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# Multimarket Contact, Competition, and Performance: An Application to Turkish Deposit Banks*

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## Abstract

The banking sector plays a pivotal role in financial markets, providing an ideal setting to examine multimarket contact (MMC)—a phenomenon where banks compete against the same rivals across multiple markets. This study investigates how MMC dynamics influence bank risk and performance, particularly in the context of technological advancements and the post-COVID-19 banking landscape. Using panel data from 17 deposit banks operating continuously in the Turkish banking system between 2012 and 2021, the study employs the Generalized Method of Moments (GMM) to analyze the effects of MMC. The findings indicate that MMC intensifies competition in the Turkish banking sector, leading to improved asset quality but negative impacts on profitability, overall performance, and bankruptcy risk. These results suggest that while broader market exposure enhances risk management and credit quality, heightened competition erodes profitability and financial stability. Given the increasing digitalization of banking services and the shift towards branchless banking, regulators and financial institutions should reconsider market expansion strategies, balancing competition with financial sustainability. This study contributes to the literature by offering empirical insights from an emerging market and highlighting the interplay between MMC, financial stability, and technological evolution in banking. The findings hold practical implications for policymakers, regulators, and financial institutions seeking to optimize competitive strategies while ensuring banking sector resilience.

Keywords: banking; multimarket contact; financial performance; risk; generalized moments method (GMM)
JEL Codes: G21; G32; L25

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*This study is derived from Berna Dogan Basar's doctoral thesis entitled "Multimarket Contact, Competition and Performance: An Application on Turkish Deposit Banks".

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## 1. Introduction

Multimarket contact has been identified as a competition-dampening factor, particularly in industries with recurring firm interactions. This concept and its competitive intensity are central to linked oligopoly theory or mutual forbearance theory, which suggests that multimarket contact can reduce local market competition intensity. When firms operate across multiple markets, retaliatory potential increases, potentially creating losses too substantial to offset through aggressive profit-seeking behavior, ultimately reducing overall competition. This perspective is supported by Alexander (1985), Edwards (1955), Feinberg (1984), and Hughes and Oughton (1993), though some theoretical studies like Mester (1992) and Solomon (1970) contest this view.

The banking sector, characterized by intense competition, provides an ideal laboratory for testing mutual forbearance theory, as banks offer identical products and services across various geographical markets. According to mutual forbearance theory, firms operating in shared geographic markets may exhibit reduced competitive aggression across all common markets (Edwards, 1955).

Over the past two decades, banking systems globally have undergone significant structural transformation driven by deregulation and technological advancement. Many countries responded through consolidation and bank mergers, substantially reducing their banking system numbers. Deregulation eliminated geographical constraints, enabling banks to establish diverse branch networks domestically and internationally. This led to an increase in large, geographically diversified banks competing simultaneously across multiple markets, potentially affecting their performance, profitability, costs, liquidity, risk, and stability. Consequently, understanding how multimarket competition influences bank risk and performance becomes crucial for risk management and sustainable profitability.

The banking sector presents an optimal setting for multimarket contact analysis for two reasons: banks sell identical products across multiple geographic markets, and recent structural reforms, consolidation, and technological advances have altered the sector's competitive conditions and market structure. Particularly, mergers and acquisitions have enabled expanded branch networks and increased inter-bank competition across local markets. Examining this multimarket contact is vital for analyzing the sector's competitive structure and its impact on performance and risk, as well as testing sector reliability and soundness.

Turkish banks are categorized into three groups: deposit, participation, and development & investment banks. Development and investment banks neither accept deposits nor compete with other banks, while participation banks operate on a profit-loss basis, distinct from deposit banks. Provincial branch data for participation and development and investment banks is only available for 2021. This study analyzes 17 deposit banks that accept deposits, compete with other banks, operate on a common basis, and maintain comprehensive provincial branch networks. These deposit banks command 86% of the Turkish banking sector's total assets as of March 2023, holding significant economic and technological influence (BAT, 2023). Analyzing competitive factors affecting these banks' risk and performance may assist banks and financial regulators in crisis preparation.

