MASTERARBEIT | MASTER'S THESIS

Titel | Title

Efficiency–Mission Trade-offs in Austrian Retail Banking

verfasst von | submitted by

Helge Friedhelm Meinikmann B.Sc.

angestrebter akademischer Grad | in partial fulfilment of the requirements for the degree of

Master of Science (MSc)

Wien | Vienna, 2026

Studienkennzahl lt. Studienblatt | Degree programme code as it appears on the student record sheet:	UA 066 913
Studienrichtung lt. Studienblatt | Degree programme as it appears on the student record sheet:	Masterstudium Applied Economics
Betreut von | Supervisor:	Univ.-Prof. Dipl.-Vw. Thomas Gehrig PhD

Acknowledgements

I would like to express my sincere gratitude to my supervisor, Univ.-Prof. Dipl.-Vw. Thomas Gehrig, PhD, for his guidance throughout this project, and to my co-supervisor, Dr. David Pothier, for his constructive feedback and steady support during every stage of this thesis. Our regular discussions shaped both the direction and the rigour of this work.

I am also grateful to my family — particularly my parents — for their unwavering encouragement throughout my studies. Your support made this possible.

Finally, I want to thank my friends and fellow students for the conversations, distractions, and motivation along the way. You know who you are.

AI Attribution Statement. This thesis was developed, researched, and written by the author. During the process, the AI assistant Claude (Anthropic) was used in the following capacities: (i) drafting and refining prose formulations based on the author's outlines, arguments, and structural decisions; (ii) assistance with R code for data processing, index construction, and regression analysis; (iii) LaTeX formatting and compilation troubleshooting; and (iv) discussion of econometric specifications, robustness strategies, and results interpretation. All substantive research decisions — including the research design, variable construction, model selection, and interpretation of findings — were made by the author under the supervision of the thesis advisors. The author takes full responsibility for all content presented in this thesis.

Abstract

This thesis investigates whether a systematic conflict exists between cost efficiency and the provision of banking services in underserved regions of Austria. Using an unbalanced panel of approximately 395 banks over the period 2014–2022, the study develops a novel Supply-Side Index (SSI) that quantifies the adequacy of regional banking infrastructure across Austria's 35 NUTS-3 districts, combining service availability, credit usage, and credit resilience into a single composite measure. Fixed-effects panel regressions link this regional index to bank-level cost-to-income ratios, controlling for ownership type, bank size, capitalisation, liquidity, and market concentration.

Three principal findings emerge. First, exposure to underserved regions does not impose a measurable cost penalty: the coefficient on regional exposure is economically negligible and statistically insignificant across all specifications, including two-way fixed effects models and extensive robustness checks. The widely held assumption that geographic dispersion raises operating costs finds no support in the Austrian data. Second, public/savings banks and cooperative banks exhibit cost-to-income ratios approximately 10 to 15 percentage points lower than those of private commercial banks in the main specifications—a finding inconsistent with the conventional expectation that mission-oriented institutions are less efficient. Third, banks in underserved regions do not charge higher net interest margins, confirming fair pricing conduct; the evidence on broader mission outcomes, including credit stability during the COVID-19 pandemic and branch network retention, is inconclusive.

The results challenge the "inefficiency premise" that has shaped discourse around Austrian banking sector consolidation and suggest that the policy trade-off between cost efficiency and regional banking access is less stark than commonly assumed.

Keywords: Banking Efficiency, Cost-to-Income Ratio, Supply-Side Index, Financial Inclusion, Cooperative Banking, Austrian Banking Sector, Panel Data

Zusammenfassung

Diese Arbeit untersucht, ob ein systematischer Konflikt zwischen Kosteneffizienz und der Bereitstellung von Bankdienstleistungen in unterversorgten Regionen Österreichs besteht. Auf Basis eines unbalancierten Panels von rund 395 österreichischen Banken für den Zeitraum 2014–2022 wird ein neuartiger Supply-Side Index (SSI) entwickelt, der die Angemessenheit der regionalen Bankinfrastruktur in den 35 österreichischen NUTS-3-Bezirken misst. Der SSI kombiniert Dienstleistungsverfügbarkeit, Kreditnutzung und Kreditresilienz zu einem einzigen Komposit-Indikator. Fixed-Effects-Panelregressionen verknüpfen diesen regionalen Index mit den bankindividuellen Kosten-Ertrags-Quoten und kontrollieren für Eigentumstyp, Bankgröße, Kapitalisierung, Liquidität und Marktkonzentration.

Die Analyse liefert drei zentrale Befunde. Erstens verursacht die Exponierung gegenüber unterversorgten Regionen keine messbaren Mehrkosten: Der Koeffizient der regionalen Exponierung ist über alle Spezifikationen hinweg – einschließlich Zwei-Wege-Fixed-Effects-Modellen und umfangreichen Robustheitsprüfungen – ökonomisch vernachlässigbar und statistisch nicht signifikant. Die verbreitete Annahme, dass geographische Streuung die Betriebskosten erhöht, findet in den österreichischen Daten keine Bestätigung. Zweitens weisen öffentliche Banken und Sparkassen sowie Genossenschaftsbanken in den Hauptspezifikationen Kosten-Ertrags-Quoten auf, die rund 10 bis 15 Prozentpunkte unter jenen privater Geschäftsbanken liegen – ein Befund, der der gängigen Erwartung, missionsorientierte Institute seien weniger effizient, direkt widerspricht. Drittens verlangen Banken in unterversorgten Regionen keine höheren Nettozinsmargen, was ein faires Preisverhalten bestätigt; die Befunde zu weiteren missionsorientierten Outcomes – Kreditstabilität während der COVID-19-Pandemie und Erhalt des Filialnetzes – sind hingegen nicht eindeutig interpretierbar.

Die Ergebnisse stellen die "Ineffizienzprämisse", die den Diskurs um die Konsolidierung des österreichischen Bankensektors geprägt hat, empirisch in Frage und legen nahe, dass der politische Zielkonflikt zwischen Kosteneffizienz und regionalem Bankenzugang weniger ausgeprägt ist als gemeinhin angenommen.

Schlagwörter: Bankeneffizienz, Kosten-Ertrags-Quote, Supply-Side Index, Finanzielle Inklusion, Genossenschaftsbanken, Österreichischer Bankensektor, Paneldaten

Contents

List of Tables

List of Figures

1. Introduction

1.1. Motivation

Austria maintains one of the densest banking networks in Europe. With approximately 472 credit institutions and over 3,195 bank branches serving a population of nine million, the country has roughly one branch per 2,800 inhabitants—well above the European Union average (Oesterreichische Nationalbank, 2024). The vast majority of these institutions are mission-oriented: cooperative banks, organised primarily within the Raiffeisen and Volksbanken networks, account for approximately 72% of all Austrian banks, while public savings banks (*Sparkassen*) constitute a further 10–15% share. Together, these mission-oriented institutions form the backbone of retail banking across Austrian regions, from metropolitan Vienna to alpine valleys in Tyrol and rural districts in Burgenland.

This institutional landscape has long attracted scrutiny. Critics argue that Austria is "overbanked"—that the proliferation of small, regionally focused institutions generates unnecessary duplication, inflates operating costs, and depresses profitability. The policy implication, frequently advanced in the context of European banking sector consolidation, is that Austria would benefit from merging its many small banks into fewer, larger, and presumably more efficient entities. This argument rests on what might be called the *inefficiency premise*: the assumption that mission-oriented banks, by virtue of their social mandates and geographic commitments, operate at a structural cost disadvantage relative to profit-maximising commercial banks.

Yet this premise has never been systematically tested for the Austrian banking sector. While the international literature on bank ownership and efficiency is extensive, it yields ambiguous predictions for mature European three-pillar systems. Studies from developing and transition economies associate state ownership of banks with weaker financial development and lower growth (La Porta et al., 2002), but evidence from advanced economies—particularly those with established cooperative and savings bank traditions—frequently points in the opposite direction (Micco et al., 2007; Levy-Yeyati et al., 2007; Beck et al., 2009). For Austria specifically, the empirical record is thin: Hahn (2007) and Burgstaller (2020) provide efficiency analyses of Austrian banks but do not construct a regional index of service provision or test for an explicit efficiency–mission trade-off.

This thesis takes the efficiency–mission puzzle as its central focus. It asks whether banks that serve underserved regions—areas with lower availability, usage, and resilience of banking services—incur systematically higher operating costs, and whether the ownership structure of the Austrian banking sector explains efficiency differences. By constructing a novel regional index of banking service provision and linking it to bank-level cost structures, the study provides the first direct empirical test of the efficiency–mission trade-off in Austrian retail banking.

1.2. Research Questions

The overarching question guiding this thesis is whether a systematic conflict exists between cost efficiency and the provision of banking services in underserved regions of Austria. This question is operationalised through three specific research questions and three testable propositions.

RQ1: Efficiency–Mission Trade-off. Is greater exposure to underserved regions—defined as regions with low values of the Supply-Side Index (SSI)—associated with higher cost-to-income ratios at the bank-year level? If banks that maintain branches in underserved areas incur structurally higher operating costs, this would constitute evidence of an efficiency–mission trade-off.

RQ2: Ownership and Efficiency. Do public/savings banks and cooperative banks exhibit systematically different cost-to-income ratios than private commercial banks, after controlling for regional exposure, bank size, capitalisation, and market structure? The conventional expectation is that mission-oriented banks are less efficient; the alternative hypothesis, motivated by the European stakeholder banking literature, is that they are at least as efficient.

RQ3: Mission Outcomes Among High-Cost Banks. Among banks with above-average costs (identified through a residual-based classification), do those with greater exposure to underserved regions deliver superior mission-related outcomes? Three propositions operationalise this question:

- **P1 (Credit Stability):** High-cost banks with high regional exposure are expected to stabilise credit during economic downturns.
- **P2 (Branch Retention):** High-cost banks with high regional exposure retain more branches.
- **P3 (Fair Pricing):** Banks in underserved regions do not charge higher net interest margins.

Together, these questions trace a logical progression: RQ1 tests whether the trade-off exists, RQ2 examines whether efficiency varies across institutional types, and RQ3 examines whether elevated costs—where they occur—reflect mission-oriented investment or mere operational inefficiency.

1.3. Contribution

This thesis makes three contributions. First, it develops a Supply-Side Index (SSI) that quantifies the adequacy of banking service provision across Austria's 35 NUTS-3 districts. Adapting the distance-based methodology of Sarma (2008, 2012), the SSI combines three dimensions—service availability (branch density per capita), credit usage (loans per capita), and credit resilience (stability of credit growth)—into a single composite measure. Unlike existing financial inclusion indices that operate at the cross-country level, the SSI is designed to capture within-country variation at the sub-national level, making it in principle applicable to policy analysis in other banking systems with adequate geographic data.

Second, the study provides the first systematic empirical test of the efficiency–mission trade-off in Austrian retail banking. Using an unbalanced panel of approximately 395 banks over the period 2014–2022, the analysis links bank-level cost structures to regional exposure through fixed-effects panel regressions, controlling for bank size, capitalisation, liquidity, and market concentration. This approach goes beyond previous Austrian banking studies, which have analysed efficiency in isolation from the geographic dimension of service provision.

Third, the residual-based methodology for identifying high-cost banks and testing for mission outcomes offers a practical framework for distinguishing mission-driven costs from operational inefficiency. This approach—classifying banks as "high-cost" based on whether their actual cost-to-income ratio exceeds the level predicted by their observable characteristics—could, with further refinement and additional data on mission outcomes, inform supervisory assessments of whether individual institutions' elevated costs reflect genuine public service or operational inefficiency.

1.4. Structure of the Thesis

The remainder of this thesis is organised as follows. Chapter 2 reviews the relevant literature across five domains: banking efficiency measurement, the ownership–performance debate, financial inclusion and regional banking, composite index construction, and the theoretical frameworks that inform the interpretation of results. Chapter 3 presents the methodology, including the construction of the Supply-Side Index, the econometric specifications for each research question, and a discussion of identification challenges and limitations. Chapter 4 describes the data sources, sample construction, variable definitions, and descriptive statistics. Chapter 5 reports the empirical results for all three research questions and the associated robustness checks. Chapter 6 discusses the findings in the context of the literature, addresses limitations, and draws out policy implications. Chapter 7 concludes.

2. Literature Review

2.1. Bank Efficiency and the Cost-to-Income Ratio

The measurement of bank efficiency has been a central concern in the financial economics literature for over three decades. Berger and Humphrey (1997), in their influential survey of 130 studies across 21 countries, distinguish between structural approaches—such as the stochastic frontier analysis (SFA) and data envelopment analysis (DEA)—and simpler accounting-based ratios. While frontier methods offer theoretically rigorous benchmarks, they are sensitive to functional form assumptions, input-output definitions, and the choice of estimation technique. Weill (2004) demonstrates this fragility empirically, finding that SFA, DFA, and DEA produce substantially different efficiency rankings for the same set of European banks. This lack of robustness across frontier methods has sustained the use of the cost-to-income ratio (CIR) as a pragmatic, transparent alternative in both academic research and regulatory practice.

The CIR—defined as operating expenses divided by operating income—has become the dominant efficiency metric in European banking supervision. The European Banking Authority (EBA) reports it as a headline indicator in its quarterly Risk Dashboard, and it features prominently in stress-testing frameworks. Its appeal lies in its simplicity: the CIR is directly computable from published financial statements, requires no parametric assumptions, and permits straightforward cross-bank comparisons. However, the ratio is not without limitations. Burger and Moormann (2008) argue that the CIR conflates cost control with productivity and is sensitive to the composition of income rather than to managerial effort. A bank that generates high trading revenues may report a low CIR without being operationally efficient, while a retail-focused institution with stable but lower-margin income may appear inefficient despite sound cost management.

Notwithstanding these critiques, the CIR remains the most widely used efficiency proxy in panel studies of European banking. Bautista Mesa et al. (2014) employ it in their analysis of 3,952 EU banks, finding that efficiency improves with bank size up to approximately $25 billion in total assets, after which the relationship flattens—suggesting diminishing returns to scale. Dietrich and Wanzenried (2011), using a panel of 372 Swiss banks, identify operational efficiency as a primary driver of profitability, alongside loan growth and funding costs. Athanasoglou et al. (2008) reach similar conclusions for Greek banks using a GMM framework, establishing that bank-specific factors—particularly cost management—dominate industry-level and macroeconomic determinants of profitability. At the euro area level, Huljak et al. (2019) apply SFA to 17 countries and report an average cost efficiency of approximately 84%, noting that larger institutions do not consistently display superior efficiency. For Switzerland, whose retail banking sector is similarly characterised by a large number of small, locally operating institutions, Blatter and Fuster (2022) find strong evidence for scale economies: cost-to-income ratios decline by approximately two percentage points per standard deviation increase in bank size over the full sample period (1997–2019), with the effect strengthening to approximately four percentage points after 2010. Their instrumental variables approach—using cantonal population as an instrument for bank size—provides a methodological benchmark for addressing endogeneity in bank efficiency studies.

For the Austrian context specifically, Hahn (2007) provides the most important methodological precedent. Using a sample of Austrian banks, Hahn demonstrates that local market conditions—including regional economic activity, population density, and competitive structure—are significant external determinants of banking efficiency. Failure to control for these environmental factors substantially biases efficiency estimates for locally operating banks. This finding directly motivates the present study's approach of constructing a regional supply-side index and linking it to bank-level cost structures: if geographic environment shapes efficiency, then any assessment of whether mission-oriented banks are "less efficient" must account for where they operate. Burgstaller (2020), in the study most directly relevant to this thesis, analyses 763 Austrian savings and cooperative banks using DEA and warns against mistaking the pursuit of non-profit objectives for managerial incompetence.

Following Burger and Moormann (2008), this study interprets the CIR as a descriptive indicator of cost structure rather than a normative measure of managerial quality, and controls for business model characteristics that affect the income denominator.

2.2. Ownership and Bank Performance

The relationship between bank ownership and performance has generated a large and contentious literature. The dominant theoretical perspective, rooted in agency theory, predicts that state-owned and cooperative banks should be less efficient than private commercial banks due to softer budget constraints—reflecting implicit government guarantees that reduce pressure for cost discipline—weaker governance incentives, and susceptibility to political interference (La Porta et al., 2002). This view found influential empirical support in cross-country studies showing that government ownership of banks is associated with slower financial development and lower economic growth.

However, the generalisability of these findings has been increasingly questioned. Micco et al. (2007) decompose the ownership-performance relationship by country income level and find that, while state-owned banks in developing countries exhibit lower profitability and higher costs, no significant performance differential emerges in industrialised countries. Levy-Yeyati et al. (2007) go further, reporting that public and mutual banks in advanced economies display slight cost and profit advantages over private counterparts, possibly reflecting lower funding costs. These findings suggest that the institutional environment mediates the ownership-efficiency relationship: in countries with strong governance, rule of law, and regulatory frameworks—such as Austria—the predicted inefficiency of public banks may not materialise.

