773.57
<b>Panel C: Control group (<math>n = 3,310</math>)</b>				
Return on assets (ROA)	0.700	0.911	-7.732	8.971
Cost-income ratio (CIR)	70.571	11.764	15.624	275.000
Loan growth (LG)	2.857	8.646	-71.256	338.954
Financial efficiency (FE)	0.751	0.120	0.247	0.976
Social efficiency (SE)	0.608	0.132	0.101	0.949
Size	1,082.46	6,207.65	6.82	124,986.50

**Table A.3:** Description and statistics of variables used to calculate marginal cost and the Lerner index. Statistics are calculated for the entire dataset (10,595 observations for 713 banks), spanning the period from 2004 to 2021. Euro values are adjusted for inflation using the Harmonized Index of Consumer Prices (HICP).

<b>Variable</b>	<b>Description</b>	<b>Measurement unit</b>
Total cost	Expenses for interest, fees and commissions, personnel, other administrative costs, depreciation, other costs	Million euro
Price of labor	Personnel expenses/total assets	%
Price of capital	Non-personnel costs/fixed assets	%
Price of funds	Interest expenses/interest-bearing liabilities	%
Output	Total assets	Million euro
Output price	Total income/total assets	%
Marginal cost		Euro
Lerner index	Margin of the aggregate price over marginal cost	% (of price)

<b>Variable</b>	<b>Mean</b>	<b>Standard deviation</b>	<b>Minimum</b>	<b>Maximum</b>
Total cost	37.25	261.39	0.05	7,635.98
Price of labor	1.16	0.31	0.00	3.68
Price of capital	93.32	159.67	8.24	4,438.27
Price of funds	1.15	0.93	-0.23	6.73
Output	1,261.35	8,131.96	6.43	168,558.80
Output price	0.04	0.01	0.01	0.20
Marginal cost	0.03	0.01	-0.21	0.18
Lerner index	0.21	0.10	-2.46	4.18

**Table A.4:** Description and statistics of variables used to balance the control group with the treatment group. Matching variables for the treatment group are obtained by notionally merging the data for the 127 considered acquirers and their respective targets for the specific pre-merger year. Statistics for the control group are reported for all potential pre-merger years (2004–2017). The control group consists of all banks (about 240, on average) that never participated in a merger during the entire period observed (2000–2021). Euro values are adjusted for inflation using the Harmonized Index of Consumer Prices (HICP).

Variable	Description	Measurement unit
Bank size	Log of total assets	Ln (million euro)
Loans ratio	Loans to non-financial customers/total assets	%
Equity ratio	Equity capital/total assets	%
Interest income ratio	Interest income/total income	%
Lerner index	Margin of the aggregate price over marginal cost	% (of price)
Population	Number of inhabitants	1,000 capita
Elderly inhabitants	Share of inhabitants aged 60 or more in the total population of the municipality	%
Average income	Average yearly income of the employed population	1,000 euro per capita
Municipal tax	Revenues of the community from municipality tax	100 euro per capita
Bank office density	Bank offices relative to population	Offices per 1,000 capita
Start-up intensity	Newly founded firms relative to district population	Firms per 1,000 capita

Variable	Mean	Standard deviation	Minimum	Maximum
<b>Panel A: Notionally merged banks in <math>t - 1</math> (<math>n = 127</math>)</b>				
Bank size	1,622.30	7,714.48	59.51	72,948.81
Loans ratio	55.77	13.17	19.96	82.25
Equity ratio	9.69	3.15	2.80	19.04
Interest income ratio	70.98	7.85	45.77	87.00
Lerner index	0.20	0.08	-0.17	0.39
Population	26.26	51.24	2.69	295.53
Elderly inhabitants	24.11	3.06	18.43	32.19
Average income	24.76	2.66	18.10	36.05
Municipal tax	2.66	1.35	0.54	6.13
Bank office intensity	0.68	0.21	0.31	1.49
Start-up intensity	4.17	1.12	2.00	7.30
<b>Panel B: Control group (<math>n = 3,310</math>)</b>				
Bank size	1,082.46	6,207.65	6.82	124,986.50
Loans ratio	57.71	14.89	0.00	90.36
Equity ratio	10.67	5.61	2.77	99.56
Interest income ratio	72.45	9.90	12.50	100.00
Lerner index	0.22	0.12	-2.46	4.18
Population	16.00	38.75	0.68	275.01
Elderly inhabitants	22.64	3.35	12.90	35.53
Average income	23.89	3.15	14.89	40.60
Municipal tax	2.77	1.77	0.001	16.58
Bank office intensity	0.79	0.38	0.11	4.43
Start-up intensity	3.66	0.88	1.90	7.60