This study examines the relationship between multimarket contact and bank risk and performance in the Turkish banking sector from 2012-2021. Technological developments and banks' adaptation to these changes motivate this research. Financial technology development and innovation have prompted strategic shifts in banking, potentially affecting banks' risks and performance. Consequently, this study investigates whether income diversification levels moderate multimarket contact's impact on bank risk and performance. The paper proceeds as follows: Section 2 reviews relevant literature, Section 3 details data and methodology, and Section 4 presents results.

## 2. Literature review

The theoretical foundation of multimarket contact was established by Edwards (1955), catalyzing rapid development in theoretical literature. Empirical investigations of multimarket contact span various sectors: manufacturing (Hughes & Oughton, 1993; Li & Greenwood, 2004), airlines (Asahi, 2023; Gimeno, 2002; Su & Dresner 2021; Yimga, 2023), telecommunications (Busse, 2000; Giachetti et al., 2022; Waldfogel & Wulf, 2006), hotels (Batinić, 2015; Deng et al., 2023), fuel (Balaguer & Ripollés, 2021), cement (Chicu & Ziebarth, 2013), and financial services (Cruz-García et al., 2021; Dao et al., 2021; Haveman & Nonnemaker, 2000; Hoang et al., 2021; Le & Pham, 2022; Ljubownikow et al., 2023; Molnar et al., 2013).

The literature reveals diverse findings regarding competition's effects on performance, with researchers employing varied approaches to measure competition intensity. Several studies link mutual forbearance to enhanced business outcomes: higher profits (Feinberg, 1984; Scott 1982), increased prices (Evans & Kessides, 1994; Parker & Roller, 1997), improved yields (Gimeno & Woo, 1996; Singal 1996), and greater market share stability (Heggestad & Rhoades 1978; Martinez, 1990).

In rural banking markets, Hannan and Prager (2009) found significant associations between small single-market bank profitability and non-market bank presence, noting that increased non-market bank presence diminishes concentration's positive effect on small bank profits. Coccorese and Pellecchia's (2009) research demonstrates positive correlations between multimarket contacts and bank profitability, particularly pronounced for banks with higher contact numbers, though market concentration showed no significant profitability relationship. Their 2013 study further revealed positive associations between multimarket contact and market power indices, suggesting increased collusion likelihood among firms with more contacts.

Molnar et al. (2013) found that banks with broader multimarket contacts exhibit less competitive behavior, with smaller banks demonstrating collaborative profit-maximization tendencies. Pham et al. (2016) supported the mutual forbearance hypothesis, showing banks' preference for cooperation over aggressive competition when facing similarly sized rivals across multiple markets. Conversely, Dao et al. (2021) identified negative impacts of multimarket contact on bank profitability in Vietnamese banks, though finding positive associations between contact numbers, bank size, capitalization, and risk-adjusted profitability.

Prior literature predominantly focuses on multimarket contact in developed countries' banking sectors (Coccorese & Pellecchia, 2009, 2013; De Bonis & Ferrando, 2000), particularly in Italy, the USA, and Spain. This study makes two significant contributions to existing literature.

First, it examines deposit banks in Turkey, a developing nation undergoing recent structural banking reforms. This perspective is particularly valuable as developing countries' financial systems heavily rely on banking sectors, and rapid technological advancement has created nearly unlimited market access through communication networks. Analyzing multimarket contact's impact on performance and risk in the Turkish banking sector offers novel insights to international banking literature, especially given that behavioral patterns of bank managers, customers, investors, and politicians—along with technological adoption tendencies—may differ significantly from developed nations.