The European three-pillar banking system, comprising private commercial banks, public savings banks, and cooperative banks, has been the subject of particularly detailed investigation. For Germany, whose banking structure closely mirrors Austria's, Beck et al. (2009) find that cooperative banks are the most stable (highest z-scores), followed by savings banks, with private commercial banks exhibiting the highest risk despite greater profitability. Hauner (2005), in a direct comparison of German and Austrian banks, reports that state-owned banks are more cost-efficient—likely due to cheaper funds—while cooperative banks perform similarly to private banks. Čihák and Hesse (2007), using a global sample of over 16,000 banks, confirm that cooperative banks are more stable than commercial banks, with lower return volatility more than compensating for lower average profitability.

At the theoretical level, stakeholder governance models offer an alternative to the agency-theoretic prediction. Butzbach and von Mettenheim (2015) present comprehensive evidence that alternative banks—cooperative, savings, and development institutions—frequently equal or outperform private banks in efficiency, profitability, and risk management. They argue that stakeholder-oriented governance provides structural advantages, including longer planning horizons, reduced pressure for short-term profit maximisation, and closer alignment with customer interests. Ayadi et al. (2010) document these patterns specifically for European cooperative banks, concluding that the "dual bottom line"—combining financial sustainability with social objectives—does not compromise operational performance.

At the empirical level, Cornée et al. (2018) provide a detailed account of the mechanisms underlying cooperative bank performance in Europe. They document that cooperatives tend to charge lower interest rates, rely on relationship lending, maintain substantial equity buffers, and pursue conservative risk policies. This combination of features contributes simultaneously to financial stability and financial inclusion—a pattern that challenges the assumption of a necessary trade-off between social orientation and cost discipline. Groeneveld (2022), in the most recent cross-European assessment, confirms that cooperative banks' market shares reached record levels through the COVID-19 period, with loan growth of 6.7% compared to 4.1% sector-wide, while cost-to-income ratios improved. These findings suggest that the efficiency advantages of cooperative banking are structural rather than cyclical.

The countercyclical lending behaviour of mission-oriented banks provides further evidence against the inefficiency premise. Brei and Schclarek (2013) show that government-owned banks increase lending during crises while private bank lending contracts, a finding confirmed for high-income countries by Bertay et al. (2015). Ferri et al. (2014) extend this result to the euro area, demonstrating that cooperative and savings banks follow less procyclical lending policies than shareholder banks. Most recently, Wrede (2021) documents increased lending by German cooperative banks and Sparkassen during the COVID-19 pandemic, while other bank types showed no comparable expansion.

The Austrian banking sector, with its dominant cooperative sector (approximately 72% of institutions) and established savings bank network, provides a natural setting to test whether the efficiency advantages documented in the German and broader European literature extend to a closely related but distinct institutional context. The dominance of cooperative banks in the Austrian market is not accidental but reflects a specific institutional and legal framework. Brazda et al. (2016) document that Austrian cooperative banks—particularly the Raiffeisen network, which traces its origins to the first credit cooperative in Mühldorf in 1886—operate under a statutory mandate (*Förderauftrag*) anchored in the Austrian Cooperatives Act (*Genossenschaftsgesetz*). This mandate obliges them to promote the economic interests of their members and their regions. It has historically tied cooperative banks to specific municipalities and rural areas, creating the dense, geographically dispersed branch network that characterises Austrian retail banking today. The geographic footprint of Austrian banks is therefore not primarily a strategic choice but a legacy of legal and organisational structures that have evolved over more than a century. This thesis contributes to this literature by providing the first systematic test of the ownership-efficiency relationship in Austrian retail banking, while simultaneously controlling for geographic orientation—a dimension that has been largely absent from previous ownership studies.

2.3. Financial Inclusion and Regional Banking

Financial inclusion—the extent to which individuals and firms have access to and use formal financial services—has become a central concern for policymakers and international organisations over the past two decades. The World Bank's Global Findex Database (Demirgüç-Kunt and Klapper, 2012) provides the most comprehensive demand-side measurement of financial inclusion, but it does not capture the adequacy of supply-side infrastructure—branch networks, ATM density, credit availability—that determines whether financial services are physically accessible in a given region.

The consequences of inadequate banking infrastructure are well documented. Nguyen (2019), exploiting variation from US bank branch closings, finds that each closure causes a persistent annual decline of approximately $453,000 in local small business lending, with effects highly localised and dissipating within six miles. Alessandrini et al. (2009) distinguish between "operational distance" (physical proximity to a branch) and "functional distance" (proximity to a bank's headquarters), showing that both dimensions—particularly functional distance—stiffen financing constraints for small firms in less developed Italian regions. In the European context, Martín-Oliver (2019) documents how the transformation of Spanish cajas into for-profit banks after the Great Recession led to the systematic abandonment of financial inclusion missions, creating banking deserts in small municipalities. Ho and Berggren (2020) provide complementary evidence from Sweden, where branch closures negatively affect new firm formation, particularly in rural areas.

The geographic dimension of financial exclusion has deep theoretical roots. Leyshon and Thrift (1995) introduced the concept of "financial abandonment," arguing that the withdrawal of banking services from economically disadvantaged areas amplifies spatial inequality. Leyshon et al. (2008) subsequently demonstrated that UK branch closures between 1995 and 2003 were disproportionately concentrated in poorer areas, a pattern that the authors argue has been "written out" of policy discourse.

For the Austrian context, the most relevant empirical evidence comes from the OeNB's spatial analyses. Stix (2020) reports that 27% of Austria's 2,096 municipalities had no bank branch by end-2019, with average travel distances of 1.5 kilometres and 4.9% of the population travelling more than 5 kilometres to the nearest branch. Branch losses have been most pronounced in Burgenland, Styria, and parts of Lower Austria—regions that, as this thesis demonstrates, correspond to areas with lower SSI values. At the broader European level, Beckmann et al. (2018) construct NUTS-3-level indicators of branch coverage and concentration for Central and Southeastern Europe, providing a methodological template for sub-national banking access measurement that the present study adapts to the Austrian case.

The existing literature thus focuses primarily on the consequences of financial exclusion—reduced lending, lower entrepreneurship—rather than on the cost implications for banks that maintain physical presence in underserved regions. Moreover, most studies rely on a binary urban-rural distinction rather than a continuous measure of regional service provision. Both gaps motivate the present analysis.

2.4. Composite Index Construction

The construction of composite indices to measure multidimensional phenomena such as financial inclusion follows a well-established methodology. The OECD (2008) *Handbook on Constructing Composite Indicators* identifies ten steps, from theoretical framework development through normalisation, weighting, and aggregation to sensitivity analysis. Two fundamental choices shape any composite index: how to normalise heterogeneous dimensions onto a common scale, and how to weight them in the aggregation step.

The most influential financial inclusion index in the academic literature is Sarma's (2008, 2012) Index of Financial Inclusion (IFI). Sarma employs min-max normalisation to rescale each dimension to the unit interval $[0, 1]$ and aggregates them using a distance-based method inspired by the UNDP's Human Development Index. The final index is computed as the normalised inverse Euclidean distance from the ideal point (where all dimensions equal one), producing a single score between zero and one. Dimensions are equally weighted, reflecting the absence of a compelling theoretical or empirical basis for differential weighting—a choice explicitly endorsed by the OECD Handbook as the transparent default. The IFI has been widely applied in cross-country studies and has inspired numerous adaptations.

Alternative approaches exist. Cámara and Tuesta (2014) employ two-stage principal component analysis (PCA) to endogenously determine dimension weights, finding that the access dimension receives the highest weight. Amidžić et al. (2014), working at the IMF, apply factor analysis to derive weights from the statistical structure of the data rather than from theoretical priors. Chakravarty and Pal (2013) propose an axiomatic approach grounded in the measurement theory literature, applying it to Indian state-level banking data—one of few studies that, like the present thesis, operate at the sub-national level. Pesqué-Cela et al. (2021), in a systematic review, test existing indices using confirmatory factor analysis and demonstrate that methodological choices in index construction—

including normalisation, weighting, and aggregation—have substantial consequences for the resulting rankings, reinforcing the case for transparent, replicable methods such as the distance-based approach adopted in this thesis.

The application of financial inclusion indices at the sub-national level remains relatively rare. Yorulmaz (2013) adapts Sarma's distance-based methodology to construct a regional financial inclusion index for Turkish provinces, demonstrating the feasibility of the approach at a geographic granularity comparable to the Austrian NUTS-3 level. The present thesis follows this methodological tradition, adapting Sarma's framework to the Austrian context while incorporating a credit resilience dimension—measured as the standard deviation of credit growth—that captures the stability of financial service provision over time, a dimension absent from most existing indices.

2.5. Theoretical Framework and Research Gap

Two broader perspectives from the heterodox finance literature provide additional context for interpreting the empirical results of this thesis. The first draws on the mission-oriented finance framework developed by Mazzucato and Penna (2016), which conceptualises financial institutions as potential instruments for achieving public missions rather than as purely profit-maximising entities. Under this lens, banks may legitimately pursue socio-economic objectives—ensuring credit access in lagging regions, supporting SMEs, maintaining physical infrastructure in underserved areas—even if doing so entails higher operating costs. The relevant evaluative criterion is not cost minimisation per se, but whether elevated costs are justified by corresponding public value.

The second perspective is the critical macro-finance framework articulated by Gabor (2020), which questions the analytical frameworks through which market-based finance is evaluated, arguing that conventional metrics may obscure the structural role of financial institutions in sustaining public objectives. From this viewpoint, what appears as "inefficiency" in conventional accounting terms—redundant branches, higher staffing ratios, below-market pricing—may reflect deliberate policy choices and governance priorities that serve the stability and inclusiveness of the financial system. A dense network of local banks, rather than constituting an anomaly to be corrected through consolidation, may represent an intentional public good that sustains regional economic activity and financial resilience.

These perspectives provide a useful interpretive lens rather than formal hypotheses. If mission-oriented banks incur higher costs because they serve underserved regions or maintain countercyclical lending, then the efficiency–mission trade-off is real but potentially socially justified. Conversely, if banks serving underserved regions do not incur higher costs—as the empirical results of this thesis suggest—then the trade-off is less pronounced than commonly assumed. The primary theoretical foundation of the empirical analysis, however, rests on the stakeholder governance literature reviewed in Section 2.2—in particular, the evidence from Butzbach and von Mettenheim (2015), Cornée et al. (2018), and Ayadi et al. (2010) that cooperative and savings banks can match or exceed private banks in operational efficiency. The Mazzucato/Penna and Gabor frameworks complement this evidence by situating the findings within broader debates about the public purpose of financial institutions.

2.5.1. Research Gap and Contribution

Despite the extensive literatures on banking efficiency, ownership, financial inclusion, and mission-oriented finance, no existing study directly tests the efficiency–mission trade-off in Austrian retail banking. The closest precedent is Burgstaller (2020), who analyses 763 Austrian savings and cooperative banks using DEA and explicitly warns against mistaking the pursuit of non-profit objectives for managerial incompetence. Burgstaller's study establishes that Austrian mission-oriented banks are not systematically less efficient when appropriate benchmarks are used, but does not link efficiency to a geographic measure of regional service provision or construct a supply-side index that captures the intensity of a bank's exposure to underserved regions. Studies of German three-pillar banking (Beck et al., 2009; Hauner, 2005) provide relevant institutional parallels but do not construct a regional supply-side index. The financial inclusion index literature (Sarma, 2008, 2012; Cámara and Tuesta, 2014) operates predominantly at the cross-country level, with only isolated applications at the sub-national scale (Yorulmaz, 2013; Chakravarty and Pal, 2013).

This thesis addresses the gap at the intersection of these literatures by (i) developing a transparent, replicable Supply-Side Index for Austrian districts; (ii) linking this regional measure to bank-level cost structures in a panel data framework; and (iii) distinguishing mission-driven costs from operational inefficiency through a residual-based analysis of mission outcomes among high-cost banks.

3. Methodology

3.1. Research Design Overview

This study employs a panel data approach to examine the relationship between regional banking service provision and bank-level cost efficiency in Austria. The dataset comprises up to 395 Austrian banks observed annually over the period 2014–2022, yielding an unbalanced panel of approximately 2,500 bank-year observations with valid financial data. After applying lagged regressors—which require at least two consecutive years of data per bank—the main regression sample for RQ1 comprises approximately 2,100 bank-year observations. The analysis draws on unconsolidated financial statements from Moody's Orbis BankFocus, supplemented with regional banking infrastructure data from the Austrian National Bank (OeNB) and demographic statistics from Statistik Austria.

The empirical investigation proceeds in three stages, corresponding to the three research questions outlined in Section 1.2. First, to address RQ1, the study tests whether banks with greater exposure to underserved regions exhibit systematically different cost structures than banks operating primarily in well-served areas. This is operationalised through a fixed-effects panel regression of the cost-to-income ratio on a measure of regional service exposure, controlling for bank-specific characteristics and market structure.

Second, to address RQ2, the analysis examines whether cost efficiency varies systematically across ownership types—specifically, whether public/savings banks and cooperative banks differ from private commercial banks in their cost structures, after controlling for regional exposure and other factors.

Third, to address RQ3, the study investigates whether banks that combine high operating costs with substantial exposure to underserved regions deliver superior social outcomes compared to high-cost banks without such exposure. This involves examining mission-related outcomes including credit stability during economic downturns (P1), branch network retention (P2), and pricing behaviour (P3).

A central methodological contribution of this thesis is the construction of a regional Supply-Side Index (SSI) that quantifies the adequacy of banking service provision at the district level. This index combines three dimensions—service availability, credit usage, and credit resilience—into a single measure that captures complementary aspects of financial inclusion. The SSI is then translated into a bank-level exposure measure based on each bank's geographic branch distribution.

The following sections detail the construction of the SSI (Section 3.2), the econometric specifications for each research question (Section 3.3), and identification considerations and limitations (Section 3.4).

3.2. The Supply-Side Index (SSI)

This section details the construction of the Supply-Side Index (SSI), which quantifies the adequacy of banking service provision across Austrian districts. Unlike existing financial inclusion indices that focus on cross-country comparisons (Sarma, 2008, 2012), the SSI is designed to capture within-country variation at the sub-national level, enabling the identification of underserved regions within a single banking market.

3.2.1. Conceptual Framework

The SSI follows the multidimensional approach established in the financial inclusion literature, combining three complementary dimensions of banking service provision:

Availability captures the physical accessibility of banking services, measured as the number of bank branches per 10,000 inhabitants at the district (NUTS-3) level. This dimension reflects the density of banking infrastructure and the ease with which households and firms can access in-person banking services.

Usage captures the extent to which banking services are actually utilised, measured as new loan volume per capita at the state (NUTS-2) level. This dimension reflects not only supply but also realised demand for credit in a region.

Resilience captures the stability of credit provision over time, measured as the deviation of annual credit growth from its trend at the state (NUTS-2) level. Regions with highly volatile credit supply—experiencing sharp contractions during economic downturns—are considered less well-served than regions with stable credit flows.

The three dimensions enter the index with equal implicit weights, reflecting the absence of a clear theoretical or empirical basis for assigning differential importance to any single dimension. This follows the recommendation of the OECD *Handbook on Constructing Composite Indicators* (OECD, 2008), which advocates equal weighting as the transparent default when no compelling rationale for alternative weighting schemes exists. Sarma (2008) adopts the same approach in the original Index of Financial Inclusion.

The combination of these three dimensions follows the logic that adequate banking service provision requires not only physical presence (availability) but also active credit intermediation (usage) that remains stable across economic cycles (resilience).

3.2.2. Index Construction

The SSI is constructed following the distance-based methodology of Sarma (2008, 2012). Each dimension is first normalised to the unit interval $[0, 1]$ using min-max scaling across the pooled sample:

$$d_i = \frac{A_i - m_i}{M_i - m_i} \tag{3.1}$$

where A_i is the actual value of dimension i, m_i is the observed minimum, and M_i is the 95th percentile (to reduce sensitivity to outliers). Values exceeding one are capped at unity. In practice, this cap affects fewer than 5% of region-year observations per dimension, and the results are not sensitive to the choice of the 95th versus the 99th percentile as the upper bound.

The final index combines two distance measures. The first captures proximity to the worst-case point $(0, 0, 0)$:

$$X_1 = \frac{\sqrt{d_{\text{avail}}^2 + d_{\text{usage}}^2 + d_{\text{resil}}^2}}{\sqrt{3}} \tag{3.2}$$

The second captures the inverse distance from the ideal point $(1, 1, 1)$:

$$X_2 = 1 - \frac{\sqrt{(1 - d_{\text{avail}})^2 + (1 - d_{\text{usage}})^2 + (1 - d_{\text{resil}})^2}}{\sqrt{3}} \tag{3.3}$$

The SSI is then computed as the simple average of these two measures:

$$\text{SSI}_{r,t} = \frac{1}{2}(X_1 + X_2) \tag{3.4}$$

This aggregation method ensures that the index ranges between 0 and 1, where higher values indicate better financial service provision. Importantly, the scaling is performed globally across all region-years, ensuring temporal consistency and comparability over time.