**Table A.5:** This table examines how strategic variables change after the average bank merger. Coefficients represent the change in the respective variable from the pre-merger year up to three years after consolidation, relative to its development in the (balanced) control group. For the value adjustments ratio, also the difference in the cumulated change is reported. *p*-values for the *t*-test on non-significance are given in parentheses.

Variable	Description	Measurement unit
Number of bank offices	Number of branches plus headquarter	Count
Lerner index	Markup of aggregate price over marginal cost	% (of price)
Loans ratio	Loans to non-financial customers/total assets	%
Deposits ratio	Customer deposits/interest-bearing liabilities	%
Equity ratio	Equity capital/total assets	%
Interest income ratio	Interest income/total income	%
Personnel expenditures ratio	Personnel expenses/total assets	%
Administrative expenses ratio	Other administrative expenses/total assets	%
Average interest rate (assets)	Interest income/interest-earning assets	%
Average interest rate (liabilities)	Interest expenses/interest-bearing liabilities	%
Net interest margin	Net interest income/total assets	%
Net fee and commissions margin	Net fee and commission income/total assets	%
Value adjustments ratio	Net write-downs of loans/total loans	%
Number of bank offices	-1.187** (0.00)	Administrative expenses ratio -0.047** (0.02)
Lerner index	0.003 (0.92)	Average interest rate (assets) 0.019 (0.85)
Loans ratio	0.012 (0.99)	Average interest rate (liabilities) 0.010 (0.91)
Deposits ratio	-0.825 (0.27)	Net interest margin 0.003 (0.93)
Equity ratio	0.026 (0.90)	Net fee and commissions margin 0.010 (0.57)
Interest income ratio	-0.427 (0.52)	Value adjustments ratio -0.047 (0.68)
Personnel expenditures ratio	-0.016 (0.44)	Value adjustments ratio (sum) 0.317 (0.20)

One asterisk marks significance at the 10 % level, while two asterisks indicate significance at the 5 % level.

**Table A.6:** This table reports results from OLS regressions (with robust standard errors) of merger success variables on bank and merger characteristics. Dependent variables consist of the return on assets (ROA), the cost-income ratio (CIR), loan growth (LG), and financial as well as social efficiency (FE and SE). *C* stands for changes in variables from the pre-merger year up to three years after consolidation, also with dependent variables, *D* marks differences between acquirers and targets in the pre-merger year, and *S* is the sum of changes (of the value adjustments ratio) over the merger period. Estimated models also contain a constant and year dummies.