Second, this study expands the limited research examining multimarket contact's influence on banking sector risk and performance. While only three studies have analyzed this relationship's functional form in banking markets (Fuentelsaz & Gomez, 2006; Haveman & Nonnemaker, 2000; Kasman & Kasman, 2016), none have specifically investigated multimarket contact's impact on asset quality and bankruptcy risk. This research provides a comprehensive, simultaneous analysis of how multimarket contact requirements affect banks' risk and performance, suggesting that mutual forbearance behavior can emerge even with limited market exposure.

Geographic diversification's impact on bank performance has been extensively studied, yet previous research has not adequately considered the average number of competitors banks facing per market. Studies examining whether banks' multimarket contacts influence competition levels remain limited. Despite multimarket contact's empirical investigation across various industries, banking sector research remains notably sparse (Hoang, et al., 2021; Kasman & Kasman, 2016; Le 2020; Le, et al., 2019), particularly regarding how geographic diversification might trigger competitive retaliation in shared markets.

## 3. Research Methodology

This study uses data from the Turkish banking sector (2012-2021), sourced from the Banks Association of Turkey (BAT) and FinNet database. Data from 2022 was excluded due to unavailability during the study period. Initially, 35 deposit banks were considered, but only 17 were included in the final analysis due to data constraints.

The dataset explores the relationship between banks' risk, performance, and multimarket contact, with annual data from BAT's December publications across 10 years (2012-2021). As shown in Figure 2, multimarket contact indices remained stable during the COVID-19 pandemic (2020-2021), so its effects are not considered. Figures 1 and 2 show the evolution of branch numbers in the Turkish banking system and average multimarket contact over the study period (2012-2021), respectively.

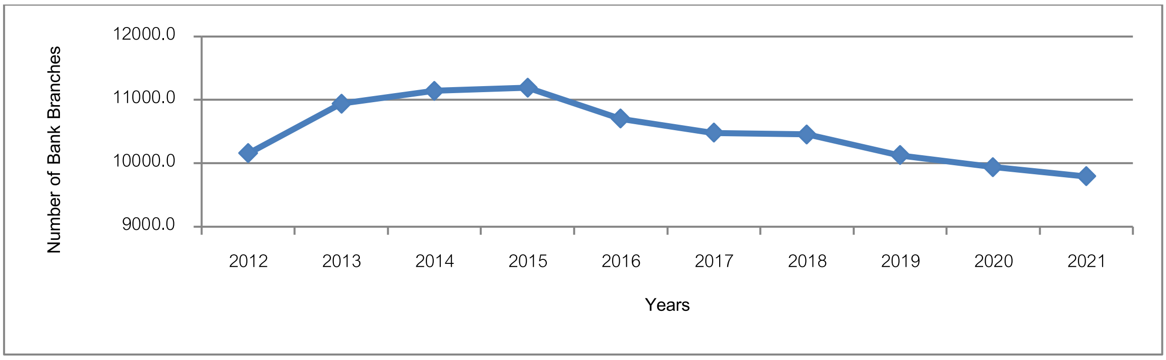


Figure 1: Development of the Number of Bank Branches in Turkey

Source: Authors' calculation based on the Banks Association of Turkey (BAT) and FinNet database

MMC1 refers to the similarity of competing banks, MMC2 refers to the proportion competing in the same market, and MMC3 refers to the size of competitors, and these are indicators of multimarket contact. For Turkish deposit banks, the evolution of these indicators for 2012-2021 is presented in Figure 2.