The hybrid structure—combining district-level availability data with state-level usage and resilience data—reflects data availability constraints, as credit volume statistics are not published at the district level in Austria.

3.2.3. From Regional SSI to Bank-Level Exposure

To link regional service provision to bank-level analysis, the district-level SSI must be translated into a bank-specific measure. This is accomplished by computing each bank's exposure to low-SSI regions based on its geographic branch distribution.

First, regions are classified as "low-SSI" if their SSI value falls in the bottom 40% of the pooled distribution. This threshold identifies districts that are relatively underserved compared to the national average. The 40th percentile is chosen to align with the classification practice in Sarma (2008), who assigns the bottom tier of her cross-country Index of Financial Inclusion to approximately the lower two-fifths of the sample distribution. It also balances two practical considerations: the threshold must be sufficiently inclusive to yield adequate statistical power in the bank-level regressions, while remaining restrictive enough to meaningfully distinguish underserved from well-served regions. As the OECD Handbook on Constructing Composite Indicators emphasises, no theoretical basis exists for a uniquely correct threshold in composite index applications; the appropriate response is sensitivity analysis rather than a search for the "right" cut-off (OECD, 2008). Accordingly, all results are re-estimated using a tercile-based classification (bottom 33%) as an alternative threshold (see Section 5.4).

Second, for each bank i in year t, the share of branches located in low-SSI regions is computed:

$$\text{Low-SSI Exposure}_{i,t} = \sum_{r} \left(\frac{\text{Branches}_{i,r,t}}{\sum_{r'} \text{Branches}_{i,r',t}} \right) \times \mathbf{1}\{\text{SSI}_{r,t} < P_{40}\} \tag{3.5}$$

where the indicator function equals one if district r falls below the 40th percentile threshold. Banks with a higher share of branches in low-SSI regions are considered to have greater "mission exposure"—that is, they are more heavily engaged in serving underserved areas.

This bank-level exposure measure serves as the key explanatory variable in the efficiency regressions (RQ1) and defines the classification of "mission-oriented" banks for the analysis of social outcomes (RQ3).

3.3. Econometric Specifications

This section presents the econometric models used to address each of the three research questions. All specifications share a common set of methodological choices. First, control variables are lagged by one period ($t-1$) to ensure they are predetermined relative to the outcome, thereby mitigating concerns about simultaneity and reverse causality. Second, standard errors are clustered at the bank level throughout to account for within-bank serial correlation in the error terms (Petersen, 2009; Cameron and Miller, 2015). Third, year fixed effects are included in all models to absorb aggregate macroeconomic shocks and common time trends that affect all banks equally, such as interest rate changes, regulatory reforms, or business cycle fluctuations. Fourth, continuous dependent variables (cost-to-income ratio, loan growth, and net interest margin) are winsorised at the 1st and 99th percentiles to limit the influence of extreme observations arising from data errors, mergers, or portfolio transfers.

3.3.1. RQ1: The Efficiency–Mission Trade-off

The first research question asks whether banks with greater exposure to underserved regions exhibit systematically higher operating costs. To test this, the cost-to-income ratio is regressed on the bank's lagged Low-SSI Exposure, controlling for observable bank characteristics and market structure:

$$\text{C/I}_{it} = \beta_1 \, \text{Low-SSI Exp.}_{i,t-1} + \mathbf{X}'_{i,t-1}\boldsymbol{\gamma} + \alpha_i + \delta_t + \varepsilon_{it} \tag{3.6}$$

where C/I_{it} denotes the cost-to-income ratio of bank i in year t, expressed in percentage points. The coefficient of interest is β_1, which captures the effect of a one percentage point increase in the share of a bank's branches located in low-SSI regions on its cost-to-income ratio. Under the trade-off hypothesis (H1), β_1 is expected to be positive and statistically significant.

The vector $\mathbf{X}_{i,t-1}$ contains time-varying bank-level controls, all lagged by one period: the natural logarithm of total assets (capturing size-related economies of scale), the equity-to-assets ratio (reflecting capitalisation and risk appetite), the ratio of liquid assets to deposits and short-term funding (measuring liquidity management), and the ratio of customer loans to deposits and short-term funding (capturing balance sheet composition). In the most comprehensive specification, the Herfindahl–Hirschman Index (HHI) at the NUTS-2 level controls for the degree of market concentration in a bank's primary operating region, ensuring that the SSI coefficient is not confounded by competitive conditions.

The terms α_i and δ_t represent bank and year fixed effects, respectively. Bank fixed effects absorb all time-invariant heterogeneity across institutions—including structural differences in business model, geographic positioning, or organisational culture—and thereby restrict identification to within-bank variation over time. Year fixed effects capture aggregate shocks common to all banks.

To assess the sensitivity of results to modelling choices, the analysis proceeds in four steps: (1) a pooled specification with year fixed effects only, exploiting cross-sectional variation; (2) a two-way fixed effects specification with bank and year effects; (3) the addition of the full set of bank-level controls; and (4) the inclusion of the regional HHI as a measure of market structure. This sequential approach makes transparent which controls drive any changes in the coefficient of interest and allows the reader to assess the stability of the estimate across specifications.

3.3.2. RQ2: Ownership Effects on Cost Efficiency

The second research question examines whether cost efficiency varies systematically across ownership types. The model specification is:

$$\mathrm{C/I}_{it} = \sum_{k\neq \mathrm{ref}} \beta_k \, \mathbf{1}[\mathrm{Ownership}_i = k] + \varphi \, \text{Low-SSI Exp.}_{i,t-1} + \mathbf{X}'_{i,t-1}\boldsymbol{\gamma} + \delta_t + \varepsilon_{it} \tag{3.7}$$

where the indicator variables $\mathbf{1}[\mathrm{Ownership}_i = k]$ capture the ownership type of bank i, classified into four categories: private commercial banks (the reference category), public/savings banks (Sparkassen), cooperative banks (Raiffeisen- and Volksbanken), and a residual "other" category. The coefficients β_k measure the average difference in the cost-to-income ratio between ownership type k and private commercial banks, conditional on observable characteristics. Under the conventional hypothesis (H2), public/savings and cooperative banks—given their social mandates and potentially less profit-driven governance—are expected to exhibit higher cost-to-income ratios ($\beta_k > 0$).

An important econometric consideration is that ownership type is effectively time-invariant in the Austrian banking context: no bank in the sample changes its fundamental ownership structure during the observation period. Consequently, bank fixed effects cannot be included alongside ownership dummies, as the latter would be perfectly collinear with the former. The RQ2 specifications therefore employ year fixed effects only, which means that identification relies on cross-sectional differences between ownership types. While this precludes the elimination of all time-invariant unobserved heterogeneity, it is the standard approach in the literature on ownership and bank performance (see, e.g., Altunbas et al., 2001; Iannotta et al., 2007), and the progressive inclusion of controls—in particular, regional SSI exposure—helps to absorb confounding variation that might otherwise bias the ownership coefficients.

As with RQ1, the analysis proceeds in four steps: (1) a baseline model with ownership dummies and basic controls (size, capitalisation); (2) the addition of Low-SSI Exposure to control for the possibility that ownership types differ in their geographic orientation; (3) the full set of bank-level controls; and (4) the inclusion of the HHI to account for differences in competitive environments across ownership types.

3.3.3. RQ3: Mission Outcomes Among High-Cost Banks

The third research question shifts the focus from cost efficiency to outcomes. It asks whether high operating costs in banks serving underserved regions reflect mission-oriented investment—that is, whether these costs translate into tangible social benefits—or whether they simply indicate operational inefficiency. This question is operationalised through three distinct propositions, each examining a different dimension of mission-consistent behaviour.

Identifying High-Cost Banks. Before estimating the mission outcome models, it is necessary to identify which banks in the sample qualify as "high-cost." Rather than relying on an arbitrary cost threshold, the classification is based on residual analysis from the RQ1 model. Specifically, a bank-year observation is classified as high-cost if its actual cost-to-income ratio exceeds the value predicted by the baseline model given the bank's observable characteristics:

$$\text{High-Cost}_{it} = \mathbf{1}\left[\text{C/I}_{it} - \widehat{\text{C/I}}_{it} > 0\right] \tag{3.8}$$

where $\widehat{\text{C/I}}_{it}$ denotes the fitted value from a regression of the cost-to-income ratio on Low-SSI Exposure, bank size, and the equity ratio with year fixed effects. This approach classifies as high-cost those banks whose costs are higher than what their structural characteristics would predict, thereby capturing "excess" costs net of observable determinants. The resulting subsample of high-cost banks forms the basis for the P1 and P2 analyses.

Additionally, banks are classified by their exposure to underserved regions using a median split: banks with Low-SSI Exposure above the sample median are assigned to the "high exposure" group. The interaction between the high-cost classification and the exposure grouping then identifies banks that both incur above-expected costs and serve predominantly underserved areas—precisely the group for which one would expect to observe mission-consistent outcomes if high costs indeed reflect social investment.

P1: Credit Stability During Economic Downturns. The first proposition tests whether high-cost banks with substantial presence in underserved regions maintained more stable credit provision during the COVID-19 pandemic. The specification takes the form of a difference-in-differences model estimated on the subsample of high-cost banks for the years 2018–2021:

$$\Delta\text{Loans}_{it} = \beta_1(\text{COVID}_t \times \text{High Exp.}_i) + \beta_2 \,\text{High Exp.}_i + \mathbf{X}'_{i,t-1}\gamma + \delta_t + \varepsilon_{it} \tag{3.9}$$

where ΔLoans_{it} is the year-over-year percentage growth in customer loans, COVID_t is an indicator variable equal to one for the years 2020 and 2021, and High Exp._i is an indicator for above-median Low-SSI Exposure. The coefficient β_1 captures the differential change in loan growth during the pandemic for high-cost banks with high exposure to underserved regions relative to high-cost banks with low exposure. A positive β_1 would indicate that high-cost, regionally focused banks played a stabilising role during the crisis, consistent with the mission hypothesis. The pre-treatment period (2018–2019) serves as the counterfactual baseline. Note that the main effect of COVID_t is absorbed by the year fixed effects δ_t, while the interaction term remains identified.

The validity of this difference-in-differences estimator rests on the parallel trends assumption: in the absence of the COVID-19 shock, high-cost banks with high and low SSI exposure would have exhibited similar loan growth trajectories. While this assumption is inherently untestable, its plausibility is assessed through a placebo test that assigns a fictitious crisis to the pre-treatment period 2016–2017 and re-estimates the model on the 2014–2017 window (see Section 3.4.3). An insignificant placebo estimate would provide supporting evidence that the parallel trends assumption is not violated.

P2: Branch Network Retention. The second proposition examines whether high-cost banks with high exposure to underserved regions are more likely to maintain their branch networks. The specification, again estimated on the high-cost subsample, is:

$$\Delta\text{Branches}_{it} = \beta_1 \,\text{High Exp.}_i + \beta_2 \,\text{Log TA}_{i,t-1} + \delta_t + \varepsilon_{it} \tag{3.10}$$

where $\Delta\text{Branches}_{it}$ denotes the change in the number of branches operated by bank i between year $t-1$ and year t. Branch data are drawn from the OeNB's quarterly bank branch register (*Bankstellenverzeichnis*), standardised to December snapshots to ensure temporal consistency. A positive β_1 would suggest that high-cost banks with greater regional exposure retain more branches, consistent with the interpretation that their higher costs partly reflect the maintenance of physical infrastructure in underserved areas.

P3: Fair Pricing. The third proposition takes a different perspective and examines the full sample of banks rather than only the high-cost subsample. It tests whether banks with greater exposure to underserved regions exploit potential market power in these areas through higher interest margins:

$$\text{NIM}_{it} = \beta_1 \,\text{Low-SSI Exp.}_{i,t-1} + \mathbf{X}'_{i,t-1}\gamma + \delta_t + \varepsilon_{it} \tag{3.11}$$

where NIM_{it} is the net interest margin, calculated as net interest income divided by total assets. The controls include lagged bank size, the equity ratio, and—in an extended specification—the regional HHI to separate SSI-related pricing effects from those attributable to market concentration. Applying this analysis to the full sample is appropriate because the fair pricing question concerns the entire market: if underserved regions are characterised by exploitative pricing, this should be observable across all banks operating in these areas, not only among those with high costs. A positive and significant β_1 would indicate that banks charge a premium in underserved regions, while an insignificant coefficient would suggest fair pricing.

3.4. Identification Considerations and Limitations

The empirical strategy outlined in the preceding sections relies on fixed-effects panel regressions with lagged regressors and clustered standard errors. While this approach is standard in the empirical banking literature, it does not constitute a natural experiment, and the estimates should be interpreted as conditional correlations rather than causal effects in the strict sense. This section discusses the main identification challenges and the steps taken to address them.

3.4.1. Endogeneity Concerns

The central identification challenge for RQ1 concerns the potential endogeneity of the Low-SSI Exposure variable. Endogeneity may arise through three distinct channels.

Reverse Causality. It is conceivable that cost-efficient banks strategically expand into underserved regions, or conversely, that inefficient banks retreat from competitive urban markets into peripheral areas where competitive pressure is lower. In both cases, the observed correlation between SSI exposure and cost efficiency would partly reflect bank behaviour rather than the causal effect of regional service provision on costs. The use of one-period lagged exposure ($t - 1$) partially mitigates this concern, as the branch network in period $t - 1$ is predetermined relative to the cost-to-income ratio in period t. However, lagging does not fully resolve endogeneity if banks' location decisions are persistent and correlated with unobserved efficiency trajectories.

Omitted Variable Bias. Banks differ in many dimensions that are difficult to observe and quantify—managerial quality, organisational culture, strategic orientation, or historical path dependencies—and some of these unobserved factors may jointly determine both a bank's geographic footprint and its cost structure. In the RQ1 specifications, bank fixed effects absorb all time-invariant sources of such heterogeneity, restricting identification to within-bank variation over time. For RQ2, where the key variable of interest (ownership type) is itself time-invariant, bank fixed effects cannot be employed. The sequential inclusion of controls—particularly SSI exposure, which captures differences in geographic orientation across ownership types—helps to absorb confounding variation, but unobserved cross-sectional heterogeneity cannot be fully excluded.

Measurement Error. The SSI is a constructed index that may imperfectly capture the true level of financial service provision in a region. As discussed in Section 3.2, credit usage and resilience are measured at the NUTS-2 (state) level rather than the NUTS-3 (district) level, introducing a degree of spatial aggregation that may attenuate the measured relationship between regional conditions and bank-level outcomes. Classical measurement error in the key regressor would bias the coefficient toward zero, which should be borne in mind when interpreting the near-zero estimates for RQ1.

3.4.2. Justification for Lagged Variables

All independent variables in the main specifications are lagged by one period ($t-1$). This choice serves three distinct purposes.

First, lagging ensures temporal precedence: the right-hand-side variables are realised before the dependent variable, which rules out mechanical simultaneity between, for instance, current asset size and current operating costs. This approach is common practice in the empirical banking literature. Bautista Mesa et al. (2014), in their study of 3,952 European banks, employ lagged bank characteristics for precisely this reason. Similarly, Dietrich and Wanzenried (2011) use lagged controls in their analysis of Swiss bank profitability to avoid capturing contemporaneous feedback effects.

Second, lagging reflects a substantive economic argument: structural changes in a bank's geographic footprint or balance sheet composition plausibly take time to affect operating costs. A bank that opens or closes branches in underserved regions in year $t-1$ will likely experience the associated cost implications—through staffing adjustments, infrastructure investments, or changes in customer base—predominantly in year t or later. One-period lags therefore align the empirical specification with the expected timing of economic effects.

Third, in the absence of credible instrumental variables, lagged regressors represent a pragmatic strategy to mitigate simultaneity bias, ensuring that right-hand-side variables are predetermined relative to the outcome (Angrist and Pischke, 2009). Bellemare et al. (2017) caution that lagging does not resolve all forms of endogeneity, particularly when unobserved confounders are persistent—a limitation acknowledged in the interpretation of results. While lagging does not fully resolve endogeneity in the presence of persistent unobserved shocks, the combination of lagged regressors with bank fixed effects—which absorb level differences—provides a reasonable approximation under the assumption that the remaining time-varying unobserved heterogeneity is not systematically correlated with changes in SSI exposure.