	C.ROA	C.CIR	C.LG	C.FE	C.SE
Dependent variable ( $t - 1$ )	-0.918**	-0.153**	-0.976**	-0.228**	-0.247**
D.Dependent variable	0.079	-0.243**	-0.084	-0.084	0.011
Non-Raiffeisen	-0.123	0.647	-5.342**	0.069	0.029
Target (later than $t + 3$ )	-0.219	1.377*	-1.159	-0.015	-0.027
Multi-bank merger	0.067	-0.350	-0.399	-0.010	0.018
Merger experience (since 2000)	-0.025	-0.668	0.154	0.052**	0.031*
D.Bank offices	-0.002	0.019	-0.015	-0.0002	0.0002
C.Bank offices	-0.005	-0.106	0.082	0.001	0.005**
D.Loans ratio	-0.001	0.006	-0.014	-0.0002	0.001
C.Loans ratio	0.004	0.001	0.608**	-0.001	-0.001
D.Equity ratio	0.012	-0.191**	-0.041	0.0004	0.004*
C.Equity ratio	0.138**	0.411**	-1.629**	0.010	0.008
D.Interest income ratio	-0.002	0.002	0.058	0.003**	0.002
C.Interest income ratio	-0.001	-0.043	0.137	-0.007**	-0.0002
D.Lerner index	0.396	-31.810**	-0.831	0.032	0.101
C.Lerner index	1.035	-102.983**	-9.292	-0.094	-0.200*
Personnel expenses ratio ( $t - 1$ )	-0.064	1.262	-2.362	-0.079	-0.009
D.Personnel expenses ratio	0.050	-0.972	2.805	-0.020	0.061*
C.Personnel expenses ratio	-1.379	9.092**	-5.309	-0.198**	-0.245**
Administrative expenses ratio ( $t - 1$ )	-0.376	-1.392	-0.251	0.017	-0.194**
D.Administrative expenses ratio	-0.046	4.261**	-1.305	0.004	0.005
C.Administrative expenses ratio	-1.379**	-2.661	-0.763	-0.123	-0.440**
Value adjustment ratio ( $t - 1$ )	0.052	-0.094	-0.533	0.001	-0.004
D.Value adjustment ratio	0.034	0.032	-0.032	-0.005	-0.003
S.Value adjustment ratio	-0.034	0.032	0.084	0.0002	0.003
$R^2$	0.897	0.965	0.692	0.648	0.663
<b>Dependent variable</b>					
Mean	0.023	-1.566	0.074	0.012	0.019
SD	0.853	7.803	6.488	0.106	0.090
Minimum	-5.500	-17.611	-18.721	-0.230	-0.266
Maximum	4.115	21.609	17.402	0.240	0.300
Improvement (% of mergers)	55	65	50	57	56

One asterisk marks significance with standard *t*-tests at the 10 % level, while two asterisks indicate significance at the 5 % level.

## B Technical Appendix

### B.1 Data Envelopment Analysis (DEA)

Data Envelopment Analysis is the main non-parametric frontier method used in efficiency assessments. Its goal is to generate one efficiency score per observational unit, also if multiple input factors and outputs are present. Whereas Stochastic Frontier Analysis (SFA, the main parametric frontier method) has some advantages in assessing cost efficiency, DEA is mostly used in the production context to gauge the technical efficiency of observational units to transform inputs (costs) into outputs (benefits). In such a setting, even benefits for which there is no price (or price information) can be considered, for example, to include performance on non-financial objectives. An overview of DEA applications with respect to efficiency in the banking industry can be obtained from the review articles of Berger and Humphrey (1997), Fethi and Pasiouras (2010) and Bhatia et al. (2018). Akdeniz et al. (2024) specifically focus on technical efficiency in banks. Behavioral banking models on which the choice of input and output factors is based in empirical studies are discussed, for example, by Ahn and Le (2014). The estimation of financial efficiency in the present paper uses a mix of the asset-oriented and the profit-oriented intermediation approach (Ahn and Le 2014, Table 2, p. 21). Ahn and Le (2015) provide an example on how to consider non-financial goals in computing technical efficiency scores. The list of benefits and costs applied with our social efficiency measure is an extended variant of the one they use (Ahn and Le 2015, Table 1, p. 957). DEA efficiency scores can be computed with input orientation, which implies minimizing the inputs used to generate a specific output level. Financial efficiency scores typically (and also in this paper) are calculated that way. Output-oriented scores (used with social efficiency) are less common and thus explained in more detail below.