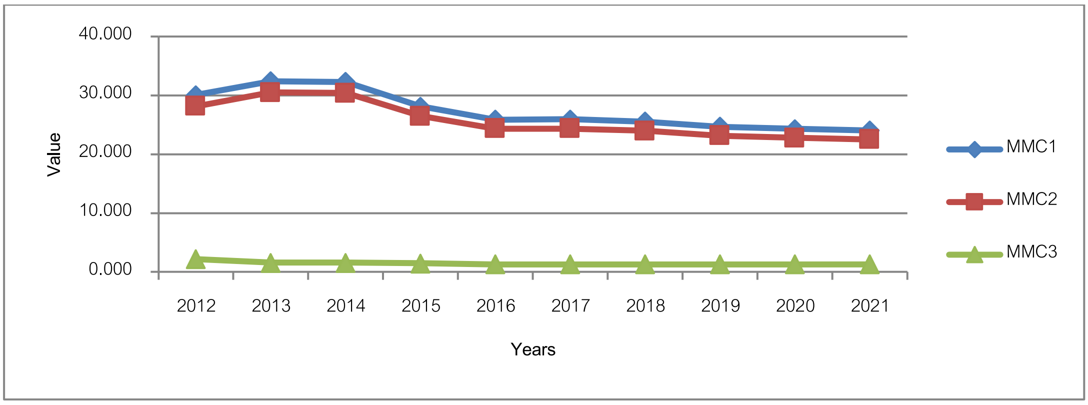


Figure 2: Mean development of MMC1, MMC2 and MMC3

Source: Authors' calculation based on the Banks Association of Turkey (BAT) and FinNet database

Multimarket contact indices (MMC1 and MMC2) exhibited an increasing trend during 2012-2014, followed by a consistent decline from 2014 onward. These fluctuations in multimarket contact parallel the changes in bank branch numbers during the same period.

The Turkish banking sector has undergone significant structural reform and liberalization over the past twenty-five years, substantially impacting competitive conditions and market structure. This transformation led to a substantial increase in branch numbers, while bank numbers showed moderate changes due to sector consolidation. However, recent technological advancements coupled with the COVID-19 pandemic have accelerated the adoption of open and branchless banking initiatives, reducing the need for physical bank branches. The sector is expected to continue this trend of decreasing physical branches, as FinTech (financial technology) gain prominence and customers increasingly utilize digital banking services, particularly through mobile applications (Incirkus & Kalpaklioglu, 2023).

In this study, models incorporate bank-specific variables alongside the primary explanatory variable (multimarket contact measure). Variable selection focused on relevant micro indicators affecting banks. The models employ several dependent variables: return on assets, return on equity, return on interest, bankruptcy risk, and asset quality. For multimarket contact indices, which serve as independent variables, three measures are utilized: MMC1, calculated by dividing the total contacts of a bank by the number of banks encountered in a particular market; MMC2, which accounts for similarity between banks in terms of market shares; and MMC3, which considers competitors in terms of size. The study also incorporates control variables including non-interest income diversification index, bank size, capital adequacy, and number of employees.

Existing literature suggests multimarket contact negatively affects banks' performance and risk levels (Dao et al., 2021; Degl'Innocenti et al., 2014; Kasman & Kasman, 2016). This relationship stems from significant structural changes in banking systems over the past two decades, driven by deregulation and technological advancement. The widespread adoption of mobile banking has shifted transactions away from physical branches, negatively impacting multimarket contact. Conversely, the control variables—diversification index (HHI), bank size, capital adequacy, and employee numbers—are expected to positively influence bank performance and risk levels.

To examine the impact of multimarket contact on bank risk and performance, we employ model (1) as follows:

$$ROA_{it} = \beta_0 + \beta_1 ROA_{i(t-1)} + \beta_2 MMC1_{it} + \beta_3 HHI_{it} + \beta_4 SIZE_{it} + \beta_5 CAR_{it} + \beta_6 PERS_{it} + \varepsilon_{it} \quad (1)$$

For our dependent variables, we employ several performance indicators: return on assets (ROA) as the primary measure, supplemented by net interest margin (NIM) and return on equity (ROE) to assess soundness (Hoang et al., 2021). Risk assessment incorporates two dependent variables: bankruptcy risk (Z-Score) and asset quality (NPL). The dynamic model's construction draws from the methodological frameworks established by Wintoki et al. (2012) and Muchtar et al. (2018).