3.4.3. Robustness and Sensitivity Design

To assess the sensitivity of results to specific modelling choices, the analysis employs a range of robustness checks that are reported in detail in Section 5.4. These include: (i) an alternative definition of the dependent variable, using the cost-to-income ratio as reported in the Orbis BankFocus database rather than the self-calculated measure, to verify that results are not driven by construction choices in the efficiency metric; (ii) an alternative SSI threshold, classifying regions in the bottom tercile (rather than the bottom 40%) as underserved, to test sensitivity to the chosen cut-off; (iii) exclusion of the five largest banks, which may operate under fundamentally different cost structures due to their systemic relevance and international activities; (iv) a cooperatives-only subsample, given that cooperative banks represent approximately 72% of observations and their within-group variation may differ from the full sample; (v) estimation without winsorisation, to ensure that the treatment of outliers does not drive the findings; (vi) clustering of standard errors at the state (NUTS-2) level rather than the bank level, which provides a more conservative inference framework by allowing for spatial correlation across banks within the same region; and (vii) exclusion of banks that first appear in the Orbis database in 2021 or later, to ensure that the discrete expansion in database coverage documented in Section 4.4 does not drive the results.

For the difference-in-differences specification in P1, an additional placebo test assigns a "fake" crisis period to 2016–2017 and re-estimates the model on the 2014–2017 window. If the interaction coefficient from the actual COVID specification reflects a genuine crisis-period effect, the placebo estimate should be statistically insignificant.

3.4.4. Remaining Limitations

Several limitations should be acknowledged. These are discussed briefly here and revisited in greater depth in Section 6.2.

First, the empirical strategy does not achieve exogenous identification in the econometric sense. Blatter and Fuster (2022), in their study of Swiss banking efficiency, employ canton population as an instrumental variable for bank size, achieving arguably stronger identification. No comparably valid instrument is available for SSI exposure in the Austrian context, as regional characteristics that predict financial infrastructure (such as population density or economic activity) are themselves likely correlated with bank cost structures through channels other than the SSI.

Second, the sample is subject to a selection constraint arising from the data extraction procedure. The Orbis BankFocus export is restricted to banks classified as "active" at the time of extraction (November 2025), meaning that institutions that ceased to exist during the 2014–2022 observation period—whether through merger, liquidation, or licence withdrawal—are excluded from the dataset entirely, including their historical observations. This introduces a form of survivorship bias: if banks that exited the market were systematically less efficient than surviving banks, the sample may underestimate the true dispersion of cost efficiency in the Austrian banking sector.

Third, the SSI primarily captures the physical dimension of financial service provision through branch density. It does not account for digital banking channels, which have expanded substantially during the observation period.

Fourth, the P1 analysis of credit stability during the COVID-19 pandemic cannot fully disentangle supply-side and demand-side effects. Distinguishing between these mechanisms would require loan application data, which is not available in the Orbis BankFocus database.

Fifth, the classification of ownership types is based on the bank specialisation field in Orbis BankFocus and follows established categories in the Austrian banking literature. However, the "other" category is heterogeneous and includes institutions with diverse business models. Results for this category should be interpreted with caution.

Despite these limitations, the combination of panel fixed effects, lagged regressors, clustered standard errors, and extensive robustness checks provides a credible basis for assessing the relationship between regional service provision, ownership, and cost efficiency in Austrian banking. The consistency of results across specifications—documented in detail in Section 5.4—strengthens confidence in the main findings.

4. Data

4.1. Data Sources

The analysis draws on three complementary data sources that together provide information on bank-level financial performance, regional banking infrastructure, and demographic conditions.

Moody's Orbis BankFocus. The primary source of bank-level financial data is the Orbis BankFocus database, maintained by Bureau van Dijk (Moody's Analytics). Orbis BankFocus provides standardised unconsolidated financial statements for banks worldwide, drawn from regulatory filings and annual reports. For this study, the database supplies balance sheet items (total assets, equity, customer loans, liquid assets, deposits, and short-term funding), income statement components (net interest income, fee and commission income, other operating income, staff expenses, administrative expenses, and other operating expenses), and pre-calculated financial ratios (cost-to-income ratio, return on equity, equity-to-assets ratio). Unconsolidated statements are used throughout to ensure that financial data reflect the operations of individual legal entities rather than consolidated group figures, which is essential for linking bank-level costs to regional branch networks.

All financial variables in Orbis BankFocus are denominated in thousands of US dollars (th USD), reflecting the database's global standardisation. Since all cross-sectional comparisons occur within a single year and year fixed effects absorb any common variation attributable to exchange rate movements, the dollar denomination does not affect the validity of the analysis.

In addition to financial data, Orbis BankFocus provides institutional characteristics for each bank, including the bank's specialisation category (e.g., "Commercial bank," "Savings bank," "Cooperative bank"), which forms the basis for the ownership classification used in RQ2. The specialisation field is matched to the Austrian banking sector structure to distinguish private commercial banks, public/savings banks (Sparkassen), cooperative banks (Raiffeisen- and Volksbanken), and a residual "other" category.

OeNB Bank Branch Register (*Bankstellenverzeichnis*). The geographic dimension of the analysis relies on the quarterly bank branch register published by the Oesterreichische Nationalbank (OeNB). This register records, for each reporting date, the name, identification number, and postal code of every bank branch operating in Austria. For the purposes of this study, year-end snapshots (December of each year) are extracted to construct annual branch distributions. Each branch is geocoded to the NUTS-3 (district) level using a postal code-to-NUTS-3 mapping derived from Eurostat's NUTS classification. The branch register serves three purposes: it provides the availability dimension of the SSI (branches per 10,000 inhabitants), it enables the computation of bank-level SSI exposure through the geographic distribution of each bank's branch network, and it supplies the branch change variable used in the P2 analysis.

Statistik Austria and Eurostat. Population data at the NUTS-3 level are obtained from Statistik Austria's annual population statistics, which report the resident population by district as of 1 January of each year. These data are used to normalise branch counts in the SSI availability dimension (branches per 10,000 inhabitants). The NUTS-3 regional classification follows Eurostat's 2016 NUTS nomenclature, which divides Austria into 35 districts. Credit volume data at the NUTS-2 (state) level, used for the usage and resilience dimensions of the SSI, are drawn from the OeNB's regional banking statistics.

Market Concentration Data. The Herfindahl–Hirschman Index (HHI) at the NUTS-2 level is constructed from the OeNB branch register by computing branch-based market shares for each bank within each state and summing the squared shares. This branch-based HHI captures the degree of market concentration in a bank's primary operating region and serves as a control variable in the regression models. The construction follows the approach recommended by the European Commission's *Guidelines on the assessment of horizontal mergers* (European Commission, 2004), adapted to the sub-national level.

4.2. Sample Construction and Filtering

4.2.1. Orbis BankFocus Extraction

The bank-level data are extracted from Orbis BankFocus using the following search strategy: the extraction is restricted to (i) banks located in Austria (country code: AT), (ii) classified as active at the time of extraction (November 2025), (iii) reporting unconsolidated financial statements, and (iv) with data available for at least one year in the period 2014–2023. No restriction on bank size, ownership type, or specialisation is imposed at the extraction stage.

Two features of this extraction warrant discussion. First, the restriction to active companies means that banks that ceased to exist during the observation period 2014–2022—whether through merger, liquidation, or licence withdrawal—are excluded from the dataset entirely, including their historical observations. This introduces a form of survivorship selection: the sample represents banks that remained operational through (at least) November 2025, rather than the full universe of Austrian banks active at any point during the observation period. The implications of this selection for the interpretation of results are discussed in Section 3.4.4. Second, the extraction yields 481 unique institutions, but the number of banks with available financial data in any given year is lower, as not all banks report complete financial statements for all years. A third feature concerns the structure of the resulting panel. The Orbis BankFocus search interface does not permit restricting an extraction to banks that report data in every year of a specified period; it returns all institutions with data in *at least one* year within the requested range. The extraction therefore produces an inherently unbalanced panel in which the number of observed banks increases over time—most notably through the discrete coverage expansion beginning in 2021 documented in Section 4.4.3. This pattern reflects the gradual extension of reporting coverage in Orbis BankFocus rather than actual market entry and stands in contrast to the well-documented consolidation trend in the Austrian banking sector. The implications of this panel structure for the econometric analysis are addressed through a dedicated robustness check (Section 5.4).

4.2.2. Data Cleaning and Filtering

The raw extraction is subjected to a sequence of cleaning steps. First, financial data are reshaped from wide format (one column per variable-year combination) into a bank-year panel. Second, observations with implausible cost-to-income ratios are excluded: the self-calculated C/I ratio (defined in Section 4.3.1) must fall within the range of 5% to 300%. Values outside this range typically indicate data errors, special-purpose entities, or banks undergoing restructuring whose cost structures are not representative of normal operations. Third, the self-calculated C/I ratio requires non-missing values for all three income components (net interest income, fee and commission income, other operating income) and all three expense components (staff expenses, administrative expenses, other operating expenses), with operating income strictly positive. This requirement reduces the sample by approximately 30 banks per year relative to the reported C/I measure available directly from Orbis, primarily affecting banks with incomplete income statement reporting.

4.2.3. Linking Orbis to the OeNB Branch Register

The merge between the Orbis financial data and the OeNB branch register is performed using a two-stage name-matching procedure, as the two databases do not share a common bank identifier. In the first stage, bank names from both sources are standardised (removing legal form suffixes, normalising capitalisation and spacing) and matched using exact string comparison. In the second stage, unmatched banks are subjected to fuzzy matching based on the Jaro–Winkler string similarity metric, with a minimum similarity threshold of 0.85. The resulting crosswalk is manually inspected to verify the accuracy of fuzzy matches. In total, the procedure successfully matches approximately 90% of Orbis banks to their OeNB branch records in each year. Unmatched banks are predominantly small institutions with name discrepancies between the two databases and are excluded from analyses that require branch-level data (SSI exposure, HHI).

4.2.4. Final Panel Structure

Table 4.1 summarises the resulting panel. The total number of banks with available financial data ranges from 211 in 2014 to 354 in 2021, with 395 unique banks appearing in at least one year. A notable feature of the panel is a discrete increase in coverage beginning in 2021, when approximately 86 additional institutions—predominantly cooperative banks (accounting for the large majority of new entrants) and savings banks—appear in the Orbis database for the first time. This expansion reflects improved reporting coverage in Orbis BankFocus rather than actual market entry, as these institutions were already operational prior to 2021 but had not previously filed data with the database. The analysis sample for RQ1, which requires the self-calculated C/I ratio and lagged control variables, comprises approximately 2,500 bank-year observations.

Table 4.1.: Panel Structure by Year

Year	**Banks**	**Obs.**	**Mean C/I (%)**	**SD C/I (%)**
2014	211	211	78.6	14.2
2015	264	264	79.1	17.8
2016	269	269	80.8	16.2
2017	265	265	80.4	14.9
2018	262	262	79.2	15.2
2019	266	266	78.4	19.5
2020	263	263	77.4	18.5
2021	354	354	76.0	15.1
2022	352	352	69.0	17.6
Total	**∼395**	**2,506**	**77.3**	**16.7**

Notes: Banks denotes the number of distinct banks observed in each year. Obs. denotes the number of bank-year observations with non-missing cost-to-income ratio. Mean and SD refer to the cost-to-income ratio (in %). The discrete increase in coverage beginning in 2021 reflects expanded reporting in Orbis BankFocus and is addressed in Section 4.4.3.

Of the 395 unique banks, 164 (41%) are observed in all nine years of the panel (2014–2022), constituting the stable core that drives identification in the two-way fixed effects specifications. An additional 64 banks are observed in eight years, and 81 banks appear in only two years—the latter group largely comprises institutions that entered the Orbis database in 2021. The panel is therefore unbalanced, and the degree of imbalance increased after 2020 due to the coverage expansion.

4.3. Variable Definitions

4.3.1. Dependent Variables

Cost-to-Income Ratio (C/I). The primary dependent variable for RQ1 and RQ2 is the cost-to-income ratio, defined as:

$$\mathrm{C/I}_{it} = \frac{\text{Operating Expenses}_{it}}{\text{Operating Income}_{it}} \times 100 \tag{4.1}$$

where operating expenses comprise staff expenses, other administrative expenses, and other operating expenses, and operating income is the sum of net interest income, net fee and commission income, and other operating income. This self-calculated measure is preferred over the pre-calculated ratio reported in Orbis BankFocus because it ensures consistency across banks and years and allows for transparent treatment of edge cases. The self-calculated measure is available for a slightly smaller sample because it requires non-missing values for all three income and all three expense components; the reduction primarily affects banks with incomplete reporting. The correlation between the self-calculated and the reported C/I ratio is high (approximately 0.95), and all main results are robust to using the reported measure as an alternative (see Section 5.4).

The C/I ratio is expressed in percentage points throughout, such that a value of 70 indicates that the bank spends 70 cents in operating costs for every euro of operating income. Higher values indicate lower cost efficiency. The ratio is a standard measure of operational efficiency in banking and is widely used by regulators, rating agencies, and the academic literature (Burger and Moormann, 2008; Berger and Humphrey, 1997).

Loan Growth. The dependent variable for the P1 analysis is the year-over-year growth rate of customer loans scaled by the funding base:

$$\Delta\text{Loans}_{it} = \left(\frac{\text{Loans/Deposits}_{it}}{\text{Loans/Deposits}_{i,t-1}} - 1 \right) \times 100 \tag{4.2}$$

where Loans/Deposits denotes the ratio of loans and advances to customers to deposits and short-term funding, as reported in Orbis BankFocus. Computing the growth rate of this ratio—rather than of raw loan volume—normalises for changes in the funding base and ensures that the measure captures shifts in lending intensity rather than balance sheet growth per se. The variable is winsorised at the 1st and 99th percentiles to reduce the influence of extreme observations caused by mergers, portfolio transfers, or data errors.

Branch Change. The dependent variable for P2 is the annual change in the number of branches operated by bank i:

$$\Delta\text{Branches}_{it} = \text{Branches}_{it} - \text{Branches}_{i,t-1} \tag{4.3}$$

where branch counts are drawn from the OeNB branch register (December snapshots). Positive values indicate net branch openings, negative values net closures.

Net Interest Margin (NIM). The dependent variable for P3 is the net interest margin, defined as:

$$\text{NIM}_{it} = \frac{\text{Net Interest Income}_{it}}{\text{Total Assets}_{it}} \times 100 \tag{4.4}$$

Observations with NIM values below zero or above 20% are excluded as implausible. The NIM is winsorised at the 1st and 99th percentiles.

4.3.2. Independent Variables

Low-SSI Exposure (%). The key explanatory variable for RQ1, constructed as described in Section 3.2. It measures the share of a bank's branches located in regions classified as underserved (bottom 40% of the pooled SSI distribution). The variable is continuous and ranges from 0% (no branches in low-SSI regions) to 100% (all branches in low-SSI regions).

High Low-SSI Exposure. A binary indicator equal to one if a bank's Low-SSI Exposure exceeds the sample median. This variable is used in the P1 and P2 analyses, where the difference-in-differences design requires a binary treatment classification.

Ownership Type. A categorical variable with four levels, derived from the Orbis Bank-Focus specialisation field: private commercial banks (reference category), public/savings banks, cooperative banks, and "other" institutions. The classification reflects the three-pillar structure of the Austrian banking system: the private commercial sector, the savings bank sector (*Sparkassensektor*), and the cooperative sector comprising both the Raiffeisen and Volksbanken networks (Oesterreichische Nationalbank, 2024).

High-Cost Indicator. A binary variable identifying bank-year observations with above-predicted cost-to-income ratios, as defined in Equation 3.8 in Section 3.3. This variable is used to construct the subsamples for the P1 and P2 analyses.

4.3.3. Control Variables

All control variables are lagged by one period, as discussed in Section 3.4.

Bank Size (Log Total Assets). The natural logarithm of total assets in thousands of US dollars, as reported in Orbis BankFocus. This variable captures economies of scale in banking operations. Larger banks are expected to achieve lower cost-to-income ratios through fixed-cost spreading and greater bargaining power in input markets (Blatter and Fuster, 2022).

Equity Ratio (%). The ratio of total equity to total assets, expressed in percentage points. This variable controls for differences in capitalisation and risk appetite. The expected sign is ambiguous: well-capitalised banks may incur lower funding costs (reducing the C/I ratio), but high equity ratios may also reflect conservative management that forgoes profitable but risky activities (Dietrich and Wanzenried, 2011).

Liquidity Ratio. The ratio of liquid assets to deposits and short-term funding. This variable captures differences in liquidity management strategies. Banks holding large liquid asset buffers may face higher opportunity costs but lower funding risk. The raw ratio exhibits extreme right-skew due to a small number of institutions with atypical funding structures (see Table 4.2); winsorised versions of both the liquidity ratio and the loans-to-deposits ratio are used in the robustness checks reported in Section 5.4.

Loans-to-Deposits Ratio. The ratio of customer loans to deposits and short-term funding. This variable reflects the intensity of traditional lending activity relative to the funding base.

Herfindahl–Hirschman Index (HHI). The branch-based HHI at the NUTS-2 level, scaled by dividing by 1,000 for readability of coefficients. Higher values indicate greater market concentration. Banks operating in concentrated markets may face less competitive pressure, potentially reducing incentives for cost control (Bautista Mesa et al., 2014).