On generating scores for productive efficiency, DEA computes weighted sums of both outputs and inputs (benefits and costs), with optimal weights being endogenously determined (Ahn and Le 2014). First, the best-practice frontier, formed by the most productive banks in the sample is approximated (observations with the most favorable benefit-cost relations are enveloped). After that, a measure of the relative distance to that frontier can be computed for each bank. A variable returns to scale (VRS) technology is assumed for social efficiency, as the pursuit of non-profit objectives may restrain banks with respect to the scale of their operations (Ahn and Le 2015). An emphasis on outputs in that case is advocated, for example, by Martínez-Campillo and Fernández-Santos (2017) and others, to highlight the role of benefits accrued for stakeholders (Ahn and Le 2015).

More formally, relative technical efficiency is estimated for each so-called Decision-Making Unit (DMU, i.e. bank) in time  $t$  (time subscripts being ignored in

the following). Assuming (VRS), the output-oriented technical efficiency (TE) score of DMU<sub>o</sub> is the solution to the Linear Programming problem

$$\max \left\{ \phi_o : \phi_o y_{ko} \leq \sum_{i=1}^n \lambda_i y_{ki}, x_{jo} \geq \sum_{i=1}^n \lambda_i x_{ji}, \sum_{i=1}^n \lambda_i = 1, \lambda_i \geq 0 \right\} \quad (1)$$

for  $j = 1, \dots, q$  cost factors  $x_j$  and  $k = 1, \dots, p$  benefits  $y_k$ . Optimization is made over  $\lambda_1, \dots, \lambda_n$  (weights pertaining to benchmark DMUs  $i = 1, \dots, n$ ) and  $\phi$ , with  $1 \leq \phi < \infty$ .  $\phi - 1$  is the proportional increase in output that can be achieved with inputs held constant, and reciprocal values of the estimated  $\phi$  define TE scores that vary between zero and one (Coelli et al. 2005, 180). For more details on DEA see, for example, the seminal articles by Charnes, Cooper, and Rhodes (1978) and Banker, Charnes, and Cooper (1984), or standard references like Cooper, Seiford, and Tone (2007) or Bogetoft and Otto (2011).

## B.2 Entropy Balancing

Entropy balancing (EB) is a reweighting method for causal inference in observational studies with binary treatments (Hainmueller 2012) under the assumption of selection. It is designed to achieve exact balance between treatment and control groups by directly imposing restrictions so that the covariate distributions match on prespecified moments (mean, variance, and possibly higher moments). For example, the balance condition of an equal mean of treatment and (reweighted) control group with respect to matching variable  $x$ , with  $T$  as treatment status and weights  $w$ , can be written as

$$\sum_{i|T_i=0} w_i x_i = \sum_{i|T_i=1} x_i \quad (2)$$

The weights used in that are obtained by solving a constrained optimization problem that minimizes the entropy divergence of weights from uniformity, subject to the applied balance conditions. Achieved improvements in balance reduce model dependence for the subsequent estimation of treatment effects as the treatment variable becomes closer to being independent of background characteristics. Unlike propensity score matching (Rosenbaum and Rubin 1983) or inverse probability weighting, entropy balancing does not require a (possibly misspecified) model for treatment assignment, and retains all observations, improving statistical efficiency. For an introduction to matching methods and further details see, for example, Huntington-Klein (2022, Chapter 14).

In sum, the following features and merits of EB emerge. First, EB weights are directly estimated from the balance constraints, to obtain a high degree of

covariate balance. This obviates the need for continual balance checking and diagnostics like in conventional propensity score models that try to stochastically balance the covariate moments. EB thus also avoids potential bias in the subsequent estimation of treatment effects stemming from likely biased propensity scores out of simple logit or probit models that other matching methods are often based upon. Parish et al. (2018) and Matschinger, Heider, and König (2020), for example, report superior covariate balance compared to traditional propensity score weighting methods. Hainmueller (2012) or Zhao and Percival (2017) confirm a reduction of bias and model dependence in outcome specifications.