The study incorporates several bank-specific variables: the Herfindahl-Hirschman Index (HHI) for non-interest income diversification, bank size (SIZE), capital adequacy ratio (CAR) calculated as shareholders' equity to total assets, and number of employees (PERS). The HHI is calculated as follows:

$$HHI = \left(\frac{COM}{NON}\right)^2 + \left(\frac{TRD}{NON}\right)^2 + \left(\frac{OTOP}{NON}\right)^2 \quad (2)$$

The NON variable represents the sum of three components: COM (net fee and commission income), TRD (net trade income), and OTOP (income from other operations). The study employs three distinct multimarket contact measures as independent variables: MMC1, weighted by bank similarity; MMC2, weighted by same-market competition rates; and MMC3, weighted by competitor size. Detailed measurement specifications for these indices are provided in the Appendix. An increase in MMC1, MMC2, or MMC3 indices indicates greater market exposure and heightened competitive intensity for the banks. Table 1 presents descriptive statistics for all variables included in the models.

Table 1: Descriptive statistics of variables used in the model

| Variables | Unit | Mean | Median | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Return on Assets (ROA) | Ratio | 1.093 | 1.199 | 0.735 | -2.210 | 2.603 |
| Return on Equity (ROE) | Ratio | 11.235 | 12.559 | 6.768 | -31.424 | 24.760 |
| Return on Interest (NIM) | Ratio | 0.162 | 0.044 | 0.508 | 0.015 | 2.783 |
| Insolvency Risk (Z-score) | Ratio | 5.516 | 4.179 | 5.949 | -1.430 | 64.876 |
| Asset Quality (NPL) | Ratio | 0.043 | 0.039 | 0.0218 | 0.005 | 0.148 |
| Multimarket Contact (MMC1) | Ratio | 27.530 | 32.654 | 11.085 | 4.731 | 40.192 |
| Multimarket Contact (MMC2) | Ratio | 25.881 | 30.682 | 10.153 | 4.656 | 38.277 |
| Multimarket Contact (MMC3) | Ratio | 1.421 | 0.95 | 1.081 | 0.038 | 2.933 |

| Variables | Unit | Mean | Median | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Herfindahl–Hirschman Index (HHI) | Index | 0.554 | 0.538 | 0.115 | 0.341 | 0.933 |
| Bank Size (SIZE) | Log | 10.045 | 10.816 | 2.292 | 3.591 | 12.174 |
| Personnel (PERS) | Log | 3.832 | 4.079 | 0.488 | 2.787 | 4.410 |
| Capital Adequacy (CAR) | Ratio | 0.16 | 0.152 | 0.025 | 0.121 | 0.256 |

Source: Authors' calculation

The study encompasses 170 observations for each variable, collected annually between 2012 and 2021 from Turkish deposit banks. The descriptive statistics reveal mean values of 1.093 for return on assets (ROA), 11.235 for return on equity (ROE), 0.162 for return on interest (NIM), 5.516 for bankruptcy risk (Z-score), and 0.043 for asset quality (NPL).

The primary research variables, MMC1, MMC2, and MMC3, demonstrate mean values of 27.530, 25.881, and 1.419, respectively. The MMC1 index range spans from one to the total number of local markets. In theory, the index minimum is zero (indicating monopoly in operating markets), while the maximum equals the number of provinces when all banks operate in all markets. As of 2021, Turkey comprises 81 provinces. MMC2 incorporates market share similarity weights across all provinces where banks operate, while MMC3 accounts for competitor size. These latter two indices serve as robustness checks for MMC1, resulting in differentiated multimarket contact indicator values.

Regarding control variables, the non-interest income diversity indicator (HHI) shows a mean of 0.554. Additional metrics include bank size (SIZE) at 10.045, logarithm of headcount (PERS) at 3.832, and capital adequacy (CAR) at 0.160. Table 2 presents the correlation matrix for all independent variables.