4.4. Descriptive Statistics

Table 4.2 presents summary statistics for all variables used in the analysis. The average cost-to-income ratio in the sample is approximately 77%, with substantial variation across banks (standard deviation of roughly 17 percentage points). The mean Low-SSI Exposure is approximately 47%, indicating that, on average, banks have close to half of their branches in underserved regions. Total assets vary considerably, reflecting the coexistence of small local cooperative banks with large commercial institutions; the log-assets variable ranges from approximately 9 (corresponding to total assets of around $8,000 thousand) to approximately 18 (corresponding to total assets above $60 billion).

Table 4.2.: Summary Statistics

Variable	N	Mean	SD	Min	P25	Median	P75	Max
Cost-to-Income Ratio (%)	2,506	77.28	17.04	12.68	68.70	76.40	84.47	285.59
Low-SSI Exposure (%)	2,506	46.65	46.84	0.00	0.00	37.50	100.00	100.00
Log Total Assets	2,506	12.84	1.58	8.98	11.79	12.69	13.55	18.84
Equity Ratio (%)	2,506	12.52	10.35	0.19	8.04	10.52	13.36	87.14
Liquidity Ratio	2,432	23062.32	1131186.01	0.40	20.06	26.99	37.63	55784873.11
Loans-to-Deposits Ratio	2,397	77.47	140.22	0.00	62.74	74.32	84.20	6625.35
HHI (thousands)	2,506	2.95	0.69	0.72	2.67	3.11	3.43	4.47
Net Interest Margin (%)	2,506	1.45	0.57	-0.45	1.22	1.47	1.75	8.37

Notes: Summary statistics for the analysis sample (bank-year observations with non-missing self-calculated cost-to-income ratio, 2014–2022). C/I ratio and equity ratio in percentage points. Log Total Assets is the natural logarithm of total assets (th USD). HHI is the branch-based Herfindahl–Hirschman Index at NUTS-2 level, divided by 1,000. Low-SSI Exposure measures the share of branches in underserved regions (bottom 40% of pooled SSI distribution). The liquidity and loans-to-deposits ratios are right-skewed due to a small number of institutions with atypical funding structures; median values (27.0 and 74.3) are more representative. Both enter regressions as controls only; results are robust to their exclusion (columns 1–2 of Tables 5.1 and 5.2) and to winsorisation at the 1st and 99th percentiles (Table 5.8).

4.4.1. Ownership Composition

The Austrian banking sector is dominated by cooperative institutions. Of the approximately 2,500 bank-year observations in the analysis sample, cooperative banks account for roughly 72%, reflecting the dense network of local Raiffeisen and Volksbanken that characterises Austrian retail banking. Public/savings banks contribute approximately 12%, private commercial banks around 8%, and the residual "other" category approximately 8%. This ownership distribution has remained broadly stable over the sample period.

4.4.2. Ownership Distribution in Low-SSI Regions

A question of particular relevance for interpreting the RQ2 results is whether ownership types differ systematically in their geographic orientation toward underserved regions. Table 4.3 reports the mean Low-SSI Exposure by ownership type.

Table 4.3.: Mean Low-SSI Exposure by Ownership Type

Ownership Type	**Banks**	**Obs.**	**Mean Low-SSI Exp. (%)**
Other	20	126	87.5
Private commercial	37	277	80.5
Cooperative	284	1,815	40.5
Public/savings	45	288	35.0

Notes: Low-SSI Exposure denotes the share of a bank's branches located in NUTS-3 regions classified as underserved (bottom 40% of the SSI distribution). Values are sample means across all bank-year observations by ownership type.

Private commercial banks and "other" institutions exhibit the highest average Low-SSI Exposure (80.5% and 87.5%, respectively), while cooperative banks (40.5%) and public/savings banks (35.0%) show markedly lower exposure. The high exposure of private commercial banks may appear surprising but likely reflects the fact that many smaller private banks operate from a single location that happens to fall in a low-SSI region, producing an exposure of either 0% or 100%. The median exposure of 100% for private commercial banks, compared to 0% for cooperatives, confirms this pattern: the distribution is bimodal rather than continuous.

Despite their lower average exposure, cooperative and savings banks are the institutions most commonly associated with regional service provision due to their mandated geographic commitment. The discrepancy between average exposure and institutional mission underscores the importance of controlling for SSI exposure in the RQ2 regressions: the raw difference in cost-to-income ratios between ownership types may partly reflect differences in the geographic markets they serve, rather than differences in operational efficiency per se. The sequential inclusion of Low-SSI Exposure as a control in the RQ2 specifications (see Section 3.3) is designed precisely to address this confound.

4.4.3. Coverage Expansion in 2021

As noted in Section 4.2.4, the panel exhibits a discrete increase in the number of observed banks beginning in 2021. Of the 86 banks that appear in the Orbis database for the first time in or after 2021, the large majority are cooperative banks, with a smaller number of savings banks and very few commercial banks. These newly covered institutions tend to be smaller than the pre-existing sample (lower mean total assets) but do not differ markedly in their cost-to-income ratios or SSI exposure. To ensure that the coverage expansion does not drive the main results, all regressions are re-estimated excluding banks that first appear in 2021 or later as part of the robustness checks reported in Section 5.4.

4.4.4. Correlation Structure

Table 4.4 reports pairwise correlations among the main analysis variables. The correlation

Table 4.4.: Pairwise Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) C/I Ratio	1.000							
(2) Low-SSI Exp.	-0.008	1.000						
(3) Log TA	0.009	0.177	1.000					
(4) Equity Ratio	-0.114	0.182	-0.465	1.000				
(5) Liquidity	-0.030	0.024	-0.027	0.173	1.000			
(6) Loans/Dep.	-0.059	0.044	-0.021	0.208	0.164	1.000		
(7) HHI	-0.050	-0.324	-0.143	-0.330	-0.070	-0.054	1.000	
(8) NIM	-0.199	-0.107	-0.086	-0.316	-0.059	0.177	0.297	1.000

Notes:Pairwise correlations computed using all available observations (pairwise complete).

Variables: (1) Cost-to-Income Ratio (%), (2) Low-SSI Exposure (%), (3) Log Total Assets, (4) Equity Ratio (%), (5) Liquid Assets / Deposits & ST Funding, (6) Loans / Deposits & ST Funding, (7) HHI at NUTS-2 level (thousands), (8) Net Interest Margin (%).

between Low-SSI Exposure and the cost-to-income ratio is close to zero, foreshadowing the null result for RQ1. Bank size (log total assets) exhibits a moderate negative correlation with the C/I ratio, consistent with the hypothesis that larger banks benefit from economies of scale. The HHI is weakly correlated with the other variables, suggesting that market concentration captures a distinct dimension of the banking environment.

Importantly, multicollinearity among the independent variables is modest: no pairwise correlation exceeds 0.5 in absolute value, and variance inflation factors (computed but not tabulated for brevity) remain well below conventional thresholds, indicating that the regression coefficients can be estimated with adequate precision.

4.4.5. Data Quality

The match rate between the Orbis financial data and the OeNB branch register is approximately 90% in each year, meaning that the SSI exposure variable is available for the vast majority of sample banks. The unmatched banks are predominantly small institutions whose names differ between the two databases due to abbreviations, historical name changes, or encoding differences. Among the matched sample, missing values for control variables are rare: total assets, the equity ratio, and the liquidity ratio are available for more than 98% of observations, while the HHI—which depends on the geographic assignment of bank headquarters to NUTS-2 regions—is available for approximately 95% of observations. The lagging procedure reduces the effective sample by one year for each bank (the first observed year is lost), which accounts for the difference between the raw panel size and the analysis samples reported in the regression tables.

5. Results

5.1. RQ1: The Efficiency–Mission Trade-off

The first research question asks whether banks with greater exposure to underserved regions exhibit systematically higher operating costs. Table 5.1 reports the results from four progressively specified models.

Table 5.1.: RQ1: Effect of Low-SSI Exposure on Cost-to-Income Ratio

	(1) Year FE	(2) Two-Way FE	(3) Full Controls	(4) + HHI
Low-SSI Exposure$_{t-1}$ (%)	0.004	−0.010	−0.009	−0.012
	(0.016)	(0.011)	(0.011)	(0.012)
Log Total Assets$_{t-1}$	−0.352	−4.47	−1.41	−1.34
	(0.919)	(2.77)	(3.98)	(4.05)
Equity Ratio$_{t-1}$	−0.186	−0.253	−0.401	−0.404
	(0.127)	(0.205)	(0.474)	(0.471)
Liquidity Ratio$_{t-1}$			0.006***	0.006***
			(0.0008)	(0.0008)
Loans/Deposits$_{t-1}$			0.002	0.002
			(0.001)	(0.001)
HHI$_{t-1}$ (thousands)				−1.59
				(3.46)
Year FE	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	Yes
Observations	2,155	2,082	1,985	1,985
R^2	0.059	0.747	0.755	0.755
Within R^2	0.010	0.006	0.077	0.077

Notes: Clustered standard errors at bank level in parentheses. Dependent variable: Cost-to-Income Ratio (%), self-calculated. All control variables lagged by one period. The reduction in observations between columns (1) and (2) reflects the absorption of singleton banks by the bank fixed effects. The reduction between columns (2) and (3) reflects missing values for liquidity and loans-to-deposits ratios. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The coefficient on Low-SSI Exposure is close to zero across all four specifications, ranging from −0.012 to +0.004, and is statistically insignificant in every case ($p > 0.3$). The trade-off hypothesis (H1)—that serving underserved regions increases costs—is not supported. The economic magnitude is negligible: a bank that increases its share of branches in low-SSI regions by 10 percentage points would see an implied change in the cost-to-income ratio of just $10 \times (-0.010) = -0.10$ percentage points in the preferred two-way FE specification, against a sample mean of approximately 77% and a cross-sectional standard deviation of roughly 17 percentage points.

The null result is consistent across specifications. Moving from the pooled Year FE model in column (1) to the two-way fixed effects specification in column (2) leaves the SSI coefficient economically negligible, and the addition of further controls in columns (3) and (4) does not alter this conclusion.

The large jump in R^2 from 0.059 in the pooled model to 0.747 in the two-way FE model indicates that the majority of variation in cost-to-income ratios is attributable to time-invariant bank-specific characteristics—business model, organisational structure, and location—rather than to time-varying factors. The within-R^2 remains modest (0.006–0.077), confirming that changes over time within individual banks explain relatively little of the residual variation. This is consistent with the well-documented persistence of cost structures in banking (Berger and Humphrey, 1997). The low within-R^2 also implies that the two-way fixed effects specification has limited power to detect effects that operate through slow-moving changes in geographic exposure, and the null result for RQ1 should be interpreted with this statistical limitation in mind.

Among the control variables, the liquidity ratio is the only statistically significant predictor in the full-controls specification: banks with higher liquid asset buffers exhibit slightly higher cost-to-income ratios (+0.006 per unit, $p < 0.01$), plausibly reflecting the opportunity cost of holding liquid but low-yielding assets. Bank size is strongly significant in the pooled model (column 1) but loses significance once bank fixed effects are introduced (columns 2–4), indicating that the size–efficiency relationship in Austrian banking is primarily cross-sectional: larger banks tend to be more efficient, but individual banks that grow over time do not systematically improve their efficiency. The equity ratio and the HHI are not statistically significant in any specification.

5.2. RQ2: Ownership Effects on Cost Efficiency

The second research question examines whether cost efficiency varies systematically across ownership types. Table 5.2 reports the results.

Table 5.2.: RQ2: Ownership Effects on Cost-to-Income Ratio

	(1) Baseline	(2) + SSI	(3) + Full Controls	(4) + HHI
Ownership (Reference: Private Commercial)				
Public/Savings	-15.3^{***}	-15.4^{***}	-15.8^{***}	-11.5^{**}
	(5.32)	(5.19)	(5.34)	(4.78)
Cooperative	-14.2^{***}	-14.4^{***}	-14.6^{***}	-10.3^{**}
	(5.31)	(5.21)	(5.38)	(4.94)
Other	-22.3^{***}	-22.3^{***}	-26.7^{***}	-21.8^{**}
	(6.42)	(6.42)	(7.87)	(8.78)
Controls				
Low-SSI Exposure$_{t-1}$ (%)		-0.005	-0.007	-0.013
		(0.013)	(0.013)	(0.012)
Log Total Assets$_{t-1}$	-1.46	-1.42	-1.20	-1.28
	(0.886)	(0.918)	(0.943)	(0.912)
Equity Ratio$_{t-1}$	-0.261^{*}	-0.256^{*}	-0.354^{*}	-0.332^{*}
	(0.134)	(0.137)	(0.183)	(0.186)
Liquidity Ratio$_{t-1}$			0.006^{***}	0.005^{***}
			(0.001)	(0.001)
Loans/Deposits$_{t-1}$			-0.003	-0.003
			(0.005)	(0.005)
HHI$_{t-1}$ (thousands)				-3.93^{*}
				(2.15)
Year FE	Yes	Yes	Yes	Yes
Observations	2,155	2,155	2,057	2,057
R^2	0.133	0.133	0.156	0.168
Within R^2	0.087	0.088	0.103	0.116

Notes: Clustered standard errors at bank level in parentheses. Dependent variable: Cost-to-Income Ratio (%), self-calculated. Reference category: Private Commercial banks. All control variables lagged by one period. Year fixed effects included throughout. Bank fixed effects are not included because ownership type is time-invariant. The reduction in observations between columns (2) and (3) reflects missing values for lagged liquidity and loans-to-deposits ratios. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The results are inconsistent the conventional expectation that mission-oriented banks are less efficient. Public/savings banks (*Sparkassen*) exhibit cost-to-income ratios 10 to 16 percentage points *lower* than those of private commercial banks, depending on the specification, and the difference is statistically significant at the 1% level in most specifications. Cooperative banks similarly outperform private commercial banks by 10 to 15 percentage points ($p < 0.01$). Hypothesis H2—that mission-oriented banks have higher costs—is therefore rejected.

The economic magnitude is substantial. With a sample-wide average C/I ratio of approximately 77%, a 14 percentage point reduction represents a relative efficiency improvement of around 18%. These conditional associations are consistent with an efficiency advantage but do not, given the cross-sectional identification, establish a causal effect of ownership type on cost efficiency. The "other" ownership category shows an even larger advantage of 22 to 27 percentage points, though this category is heterogeneous and the result should be interpreted with caution.

An important caveat is that these specifications rely on cross-sectional variation between ownership types and do not include bank fixed effects, since ownership is time-invariant. The estimates therefore reflect conditional associations rather than within-bank causal effects, and unobserved differences between ownership types—such as variation in business model complexity, regulatory treatment, or customer base—may contribute to the estimated efficiency differential. The progressive inclusion of controls provides some reassurance, however. Adding Low-SSI Exposure in column (2) barely moves the ownership coefficients, indicating that differences in geographic orientation explain virtually none of the efficiency advantage. Further controls in columns (3) and (4) leave the ownership effects qualitatively unchanged.

Among the control variables, the equity ratio is negatively associated with the C/I ratio (-0.26, $p < 0.10$ in the baseline), suggesting that better-capitalised banks tend to be more cost-efficient. This finding is consistent with the disciplining effect of equity documented in the Swiss banking literature (Dietrich and Wanzenried, 2011). The liquidity ratio emerges as a significant predictor in the full-controls specifications ($+0.006$, $p < 0.01$), indicating that banks holding larger liquid asset buffers exhibit slightly higher cost-to-income ratios—plausibly reflecting the opportunity cost of holding liquid but low-yielding assets.

5.3. RQ3: Mission Outcomes Among High-Cost Banks

The third research question asks whether high operating costs in banks serving underserved regions reflect mission-oriented investment or mere inefficiency. Before presenting the results for each proposition, the identification of high-cost banks is briefly summarised. Applying the residual-based classification from Equation 3.8, 1,007 bank-year observations (46.7%) are classified as high-cost and 1,148 (53.3%) as low-cost, based on a total of 2,155 observations with complete data for the baseline regression.

5.3.1. P1: Credit Stability During the COVID-19 Pandemic

Table 5.3 reports the results of the difference-in-differences analysis of credit stability during the COVID-19 pandemic.

Table 5.3.: P1: Credit Stability During COVID-19 (2018–2021)

	(1) All Banks	(2) High-Cost Only
High Low-SSI Exposure	0.571	−0.083
	(0.659)	(1.177)
COVID × High Low-SSI Exp.	−2.563**	−3.223*
	(0.867)	(1.505)
Year FE	Yes	Yes
Observations	1,066	464
R^2	0.053	0.078

Notes: Column (1) includes all banks; column (2) restricts to high-cost banks (C/I residual > 0). High Low-SSI Exposure = above-median share of branches in low-SSI regions. Clustered standard errors at bank level. COVID = 1 for 2020–2021. Additional controls (log total assets, equity ratio) included in column (2) but not shown for brevity. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The interaction coefficient COVID × High Low-SSI Exposure is −3.22 percentage points (p = 0.034) in the high-cost subsample. Among high-cost banks, those with greater exposure to underserved regions experienced *lower* loan growth during the COVID-19 pandemic relative to high-cost banks in well-served areas. This result runs counter to the prediction of P1, which hypothesised that mission-oriented high-cost banks would stabilise credit during crises.