Second, EB does not drop observations and typically allows weights to vary smoothly across units (Hainmueller 2012). Other approaches, such as Nearest Neighbor Matching, Kernel Matching or Coarsened Exact Matching, often discard units (or are even designed to do that). Moreover, weights calibrated by EB can be easily passed to subsequent estimation of treatment effects, e.g. a weighted least squares regression of the outcome on the treatment variable (and possible covariates). Finally, a possible drawback is that EB may produce large weights for some observations, thus making them influential (McMullin and Schonberger 2022; Parish et al. 2018).

### B.3 Details on Marginal Cost and Lerner Index Estimation

The Lerner index (Lerner 1934) is calculated as the mark-up of (aggregate) output price  $p$  over marginal cost  $mc$ , relative to price, as

$$L_{it} = \frac{p_{it} - mc_{it}}{p_{it}} \quad (3)$$

Banks are assumed to produce only one aggregate output good whose price is proxied by total income divided by total assets. The Lerner index measures the actually exercised monopoly power and ranges between zero (perfect competition) and the inverse of the price elasticity of demand (in monopoly or collusion). Marginal cost is estimated by means of a standard log-linear cost function following the intermediation approach of bank production (Sealey and Lindley 1977), with output  $q$  and the three (standard) inputs personnel, fixed assets and financial funds. Input prices are measured by personnel expenditures divided by total assets (as the number of employees is not available) as the price of labor (denoted by  $p_l$ ), other administrative and operating expenses (including depreciation and amortization) as a share of fixed assets proxying the price of capital ( $p_k$ ), and the ratio of interest expenses to total interest-bearing funds representing the cost of financial funding

( $p_d$ ). Linear homogeneity in input prices is imposed by dividing total cost ( $tc$ ) and (the remaining) input prices by  $p_d$  to obtain

$$\ln \frac{tc_{it}}{p_{d,it}} = \beta_0 + \beta_1 \ln \frac{p_{l,it}}{p_{d,it}} + \beta_2 \ln \frac{p_{k,it}}{p_{d,it}} + \alpha \ln q_{it} + \epsilon_{it} \quad (4)$$

or, respectively (introducing  $z$  and dropping bank and time subscripts  $i$  and  $t$ ),

$$\ln \frac{tc}{p_d} = \beta_0 + \beta_1 \ln w_l + \beta_2 \ln w_k + \alpha(z) \ln q + \epsilon \quad (5)$$

A PLSC (partial linear smooth coefficient) approach is applied to obtain bank-year observations on marginal cost following Delis, Iosifidi, and Tsionas (2014) and Clerides, Delis, and Kokas (2015), who argue that semi-parametric methods provide more robust and more accurate estimates of  $mc$  than parametric methods. PLSC uses local regression techniques to obtain estimates of  $\alpha$  for each bank  $i$  at time  $t$  in a two-step procedure. As no specific functional form is imposed (as in a parametric estimation of, e.g. a translog cost function), the approach allows for heterogeneous production technologies of banks (Clerides, Delis, and Kokas 2015, 279). For further details, see Clerides, Delis, and Kokas (2015), Brissimis, Delis, and Iosifidi (2014), and the references therein. Estimations for this paper use the R package `np` of Hayfield and Racine (2008). The estimated model (Equation (5)) is linear in the regressors, but the coefficient of output is allowed to change “smoothly” with the value of the smoothing variable  $z$ , which shifts  $mc$  and varies across banks and time (Clerides, Delis, and Kokas 2015, 278). Following Clerides, Delis, and Kokas (2015), we choose  $z = \ln w_l + \ln w_k$  (Delis, Iosifidi, and Tsionas 2014, apply the average of  $w_l$  and  $w_k$ ). Marginal cost is then obtained by multiplying the first derivative with respect to output by average cost ( $ac$ ) per unit of output:

$$mc = \frac{\partial tc}{\partial q} = \alpha(z) \frac{tc}{q} = \alpha(z) ac \quad (6)$$

Descriptive statistics of all variables applied and calculated can be found in Table A.3.

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