Table 2: Correlation matrix between independent variables

Correlation matrix for the models for MMC1

| | MMC1 | HHI | SIZE | PERS | CAR |
|---|---|---|---|---|---|
| MMC1 | 1.000 | | | | |
| HHI | 0.033 | 1.000 | | | |
| SIZE | 0.142 | 0.094 | 1.000 | | |
| PERS | 0.47 | 0.227 | 0.209 | 1.000 | |
| CAR | -0.08 | -0.016 | 0.128 | -0.226 | 1.000 |

Correlation matrix for the models for MMC2

| | MMC2 | HHI | SIZE | PERS | CAR |
|---|---|---|---|---|---|
| MMC2 | 1.000 | | | | |
| HHI | 0.036 | 1.000 | | | |
| SIZE | 0.134 | 0.094 | 1.000 | | |
| PERS | 0.443 | 0.227 | 0.209 | 1.000 | |
| CAR | -0.088 | -0.016 | 0.128 | -0.226 | 1.000 |

Correlation matrix for the models for MMC3

| | MMC3 | HHI | SIZE | PERS | CAR |
|---|---|---|---|---|---|
| MMC3 | 1.000 | | | | |
| HHI | -0.012 | 1.000 | | | |
| SIZE | 0.134 | 0.094 | 1.000 | | |
| PERS | 0.535 | 0.227 | 0.209 | 1.000 | |
| CAR | -0.118 | -0.016 | 0.128 | -0.226 | 1.000 |

Source: Authors' calculation

The correlation analysis indicates no multicollinearity problems among the variables. All correlation coefficients presented in Table 2 fall below 90%, confirming the absence of multicollinearity among the independent variables used in the analysis.

## 4. Results and Discussion

Panel data analysis has gained prominence in econometrics and social sciences, examining relationships between dependent and independent variables across multiple units over time. Given our data structure, where the time dimension is N>T and accounts for time series features, we employ the system GMM estimator. This method, initially developed by Arellano and Bond (1991) and later refined by Arellano and Bover (1995), combines difference and level equations to test multimarket contact effects on selected dependent variables.

The system GMM estimator represents an advancement over the first difference GMM estimator through methodological improvements. Blundell and Bond (1998) and Blundell et al. (2000) demonstrated that while difference GMM showed weak predictive power in finite samples and produced biased coefficient estimates, system GMM exhibited superior predictive capability (Dökmen, 2012). The system GMM estimator's advantages include lower bias and higher efficiency compared to other estimators, particularly the first difference GMM (Bond et al., 2001).

Tables 3 and 4 present the model estimation results. The significant and positive correlation between lagged dependent variables and their corresponding dependent variables validates our use of a dynamic model. The AR(2) test and Hansen test p-values exceed 10 percent, satisfying second-order autocorrelation and overidentification conditions, thus confirming the estimates' validity for statistical inference.

Table 3: Performance variables and regression results with multimarket contact.