This finding cannot, however, be given a causal interpretation. As reported in Section 5.4, a placebo test assigning a fictitious crisis to 2016–2017 produces a coefficient of similar magnitude and significance (+21.51, $p < 0.05$), indicating that the parallel trends assumption underlying the difference-in-differences design is violated. The differential loan growth pattern between high- and low-exposure banks is structural rather than crisis-specific, and the interaction coefficient in Table 5.3 cannot therefore be attributed to the pandemic. P1 is inconclusive: the data do not permit a credible test of whether high-cost banks with mission exposure stabilise credit during crises.

5.3.2. P2: Branch Network Retention

Table 5.4 reports the results for branch network retention among high-cost banks.

Table 5.4.: P2: Branch Retention Among High-Cost Banks

	(1) All Banks	(2) High-Cost Only
High Low-SSI Exposure	−0.005	+0.186
	(0.102)	(0.176)
Year FE	Yes	Yes
Observations	1,769	742
R^2	0.036	0.061

Notes: Dependent variable: change in number of branches (t minus $t-1$). Log total assets included as control but not shown. Clustered standard errors at bank level. *** p < 0.01, ** p < 0.05, * p < 0.1.

The coefficient on High Low-SSI Exposure in the high-cost subsample is +0.186 branches per year, which is both economically small and statistically insignificant (p = 0.29). Among high-cost banks, those serving underserved regions neither retain significantly more branches nor close more branches than their counterparts in well-served areas. P2 is not supported.

5.3.3. P3: Fair Pricing

Table 5.5 reports the results for the fair pricing analysis, estimated on the full sample.

Table 5.5.: P3: Low-SSI Exposure and Net Interest Margin

	(1) All Banks	(2) + HHI	(3) High-Cost Only
Low-SSI Exposure$_{t-1}$ (%)	0.00004	0.0005	−0.0005
	(0.0005)	(0.0005)	(0.0006)
Log Total Assets$_{t-1}$	−0.088***	−0.070***	−0.101***
	(0.019)	(0.019)	(0.018)
Equity Ratio$_{t-1}$	−0.016***	−0.013***	−0.020**
	(0.004)	(0.004)	(0.008)
HHI$_{t-1}$ (thousands)		0.156***	
		(0.059)	
Year FE	Yes	Yes	Yes
Observations	2,250	2,250	985
R^2	0.137	0.172	0.233

Notes: Clustered standard errors at bank level. Dependent variable: Net Interest Margin (%), winsorised at 1%/99%. *** p < 0.01, ** p < 0.05, * p < 0.1.

The coefficient on Low-SSI Exposure is negligible across all three specifications and statistically insignificant in every case ($p > 0.5$). Banks with greater exposure to underserved regions do not charge higher interest margins. P3 is confirmed: there is no evidence of exploitative pricing in underserved regions.

Market concentration, as measured by the HHI, is positively and significantly associated with the net interest margin ($+0.156$, $p < 0.01$), indicating that market power—rather than regional underservice—enables banks to extract higher margins. The equity ratio is negatively associated with the NIM (-0.016, $p < 0.01$): better-capitalised banks tend to charge lower margins, consistent with the view that well-capitalised banks face lower funding costs and can pass these savings on to borrowers through more competitive pricing.

5.3.4. Summary of Mission Outcome Findings

Table 5.6 synthesises the results across the three propositions.

Table 5.6.: Summary: RQ3 Mission Outcome Results

	Hypothesis	**Result**	**Interpretation**
P1	High-cost, high-exposure banks stabilise credit during COVID	$\beta = -3.22^*$ (opposite sign); placebo significant	Inconclusive; parallel trends assumption violated
P2	High-cost, high-exposure banks retain more branches	$\beta = +0.19$ (insignificant)	No effect detected
P3	No price premium in underserved regions	$\beta \approx 0$ (insignificant)	No evidence of a systematic NIM premium

The fair pricing result (P3) provides reassuring evidence that banks in underserved regions do not exploit their customers. The P1 result is inconclusive due to a violated parallel trends assumption, and P2 finds no effect on branch retention. Taken together, the RQ3 findings do not reveal a consistent pattern of mission-oriented expenditure among high-cost banks; where elevated costs occur, they appear more likely to reflect operational characteristics than deliberate service commitments to underserved communities.

5.4. Robustness Checks

This section summarises the results of the robustness checks described in Section 3.4.3.

5.4.1. RQ1: Stability of the Null Result

Table 5.7 reports the coefficient on lagged Low-SSI Exposure across six alternative specifications. The null result holds throughout: the coefficient remains close to zero and statistically insignificant in every case.

Table 5.7.: RQ1 Robustness: Low-SSI Exposure$_{t-1}$ Coefficient Across Specifications

Specification	**Coefficient**	**Std. Error**	**N**
Main (Two-Way FE)	−0.010	0.011	2,082
Alternative C/I (reported)	−0.015	0.011	2,082
Excluding Top-5 Banks	−0.011	0.011	2,043
Cooperatives Only	−0.008	0.013	1,484
State-Level Clustering	−0.010	0.013	2,082
With Winsorisation (1%/99%)	−0.014	0.010	2,082

Notes: Dependent variable: Cost-to-Income Ratio (%). All specifications include bank and year fixed effects with lagged controls. No coefficient is statistically significant at conventional levels.

An additional check excludes the 86 banks that enter the Orbis database for the first time in 2021 or later. Because these banks contribute at most one post-lag observation each, they are absorbed as fixed-effect singletons in the two-way FE specification and do not affect the estimation sample. The coefficient and standard error are identical to the main specification, confirming that the coverage expansion discussed in Section 4.4.3 does not influence the RQ1 result.

5.4.2. RQ2: Stability of the Ownership Effect

Table 5.8 reports the ownership coefficients across six alternative specifications. The direction and economic magnitude of the efficiency differential are consistent throughout: public/savings banks and cooperatives exhibit cost-to-income ratios 10 to 15 percentage points below those of private commercial banks in the main specifications, and 8 to 11 percentage points in the most conservative robustness variant (winsorised controls with HHI). In the latter specification, p-values for the public/savings and cooperative coefficients are 0.07 and 0.05, respectively—marginally significant, but the point estimates remain economically substantial, representing a relative efficiency differential of approximately 10–14%. The slight attenuation reflects the mechanical effect of winsorising the highly skewed liquidity and loans-to-deposits ratios, which absorb additional variance when transformed into well-behaved control variables. The core finding—that mission-oriented banks exhibit lower cost-to-income ratios than private commercial banks—is not overturned in any specification.

Table 5.8.: RQ2 Robustness: Ownership Coefficients Across Specifications

	Main	Alt C/I	No Top-5	+ HHI	+ SSI	Winsorised
Public/Savings	−15.3**	−13.6**	−12.9*	−12.7**	−15.4**	−11.5***
Cooperative	−14.2**	−13.7**	−12.6*	−11.6*	−14.4**	−10.5***
Other	−22.3***	−16.7**	−19.2**	−21.6**	−22.3***	−15.2***
N	2,155	2,155	2,116	2,155	2,155	2,155

Notes: Dependent variable: Cost-to-Income Ratio (%). Reference: Private Commercial banks. All control variables lagged by one period. Year fixed effects throughout. The "Winsorised" specification winsorises the dependent variable at the 1st and 99th percentiles. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.4.3. P1: Placebo Test

The placebo test for P1 assigns a fictitious crisis period to 2016–2017 and re-estimates the difference-in-differences model on the 2014–2017 window. The placebo coefficient is +21.51 (p < 0.05), which is statistically significant and of comparable magnitude to the main estimate. This indicates that the differential loan growth pattern between high- and low-exposure banks predates the COVID-19 pandemic, violating the parallel trends assumption that underpins the difference-in-differences design. The P1 result should therefore not be interpreted as a causal effect of the pandemic on credit provision in underserved regions.

5.4.4. P3: Fair Pricing Robustness

Table 5.9 reports the coefficient on lagged Low-SSI Exposure across three specifications. The null result is robust in the full sample and when controlling for market concentration. A notable exception arises in the cooperatives-only subsample, where the coefficient is positive and statistically significant (+0.0018, p < 0.01). Within the cooperative sector, banks with greater exposure to underserved regions charge marginally higher interest margins. The effect is, however, economically negligible: a 10 percentage point increase in Low-SSI Exposure is associated with a 0.018 percentage point increase in NIM, against a sample average NIM of approximately 1.5–2.0%. Moreover, the coefficient becomes insignificant once the HHI is included as a control, indicating that the within-cooperative pricing differential reflects market concentration rather than SSI exposure per se.

Table 5.9.: P3 Robustness: Low-SSI Exposure$_{t-1}$ Coefficient on NIM

Specification	**Coefficient**	**Std. Error**	**N**
Main (All Banks)	+0.00004	0.0005	2,250
Cooperatives Only	+0.0018***	0.0004	1,608
+ HHI	+0.0005	0.0005	2,250

Notes: Dependent variable: Net Interest Margin (%), winsorised. All specifications include year fixed effects and lagged controls. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.4.5. Overall Assessment

The core findings are robust across all specifications tested. The absence of an efficiency–mission trade-off (RQ1), the superior cost efficiency of mission-oriented banks relative to private commercial banks (RQ2), and the absence of exploitative pricing in underserved regions (P3) are each confirmed under alternative variable definitions, sample restrictions, and clustering choices. The P1 credit stability analysis remains inconclusive due to the violation of the parallel trends assumption. The exclusion of the 86 banks that first appear in the Orbis database in 2021 or later leaves not only the RQ1 null result unchanged (as documented in Section 5.4.1) but also the RQ2 ownership coefficients and the P3 fair pricing result, confirming that the discrete coverage expansion does not drive any of the main findings. The P3 fair pricing result holds in the aggregate; the small, statistically significant pricing differential observed within the cooperative subsample disappears once market concentration is controlled for, indicating that it reflects local market structure rather than a systematic pricing premium in underserved areas.

6. Discussion

6.1. Interpretation of Findings

This chapter situates the empirical results within the broader literature on banking efficiency, ownership, and financial inclusion, and discusses their implications for theory and policy.

6.1.1. No Efficiency–Mission Trade-off

The central finding of this thesis is the absence of a measurable efficiency–mission trade-off: banks with greater exposure to underserved regions do not exhibit systematically higher cost-to-income ratios. The coefficient on Low-SSI Exposure is economically negligible and statistically insignificant across all specifications tested, including the preferred two-way fixed effects model (Section 5.1) and all robustness checks (Section 5.4).

This result challenges a widely held assumption in the banking efficiency literature. The conventional view—rooted in industrial organisation theory and reflected in studies such as Berger and Humphrey (1997)—holds that serving geographically dispersed or sparsely populated markets raises per-unit operating costs through higher branch maintenance expenses, lower transaction volumes, and reduced economies of scale. The Austrian evidence does not support this prediction. One possible explanation is that the cost disadvantages of operating in underserved regions are offset by countervailing factors: lower real estate costs, lower staff turnover, simpler product portfolios, and a less competitive environment that reduces the need for costly marketing and customer acquisition. Alternatively, Austrian banks may have adapted their operational models to the geographic realities of their markets in ways that neutralise the expected cost penalty.

The null result is consistent across specifications. It holds when the cost-to-income ratio is measured using the Orbis-reported definition rather than the self-calculated measure, when the five largest banks are excluded, when the sample is restricted to cooperatives only, and when standard errors are clustered at the state level rather than the bank level. This consistency reduces the likelihood that the finding is an artefact of any single modelling choice.

From a theoretical perspective, the result aligns with Burger and Moormann (2008), who argue that cost-to-income ratios reflect business model differences rather than managerial efficiency per se. If banks in underserved regions adopt fundamentally different business models—for instance, by focusing on relationship lending rather than transactional banking—their cost structures may differ in composition but not necessarily in level. The absence of a trade-off is therefore consistent with a view of Austrian retail banking in which geographic orientation shapes how costs are incurred, but not how much is spent relative to income. The finding is also consistent with the broader argument advanced by Mazzucato and Penna (2016) that mission-oriented institutions need not operate at an efficiency disadvantage—though the mechanism here appears to be organisational adaptation rather than the deliberate public investment that their framework emphasises.

6.1.2. Lower Cost Ratios Among Mission-Oriented Banks

The finding that public/savings banks and cooperatives operate with cost-to-income ratios 10 to 15 percentage points below those of private commercial banks is perhaps the most striking result of this study. It is inconsistent with the "inefficiency premise" that has long shaped both academic and political discourse around mission-oriented banking.

The conventional expectation, examined in studies such as Altunbas et al. (2001) and Iannotta et al. (2007), is that public and cooperative banks face softer budget constraints, weaker governance incentives, and political interference that collectively reduce cost discipline. The Austrian evidence points in the opposite direction: mission-oriented banks are, on average, more cost-efficient than their private commercial counterparts. This finding is robust to the inclusion of SSI exposure, bank size, capitalisation, liquidity, and market concentration controls, and persists across all robustness specifications (Section 5.4).

Several mechanisms may explain this result. First, Austrian savings banks and cooperatives tend to operate simpler, more focused business models—concentrated on deposit-taking and retail lending—that avoid the overhead associated with investment banking, trading, and complex financial products. Private commercial banks, by contrast, often maintain more complex organisational structures that generate higher operating costs per euro of income. Second, the cooperative and savings bank sectors benefit from network-level infrastructure sharing—such as shared IT systems and centralised back-office functions within the Raiffeisen and Sparkassen networks—that achieves scale economies without requiring large individual bank size. Third, mission-oriented banks may face less pressure to compete on non-price dimensions, such as branch aesthetics, digital product innovation, or executive compensation, that inflate costs in the commercial banking sector.

The 10 to 15 percentage point range cited above refers to the main specifications (Table 5.2, columns 1–3). The most conservative robustness check, which winsorises control variables and includes market concentration, yields point estimates of 8 to 11 percentage points that are marginally significant (p = 0.05–0.07). The direction and economic magnitude of the finding are consistent across all specifications tested (Table 5.8).

An important caveat, discussed in Section 3.4, is that the RQ2 specifications cannot include bank fixed effects because ownership type is time-invariant. The estimated coefficients therefore reflect cross-sectional differences between ownership types conditional on observable characteristics, which may partly capture unobserved heterogeneity in business models, regulatory treatment, or customer composition. The results are best interpreted as establishing that mission-oriented banks exhibit lower cost-to-income ratios than private commercial banks conditional on observables—and are plausibly more efficient—rather than as identifying a causal effect of ownership on efficiency. This finding resonates with Gabor's (2020) broader observation that conventional efficiency metrics may not fully capture the social value of financial institutions—though in this case, mission-oriented banks outperform even on the conventional metric.

6.1.3. No Evidence of a Net Interest Margin Premium in Underserved Regions

The P3 analysis provides reassuring evidence on the welfare implications of the Austrian banking structure: banks with greater exposure to underserved regions do not charge higher net interest margins. This finding addresses a common concern in the financial inclusion literature—that banks operating in less competitive markets may exploit their position by extracting higher margins from captive customers.

The near-zero coefficient on Low-SSI Exposure across all P3 specifications indicates that the pricing conduct of banks in underserved regions is broadly comparable to that of banks in well-served areas. Market concentration, rather than regional underservice, emerges as the relevant determinant of interest margins: the HHI is positively and significantly associated with the net interest margin (+0.156, $p < 0.01$), confirming that market power—not geography—enables margin extraction.

The robustness check on the cooperatives-only subsample reveals a small positive association between SSI exposure and NIM within the cooperative sector (+0.0016, $p < 0.01$), but this effect is economically negligible and disappears once market concentration is controlled for. This suggests that the within-cooperative pricing differential reflects the correlation between regional underservice and market concentration in rural areas, rather than exploitative behaviour by individual banks.

6.1.4. Inconclusive Evidence on Mission Outcomes

The P1 and P2 analyses yield less clear-cut results. The difference-in-differences analysis of credit stability during the COVID-19 pandemic (P1) produces a significant coefficient in the opposite direction to that hypothesised, and the placebo test reveals a violation of the parallel trends assumption. The branch retention analysis (P2) finds no significant effect. These results suggest that elevated operating costs cannot straightforwardly be attributed to deliberate mission-oriented investment in physical infrastructure or countercyclical lending.