| | ROA | | | | | | ROE | | | | | | NIM | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | |
| | Coefficient | P-Value | Coefficient | P-Value | Coefficient | P-Value | Coefficient | P-Value | Coefficient | P-Value | Coefficient | P-Value | Coefficient | P-Value | Coefficient | P-Value | Coefficient | P-Value |
| $ROA_{(t-1)}$ | 0.558** | 0,000 | 0.494** | 0,000 | 0.479** | 0,000 | | | | | | | | | | | | |
| $\mathrm{ROE}_{(t-1)}$ | | | | | | | 0.514** | 0,000 | 0.363** | 0,000 | 0.604** | 0,000 | | | | | | |
| $\mathrm{NIM}_{(t-1)}$ | | | | | | | | | | | | | 1.364** | 0,000 | 1.362** | 0,000 | 1.376** | 0,000 |
| MMC1 | -0.051** | 0,001 | | | | | -0.614** | 0,000 | | | | | -0.001** | 0,000 | | | | |
| MMC2 | | | -0.024** | 0,000 | | | | | -0.683** | 0,000 | | | | | -0.001** | 0,000 | | |
| MMC3 | | | | | -0.180** | 0,000 | | | | | -3.618** | 0,001 | | | | | -0.028** | 0,000 |
| HHI | -0.821* | 0,043 | -1.101* | 0,019 | -0,99 | 0,147 | -6,824 | 0,242 | 3,38 | 0,671 | -70,167 | 0,113 | 0.031* | 0,013 | 0.031* | 0,012 | 0,02 | 0,128 |
| SIZE | 0,119 | 0,584 | -0.042** | 0,002 | -0,018 | 0,173 | 7.292* | 0,035 | 8.389* | 0,036 | 16.112** | 0,004 | -0.014** | 0,000 | -0.013** | 0,000 | -0.016** | 0,000 |
| PERS | 0,118 | 0,69 | 0,021 | 0,882 | -0,061 | 0,72 | -1,262 | 0,843 | -0,796 | 0,856 | -3,592 | 0,275 | 0.141** | 0,000 | 0.138** | 0,000 | 0.160** | 0,000 |
| CAR | 1,675 | 0,397 | 0,338 | 0,891 | 2,132 | 0,121 | 2,105 | 0,48 | -3,488 | 0,581 | -52,511 | 0,189 | -0.392** | 0,000 | -0.392** | 0,000 | -0.460** | 0,000 |
| AR(1) | -1,807 | 0,071 | -1,917 | 0,055 | -1,924 | 0,054 | -1,77 | 0,077 | -1,7 | 0,089 | -1,717 | 0,086 | 2,55 | 0,011 | 1,67 | 0,095 | -1,051 | 0,06 |
| AR(2) | -0,267 | 0,79 | -0,429 | 0,668 | -0,819 | 0,413 | -0,466 | 0,641 | -1,33 | 0,184 | -0,7965 | 0,426 | -0,997 | 0,319 | 0,87 | 0,385 | -1,04 | 0,2983 |
| Hansen | 14,481 | 0,884 | 13 | 0,448 | 14,467 | 0,342 | 13,719 | 0,911 | 13,982 | 0,6 | 14,26 | 0,161 | 14,46 | 0,342 | 14,69 | 0,327 | 13,341 | 0,576 |

Source: Authors' calculation. Note: **, * indicate significance at the 1 percent, and 5 percent levels, respectively.

Table 4: Regression results with risk variables and multimarket contact.

| | Z-Score | | | | | | NPL | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | | 11 | | 12 | | 13 | | 14 | | 15 | |
| | Coefficient | P-Value | Coefficient | P-Value | Coefficient | P-Value | Coefficient | P-Value | Coefficient | P-Value | Coefficient | P-Value |
| $Z-Score_{(t-1)}$ | 1.099** | 0,000 | 0.773** | 0,000 | 1.004** | 0,000 | | | | | | |
| $NPL_{(t-1)}$ | | | | | | | 0,323 | 0,873 | 0.329** | 0,000 | 0.374** | 0,000 |
| MMC1 | -0,026 | 0,762 | | | | | -0.001** | 0,000 | | | | |
| MMC2 | | | -0.084* | 0,029 | | | | | -0.001** | 0,000 | | |
| MMC3 | | | | | -1.209** | 0,000 | | | | | -0.004** | 0,001 |
| HHI | -4.256** | 0,000 | -2,658 | 0,171 | -2.857* | 0,025 | 0,006 | 0,725 | 0,006 | 0,717 | -0,003 | 0,838 |
| SIZE | -1,402 | 0,524 | -0,031 | 0,829 | -0,099 | 0,336 | 0,001 | 0,936 | 0,001 | 0,852 | 0,001 | 0,579 |
| PERS | -1.449** | 0,000 | -5.655* | 0,048 | -11.370** | 0,000 | 0.007* | 0,018 | 0,007 | 0,249 | 0,003 | 0,483 |
| CAR | -4.116** | 0,007 | 15,511 | 0,255 | -14,862 | 0,126 | 0.297** | 0,000 | 0.294** | 0,000 | 0.310** | 0,000 |
| AR(1) | -1,666 | 0,096 | -1,766 | 0,077 | -1,499 | 0,047 | -1,69 | 0,091 | -1,691 | 0,091 | -2,085 | 0,037 |
| AR(2) | 0,831 | 0,406 | 0,874 | 0,382 | 1,356 | 0,175 | -1,204 | 0,229 | -1,199 | 0,231 | -1,239 | 0,215 |
| Hansen | 12,287 | 0,873 | 10,857 | 0,623 | 12,168 | 0,351 | 13,318 | 0,578 | 13,325 | 0,577 | 14,989 | 0,452 |