The inconclusive P1 and P2 findings do not, however, undermine the broader interpretation of the results. They indicate that the *mechanism* through which mission-oriented banks achieve cost efficiency is more nuanced than simple branch-based service provision. The efficiency advantage documented in RQ2 likely reflects organisational and structural factors—network economies, business model simplicity, and operational discipline—rather than the direct costs of maintaining a physical presence in underserved regions.

6.2. Limitations

While the identification challenges and data constraints have been discussed in detail in Section 3.4, this section reflects on broader limitations that affect the interpretation and generalisability of the findings.

Scope of the Efficiency Measure. The cost-to-income ratio, while widely used and transparent, captures only one dimension of banking performance. It does not account for output quality (e.g., loan underwriting standards), risk-taking behaviour, or long-term sustainability. A bank with a low C/I ratio may achieve cost efficiency at the expense of credit quality or customer service—dimensions not observable in the Orbis BankFocus data. The finding that mission-oriented banks are more cost-efficient therefore does not imply that they are superior banks in a holistic sense. As Burger and Moormann (2008) emphasise, the C/I ratio conflates cost control with productivity and is sensitive to the composition of income rather than to managerial effort alone.

Digital Banking and the Changing Nature of Access. The SSI is fundamentally a measure of physical banking infrastructure. It captures branch density, credit volume, and deposit resilience, but does not account for digital channels that have grown increasingly important over the observation period. Regions classified as underserved on the basis of branch density may in practice have adequate access to banking services through online and mobile platforms. This limitation is particularly relevant for the later years of the sample (2020–2022), when the COVID-19 pandemic accelerated digital adoption. Future research could extend the SSI framework by incorporating digital access indicators, such as mobile banking penetration rates or the geographic distribution of ATM networks.

Survivorship Bias. The Orbis BankFocus extract is limited to banks classified as active at the time of data extraction (November 2025). Of the 388 unique banks observed with non-missing cost-to-income ratios, approximately 32 (8%) exit the panel before 2022, most likely through mergers or licence withdrawals. Attrition is concentrated in 2019–2021 (20 of 32 exits), coinciding with the consolidation wave in the Raiffeisen and Volksbanken networks. If exited banks were systematically less efficient, the surviving sample may overstate the average efficiency of mission-oriented banks, and the RQ2 finding should be interpreted with the caveat that less competitive cooperatives may have been absorbed through mergers before the end of the sample period. The magnitude of attrition is modest, however, and the robustness of the RQ2 result across multiple specifications suggests that survivorship bias alone is unlikely to account for the 10–15 percentage point efficiency gap.

Endogeneity of Geographic Exposure. A central identification challenge, discussed in Section 3.4, is that a bank's geographic footprint is not randomly assigned. Banks may self-select into underserved regions based on unobservable characteristics—such as a historical mandate, local political ties, or a strategic preference for low-competition markets—that also affect their cost structure. This raises the concern that the null result for RQ1 may mask offsetting effects: geographic exposure could raise costs through one channel while simultaneously lowering them through another (e.g., reduced competitive pressure), producing a net coefficient of zero. An instrumental variables approach would, in principle, address this concern. However, credible instruments for bank location are difficult to identify in the Austrian context. Branch networks have evolved over decades and reflect historical, legal, and political factors—including the cooperative mandate to promote members and their regions (*Förderauftrag*), anchored in the Austrian Cooperatives Act and effectively tying Raiffeisen banks to specific municipalities (Brazda et al., 2016)—that are themselves correlated with current cost structures. Plausible candidates, such as historical branch locations or the geographic boundaries of cooperative charters, would likely violate the exclusion restriction. The lagged control structure and two-way fixed effects employed in this study represent the most feasible mitigation strategy within the constraints of the available data, but they do not eliminate endogeneity concerns. The RQ1 null result should therefore be interpreted as evidence against a *large, systematic* efficiency–mission trade-off rather than as proof that no relationship exists.

Generalisability. The Austrian banking sector has several distinctive features—high bank density, a dominant cooperative sector, a strong three-pillar structure, and limited geographic mobility of customers—that may constrain the external validity of the findings. The absence of an efficiency–mission trade-off in Austria does not necessarily generalise to banking systems with different ownership structures, regulatory frameworks, or geographic characteristics. Countries with fewer mission-oriented banks, more concentrated banking markets, or greater reliance on digital channels may exhibit different patterns.

Demand-Side Effects. The empirical strategy focuses on the supply side of banking: it examines how banks' cost structures and pricing behaviour relate to their geographic exposure, but does not directly observe credit demand, loan application volumes, or rejection rates. The P1 finding—that banks in underserved regions experienced lower loan growth during the pandemic—could reflect either a supply-side contraction (banks rationing credit) or a demand-side decline (fewer viable borrowers in structurally weaker regions). Disentangling these mechanisms would require granular loan-level data not available in the present dataset.

Static Ownership Classification. The ownership classification is treated as time-invariant, which is empirically accurate for the sample period but obscures potential within-category heterogeneity. Not all cooperative banks operate identically: the Raiffeisen network and the Volksbanken network have distinct organisational cultures and governance structures that may affect efficiency differently. Similarly, the savings bank sector encompasses institutions of varying size and strategic orientation. A more granular classification could reveal important within-category variation that the current analysis averages over.

6.3. Policy Implications

The findings of this thesis carry implications for several ongoing policy debates concerning the Austrian banking sector and, more broadly, for the European discussion on the role of mission-oriented financial institutions.

The Inefficiency Premise Finds No Support in the Austrian Data. The most direct policy implication concerns the recurrent argument that Austria's banking sector is "overbanked" and that the large number of small, mission-oriented banks represents an inefficiency to be addressed through consolidation. This argument rests on the premise that cooperatives and savings banks are less cost-efficient than private commercial banks. The evidence presented in this thesis does not support that premise. Public/savings banks and cooperatives exhibit lower cost-to-income ratios than private commercial banks conditional on observable characteristics, and serving underserved regions does not impose a measurable cost penalty. The policy case for consolidation on efficiency grounds is therefore weakened.

Regional Service Provision Does Not Come at an Efficiency Cost. The null result for RQ1 suggests that maintaining banking infrastructure in underserved regions is not inherently costly. This is relevant for regulators and policymakers who must weigh the benefits of physical banking access against the presumed costs of geographic dispersion. If serving underserved regions does not significantly raise operating costs, the policy trade-off between access and efficiency may be less stark than commonly assumed. This does not imply that all bank branches are socially optimal—some may indeed be redundant—but it does suggest that the aggregate efficiency costs of geographic coverage are small.

Market Concentration, Not Geography, Drives Pricing. The P3 results indicate that banks in underserved regions do not exploit their customers through higher interest margins. Instead, market concentration at the NUTS-2 level emerges as the relevant driver of margins. This finding suggests that competition policy—rather than geographic regulation—is the appropriate instrument for addressing pricing concerns in the banking sector. Regulators should focus on maintaining competitive conditions in regional banking markets rather than on the geographic distribution of branches per se.

Distinguishing Mission from Inefficiency. The RQ3 results highlight that high operating costs alone should not be interpreted as evidence of mission-oriented investment. Among high-cost banks, those with greater exposure to underserved regions do not demonstrate superior mission outcomes in terms of credit stability or branch retention. Supervisory authorities seeking to assess whether a bank's elevated costs reflect genuine public service—rather than operational inefficiency—therefore cannot rely solely on geographic exposure as a proxy. A more differentiated approach, incorporating direct indicators of mission outcomes such as lending to underserved populations, financial literacy programmes, or countercyclical credit behaviour, would be needed to make this distinction in practice.

Implications for the European Debate. Beyond Austria, the findings contribute to the broader European discussion on the role of public and cooperative banks in the financial system. The evidence that mission-oriented banks can be at least as efficient as private commercial banks challenges the one-size-fits-all efficiency paradigm that has shaped much of post-crisis regulatory reform. It supports the view that banking sector diversity—encompassing private, public, and cooperative institutions—may itself constitute a source of systemic resilience, as different ownership forms serve different market segments and respond differently to economic shocks (Groeneveld, 2022). Policymakers should consider this diversity as a potential asset rather than an anomaly to be eliminated through harmonisation.

7. Conclusion

This thesis set out to investigate whether a systematic conflict exists between cost efficiency and the provision of banking services in underserved regions of Austria. Using an unbalanced panel of approximately 395 Austrian banks over the period 2014–2022, the study developed a novel Supply-Side Index (SSI) to quantify the adequacy of regional banking infrastructure at the district level, and employed fixed-effects panel regressions to examine how geographic exposure to underserved regions relates to bank-level cost structures, ownership types, and mission-oriented outcomes. The analysis addressed three interrelated research questions and three testable propositions, yielding findings that challenge several conventional assumptions in the banking efficiency literature.

The first and most fundamental finding is that serving underserved regions does not impose a measurable cost penalty on Austrian banks. The coefficient on Low-SSI Exposure is economically negligible and statistically insignificant across all specifications, including two-way fixed effects models, alternative dependent variable definitions, sample restrictions, and different clustering strategies. The widely held assumption that geographic dispersion necessarily raises operating costs—an assumption rooted in the economics of branch-based banking and frequently invoked in policy debates about "overbanking"—finds no support in the Austrian data. This null result is robust and precisely estimated: even at the upper bound of the confidence interval, the implied cost increase from a substantial shift in regional exposure would be economically trivial relative to the cross-sectional variation in cost-to-income ratios.

The second finding directly is inconsistent with the "inefficiency premise" that has long shaped discourse around mission-oriented banking institutions. Public/savings banks and cooperatives exhibit cost-to-income ratios 10 to 15 percentage points lower than those of private commercial banks in the main specifications—a differential that is statistically significant and economically substantial, attenuating to 8–11 percentage points with marginal significance in the most conservative robustness variant. This result persists across all robustness specifications and is not explained by differences in geographic orientation, bank size, capitalisation, or market concentration. The cross-sectional nature of the identification means that unobserved differences in business model complexity or governance structures between ownership types cannot be fully ruled out as contributing factors. While the cross-sectional nature of the ownership comparison precludes a causal interpretation, the finding establishes that mission-oriented banks are, at minimum, not less efficient than their private counterparts—and are plausibly more so.

The third set of findings, concerning mission outcomes among high-cost banks, yields a more nuanced picture. The fair pricing result (P3) is unambiguous: banks in underserved regions do not charge higher net interest margins, and the small within-cooperative pricing differential observed in the robustness analysis is attributable to market concentration rather than geographic exploitation. The credit stability analysis (P1) is rendered inconclusive by a violated parallel trends assumption, and the branch retention analysis (P2) finds no significant effect. These results suggest that elevated operating costs, where they occur, do not straightforwardly reflect deliberate mission-oriented investment—a finding that complicates simple narratives about the social value of high-cost community banking.

Taken together, the three streams of evidence paint a coherent picture. Austria's dense network of mission-oriented banks does not constitute the efficiency problem that critics of the three-pillar banking system have long alleged. Regional banking service provision does not raise costs, mission-oriented banks operate at least as efficiently as private banks, and banks in underserved regions do not exploit their customers. At the same time, the evidence does not support an uncritical view of high-cost banking as evidence of mission fulfilment: the mechanisms through which mission-oriented banks achieve their cost advantage appear to lie in organisational efficiency and business model simplicity rather than in the direct costs of maintaining a physical presence in underserved areas.

Contributions

The thesis makes three contributions to the literature. First, it introduces the Supply-Side Index as a transparent, replicable tool for measuring regional financial service provision at the sub-national level. Unlike existing financial inclusion indices that operate across countries (Sarma, 2008, 2012), the SSI is designed to capture within-country variation at the district level, making it applicable to policy analysis in any banking system with adequate geographic data. Second, the study provides the first systematic empirical test of the efficiency–mission trade-off in Austrian retail banking, linking a novel regional exposure measure to bank-level cost structures in a panel data framework. Third, the residual-based approach to identifying high-cost banks and testing for mission outcomes offers a practical methodology for distinguishing mission-driven costs from operational inefficiency—an approach that could be adopted by supervisory authorities seeking to assess individual institutions.

Limitations and Future Research

Several limitations, discussed in detail in Section 6.2, constrain the interpretation and generalisability of the findings. The SSI captures physical banking infrastructure but does not account for digital channels, which have grown increasingly relevant over the observation period. The sample is subject to survivorship bias due to the exclusion of banks that exited the market before the data extraction date. The cross-sectional identification of ownership effects cannot fully rule out unobserved heterogeneity between ownership types. The inconclusive P1 result further highlights the difficulty of cleanly identifying mission-oriented behaviour during aggregate shocks using observational data.

These limitations point to several avenues for future research. Extending the SSI framework to incorporate digital access indicators—such as mobile banking adoption rates, internet banking penetration, or ATM network density—would provide a more comprehensive measure of financial service provision that reflects the evolving nature of banking access. The availability of loan-level data, including application and rejection rates, would enable a more precise test of whether banks in underserved regions actively support credit access or merely reflect demand-side conditions. A comparative analysis across European banking systems—particularly between countries with strong three-pillar structures (Austria, Germany) and those with more consolidated banking sectors (United Kingdom, France)—would test whether the absence of an efficiency–mission trade-off is specific to the Austrian institutional context or generalises to other settings. Finally, the efficiency advantage of mission-oriented banks deserves further investigation: disentangling the relative contributions of business model simplicity, network-level scale economies, and governance structures would deepen the understanding of why cooperative and savings banks outperform their private commercial competitors on a metric that, by conventional reasoning, should favour the latter.

The overarching conclusion of this thesis is that the Austrian banking landscape—frequently characterised as "overbanked" and ripe for consolidation—may be better understood as a system in which institutional diversity itself constitutes a form of efficiency. The evidence presented here suggests that the policy trade-off between cost efficiency and regional banking access is less stark than commonly assumed, and that the preservation of mission-oriented banking institutions need not come at the expense of operational performance.

Bibliography

Alessandrini, P., Presbitero, A. F., and Zazzaro, A. (2009). Banks, distances and firms' financing constraints. *Review of Finance*, 13(2):261–307.

Altunbas, Y., Evans, L., and Molyneux, P. (2001). Bank ownership and efficiency. *Journal of Money, Credit and Banking*, 33(4):926–954.

Amidžić, G., Massara, A., and Mialou, A. (2014). Assessing countries' financial inclusion standing: A new composite index. IMF Working Paper WP/14/36, International Monetary Fund.

Angrist, J. D. and Pischke, J.-S. (2009). *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press.

Athanasoglou, P. P., Brissimis, S. N., and Delis, M. D. (2008). Bank-specific, industry-specific and macroeconomic determinants of bank profitability. *Journal of International Financial Markets, Institutions and Money*, 18(2):121–136.

Ayadi, R., Llewellyn, D. T., Schmidt, R. H., Arbak, E., and De Groen, W. P. (2010). *Investigating Diversity in the Banking Sector in Europe: Key Developments, Performance and Role of Cooperative Banks*. Centre for European Policy Studies, Brussels.

Bautista Mesa, R., Molina Sánchez, H., and Ramírez Sobrino, J. N. (2014). Main determinants of efficiency and implications on banking concentration in the European Union. *Revista de Contabilidad – Spanish Accounting Review*, 17(1):78–87.

Beck, T., Hesse, H., Kick, T., and von Westernhagen, N. (2009). Bank ownership and stability: Evidence from Germany. Unpublished manuscript, Deutsche Bundesbank.

Beckmann, E., Reiter, S., and Stix, H. (2018). A geographic perspective on banking in Central, Eastern and Southeastern Europe. *Focus on European Economic Integration*, Q1-18:26–47. Oesterreichische Nationalbank.

Bellemare, M. F., Masaki, T., and Pepinsky, T. B. (2017). Lagged explanatory variables and the estimation of causal effect. *The Journal of Politics*, 79(3):949–963.

Berger, A. N. and Humphrey, D. B. (1997). Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research*, 98(2):175–212.

Bertay, A. C., Demirgüç-Kunt, A., and Huizinga, H. (2015). Bank ownership and credit over the business cycle: Is lending by state banks less procyclical? *Journal of Banking & Finance*, 50:326–339.

Blatter, M. and Fuster, A. (2022). Scale effects on efficiency and profitability in the Swiss banking sector. *Swiss Journal of Economics and Statistics*, 158:Article 12.

Brazda, J., Blisse, H., and Schediwy, R. (2016). Cooperative banks in the Austrian banking system. In Karafolas, S., editor, *Credit Cooperative Institutions in European Countries*. Springer.

Brei, M. and Schclarek, A. (2013). Public bank lending in times of crisis. *Journal of Financial Stability*, 9(4):820–830.

Burger, A. and Moormann, J. (2008). Productivity in banks: Myths and truths of the cost income ratio. *Banks and Bank Systems*, 3(4):85–94.

Burgstaller, J. (2020). Retail-bank efficiency: Nonstandard goals and environmental determinants. *Annals of Public and Cooperative Economics*, 91(2):269–301.

Butzbach, O. and von Mettenheim, K. E. (2015). Alternative banking and theory. *Accounting, Economics, and Law: A Convivium*, 5(2):105–171.

Cámara, N. and Tuesta, D. (2014). Measuring financial inclusion: A multidimensional index. *BBVA Research Working Paper*, (14/26).

Cameron, A. C. and Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. *The Journal of Human Resources*, 50(2):317–372.

Chakravarty, S. R. and Pal, R. (2013). Financial inclusion in India: An axiomatic approach. *Journal of Policy Modeling*, 35(5):813–837.

Čihák, M. and Hesse, H. (2007). Cooperative banks and financial stability. IMF Working Paper WP/07/02, International Monetary Fund.

Cornée, S., Fattobene, L., and Migliorelli, M. (2018). An overview of cooperative banking in europe. In Migliorelli, M., editor, *New Cooperative Banking in Europe*, pages 1–27. Palgrave Macmillan.

Demirgüç-Kunt, A. and Klapper, L. (2012). Measuring financial inclusion: The global findex database. Policy Research Working Paper 6025, The World Bank.

Dietrich, A. and Wanzenried, G. (2011). Determinants of bank profitability before and during the crisis: Evidence from Switzerland. *Journal of International Financial Markets, Institutions and Money*, 21(3):307–327.

European Commission (2004). Guidelines on the assessment of horizontal mergers under the council regulation on the control of concentrations between undertakings. Official Journal of the European Union, 2004/C 31/03.

Ferri, G., Kalmi, P., and Kerola, E. (2014). Does bank ownership affect lending behavior? evidence from the euro area. *Journal of Banking & Finance*, 48:194–209.

Gabor, D. (2020). Critical macro-finance: A theoretical lens. *Finance and Society*, 6(1):45–55.

Groeneveld, H. (2022). European co-operative banks in 2021: A concise assessment. *SSRN Working Papers*.

Hahn, F. (2007). Environmental determinants of banking efficiency in Austria. *Empirica*, 34(3):231–245.

Hauner, D. (2005). Explaining efficiency differences among large German and Austrian banks. *Applied Economics*, 37(9):969–980.

Ho, C. S. T. and Berggren, B. (2020). The effect of bank branch closures on new firm formation: The Swedish case. *The Annals of Regional Science*, 65(2):319–350.

Huljak, I., Martin, R., and Moccero, D. (2019). The cost-efficiency and productivity growth of euro area banks. Working Paper Series 2305, European Central Bank.

Iannotta, G., Nocera, G., and Sironi, A. (2007). Ownership structure, risk and performance in the European banking industry. *Journal of Banking & Finance*, 31(7):2127–2149.

La Porta, R., Lopez-de Silanes, F., and Shleifer, A. (2002). Government ownership of banks. *The Journal of Finance*, 57(1):265–301.

Levy-Yeyati, E., Micco, A., and Panizza, U. (2007). A reappraisal of state-owned banks. *Economía*, 7(2):209–247.

Leyshon, A., French, S., and Signoretta, P. (2008). Financial exclusion and the geography of bank and building society branch closure in Britain. *Transactions of the Institute of British Geographers*, 33(4):447–465.

Leyshon, A. and Thrift, N. (1995). Geographies of financial exclusion: Financial abandonment in Britain and the United States. *Transactions of the Institute of British Geographers*, 20(3):312–341.

Martín-Oliver, A. (2019). Financial exclusion and branch closures in Spain after the great recession. *Regional Studies*, 53(4):562–573.

Mazzucato, M. and Penna, C. C. R. (2016). Beyond market failures: The market creating and shaping roles of state investment banks. *Journal of Economic Policy Reform*, 19(4):305–326.

Micco, A., Panizza, U., and Yañez, M. (2007). Bank ownership and performance. does politics matter? *Journal of Banking & Finance*, 31(1):219–241.

Nguyen, H.-L. Q. (2019). Are credit markets still local? evidence from bank branch closings. *American Economic Journal: Applied Economics*, 11(1):1–32.

OECD (2008). *Handbook on Constructing Composite Indicators: Methodology and User Guide*. OECD Publishing, Paris.

Oesterreichische Nationalbank (2024). Facts on Austria and its banks – july 2024. Technical report, OeNB, Vienna.

Pesqué-Cela, V., Tian, L., Luo, D., Tobin, D., and Kling, G. (2021). Defining and measuring financial inclusion: A systematic review and confirmatory factor analysis. *Journal of International Development*, 33(2):316–341.

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *The Review of Financial Studies*, 22(1):435–480.

Sarma, M. (2008). Index of financial inclusion. *ICRIER Working Paper*, (215).

Sarma, M. (2012). Index of financial inclusion – a measure of financial sector inclusiveness. *Berlin Working Papers on Money, Finance, Trade and Development*, (07/2012).

Stix, H. (2020). The Austrian bank branch network from 2000 to 2019 from a spatial perspective. *Financial Stability Report*, 40:87–101. Oesterreichische Nationalbank.

Weill, L. (2004). Measuring cost efficiency in European banking: A comparison of frontier techniques. *Journal of Productivity Analysis*, 21(2):133–152.

Wrede, M. (2021). Lending by credit cooperatives, savings banks and other banks during the Covid-19 pandemic in Germany. *Zeitschrift für das gesamte Genossenschaftswesen*, 71(3):192–209.

Yorulmaz, R. (2013). Construction of a regional financial inclusion index in Turkey. *BDDK Bankacilik ve Finansal Piyasalar*, 7(1):79–101.

A. Appendix

This appendix provides supplementary material referenced in the main text. Table A.1 reports the full set of robustness checks for RQ1, including all seven alternative specifications discussed in Section 3.4.3. Table A.2 presents the Supply-Side Index components for each of Austria's 35 NUTS-3 districts as period averages over 2014–2022, providing transparency on the index construction detailed in Section 3.2. Figure A.1 visualises the geographic distribution of SSI values across Austrian districts. Figure A.2 summarises the RQ2 ownership coefficients across robustness specifications. Figure A.3 visualises the stability of the Low-SSI Exposure coefficient across the four main RQ1 specifications.

Table A.1.: RQ1 Robustness: Low-SSI Exposure$_{t-1}$ Coefficient Across All Specifications

Specification	Coefficient	Std. Error	p-value	N
Main (Two-Way FE)	-0.0098	0.0113	0.3822	2,082
Alternative C/I (reported)	-0.0153	0.0108	0.1555	2,082
Excluding Top-5 Banks	-0.0114	0.0111	0.3061	2,043
Cooperatives Only	-0.0082	0.0127	0.5162	1,484
State-Level Clustering	-0.0098	0.0134	0.4826	2,082
Without Winsorisation	-0.0098	0.0113	0.3822	2,082
Excl. 2021+ Entrants	-0.0098	0.0113	0.3822	2,082

Notes:

Dependent variable: Cost-to-Income Ratio (%), self-calculated (except specification 2). All specifications include bank and year fixed effects with lagged controls (log total assets, equity ratio). Standard errors clustered at the bank level throughout (except specification 5: state-level clustering). No coefficient is statistically significant at conventional levels

Table A.2.: Supply-Side Index Components by NUTS-3 Region (2014–2022 Average)

NUTS-3	Region	Avail.	Usage	Resil.	SSI	Low-SSI
AT111	Mittelburgenland	0.936	0.178	0.895	0.637	No
AT112	Nordburgenland	0.762	0.178	0.895	0.594	Yes
AT113	Südburgenland	0.768	0.178	0.895	0.594	Yes
AT121	Mostviertel-Eisenwurzen	0.682	0.209	0.681	0.518	Yes
AT122	Niederösterreich-Süd	0.635	0.209	0.681	0.504	Yes
AT123	Sankt Pölten	0.690	0.209	0.681	0.520	Yes
AT124	Waldviertel	0.940	0.209	0.681	0.588	No
AT125	Weinviertel	0.896	0.209	0.681	0.576	No
AT126	Wiener Umland/Nordteil	0.596	0.209	0.681	0.493	Yes
AT127	Wiener Umland/Südteil	0.411	0.209	0.681	0.437	Yes
AT130	Wien	0.148	1.000	0.764	0.609	No
AT211	Klagenfurt-Villach	0.541	0.367	0.872	0.584	Yes
AT212	Oberkärnten	0.888	0.367	0.872	0.684	No
AT213	Unterkärnten	0.744	0.367	0.872	0.645	No
AT221	Graz	0.378	0.304	0.778	0.485	Yes
AT222	Liezen	0.831	0.304	0.778	0.617	No
AT223	Östliche Obersteiermark	0.562	0.304	0.778	0.542	Yes
AT224	Oststeiermark	0.641	0.304	0.778	0.564	Yes
AT225	West- und Südsteiermark	0.552	0.304	0.778	0.538	Yes
AT226	Westliche Obersteiermark	0.659	0.304	0.778	0.570	Yes
AT311	Innviertel	0.870	0.708	0.854	0.796	No
AT312	Linz-Wels	0.596	0.708	0.854	0.708	No
AT313	Mühlviertel	0.830	0.708	0.854	0.785	No
AT314	Steyr-Kirchdorf	0.728	0.708	0.854	0.753	No
AT315	Traunviertel	0.687	0.708	0.854	0.739	No
AT321	Lungau	0.968	0.837	0.925	0.893	No
AT322	Pinzgau-Pongau	0.823	0.837	0.925	0.849	No
AT323	Salzburg und Umgebung	0.664	0.837	0.925	0.792	No
AT331	Außerfern	0.926	0.797	0.921	0.868	No
AT332	Innsbruck	0.520	0.797	0.921	0.727	No
AT333	Osttirol	0.854	0.797	0.921	0.848	No
AT334	Tiroler Oberland	0.875	0.797	0.921	0.854	No
AT335	Tiroler Unterland	0.854	0.797	0.921	0.848	No
AT341	Bludenz-Bregenzer Wald	0.863	0.945	0.844	0.874	No
AT342	Rheintal-Bodenseegebiet	0.520	0.945	0.844	0.746	No

Notes: Period averages (2014–2022) of Supply-Side Index components for Austria's 35 NUTS-3 districts. Availability = branches per 10,000 inhabitants (normalised). Usage = new loan volume per capita (normalised). Resilience = inverse deviation of credit growth from baseline trend (normalised). SSI is the composite index following Sarma (2008)'s distance-based methodology. "Low-SSI" indicates districts classified as underserved in the majority of sample years (five or more of nine years). The classification applies a fixed cutoff (40th percentile of the pooled region×year SSI distribution, equal to 0.612) to each region-year; because SSI values fluctuate across years, the number of underserved districts varies between 10 and 17 per year, with 9 districts classified as underserved in every year of the sample period.

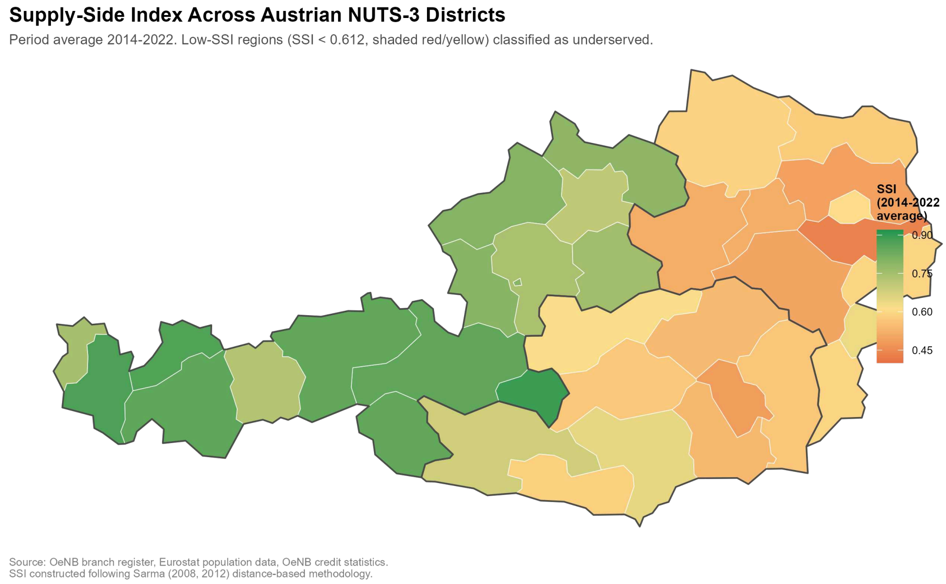

Figure A.1.: Supply-Side Index across Austria's 35 NUTS-3 districts, 2014–2022 period average. Regions shaded in red/orange fall below the 40th percentile threshold (SSI < 0.612) and are classified as underserved. Green regions indicate well-served districts.

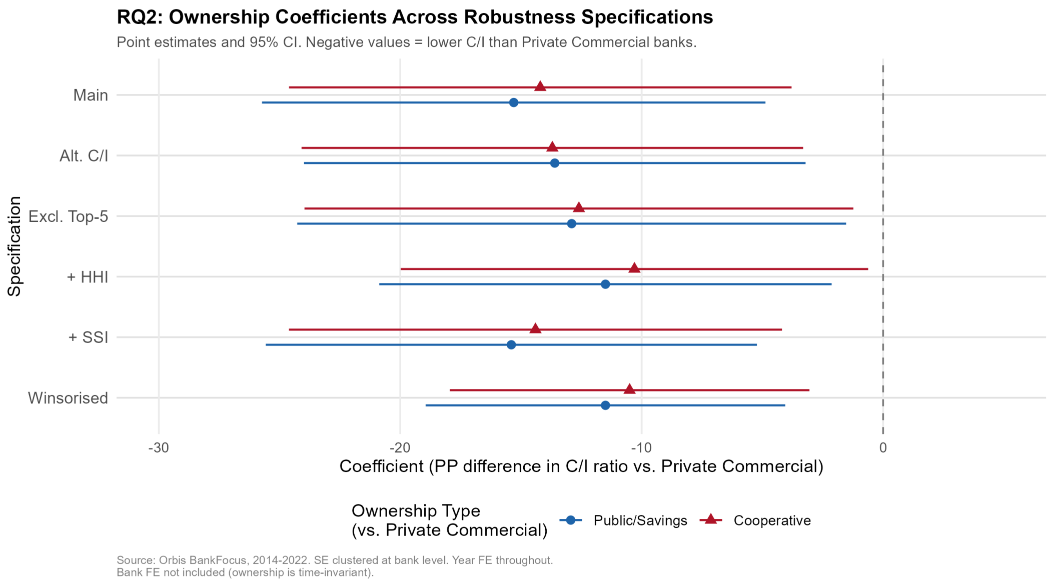

Figure A.2.: Ownership coefficients (relative to private commercial banks) across six robustness specifications with 95% confidence intervals. All coefficients are negative and statistically significant, confirming that public/savings banks and cooperative banks exhibit lower cost-to-income ratios across all specifications. Year fixed effects included throughout; bank fixed effects not included because ownership type is time-invariant.

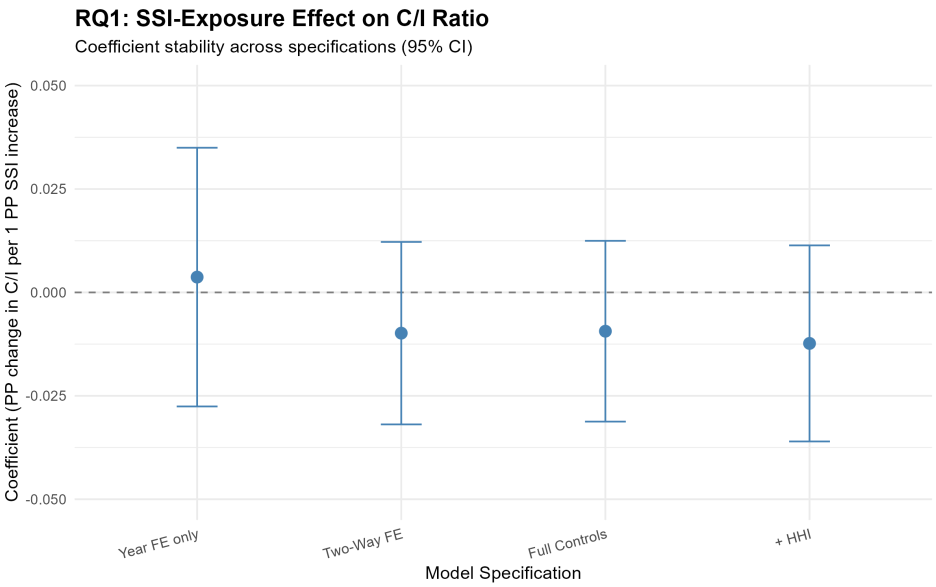

Figure A.3.: RQ1: Stability of the Low-SSI Exposure Coefficient Across Specifications
Notes: Point estimates and 95% confidence intervals for the coefficient on Low-SSI Exposure$_{t-1}$ across four progressively specified models (see Table 5.1). The dashed line indicates zero. The coefficient remains economically negligible and statistically insignificant in all specifications.