Source: Authors' calculation.

Note: **, * indicate significance at the 1 percent, and 5 percent levels, respectively.

The analysis reveals significant relationships between multimarket contact measures (MMC1, MMC2, MMC3) and bank performance and risk variables. All three multimarket contact indicators demonstrate negative and statistically significant relationships with performance measures (ROA, ROE, NIM) and risk indicators (Z-Score and NPL) at the 1% significance level according to the GMM estimator. The exception is the relationship between Z-score and MMC2, which shows significance at the 5% level, while MMC3 maintains a 1% significance level correlation with Z-score. These results indicate statistically significant inverse relationships between multimarket contact measures and ROA, ROE, NIM, and Z-Score, while demonstrating a positive relationship with NPL.

The NPL ratio, reflecting banks' effectiveness in borrower selection and monitoring, shows an expected negative relationship with multimarket contact measures. As MMC1, MMC2, and MMC3 increase, NPL decreases, indicating an inverse relationship between competition and non-performing loans. Specifically, a one-unit increase in multimarket contact leads to decreases of 0.001 units in Models 13 and 14, and 0.004 units in Model 15 regarding banks' asset quality. This suggests that heightened inter-bank competition promotes more institutionalized banking practices, including enhanced collateral requirements and improved financial intelligence studies for credit risk minimization. These practices contribute to improved asset quality through reduced non-performing loan ratios.

These findings indicate that increased multimarket contact competition decreases both bank profitability and bankruptcy risk. While these results contradict the findings of Coccorese and Pellecchia (2009) and Pilloff (1999), they align with more recent studies by Dao et al. (2021), Hoang et al. (2021), Kasman and Kasman (2016), and Le (2020).

The study employs MMC2 and MMC3 as robustness indicators for multimarket contact, demonstrating consistent directional relationships with dependent variables across all models. This consistency reinforces the reliability of our findings. While return on assets may show bias by excluding off-balance sheet activities, and larger banks in the Turkish banking sector may have reached profitability saturation points, our analysis of return on equity and return on interest yields statistically comparable results, further validating our findings.

The negative relationship between multimarket contact and bankruptcy risk suggests that geographical expansion increases bankruptcy risk and reduces bank stability. This dynamic creates a chain effect where reduced profitability from multimarket contact adversely affects bank stability and bankruptcy risk. The analysis indicates that broader market exposure and diversified activities intensify competition, subsequently reducing bank profitability.

Regarding non-interest income diversification, the study reveals significant negative relationships with return on assets and bankruptcy risk. This suggests banks might benefit from focusing on core deposit-taking and lending activities rather than diversifying non-interest income streams. However, increased non-interest income diversification positively affects interest profitability, particularly benefiting geographically dispersed banks with diverse business activities.

Bank size demonstrates a negative relationship with returns on assets and interest returns, suggesting larger banks may inadvertently encourage market entry, challenging profit sustainability. This aligns with Eichengreen and Gibson's (2001) observation that size benefits profitability only up to a certain threshold. Conversely, larger banks show improved return on equity, potentially due to better equity capital adequacy and fund utilization.

Personnel numbers positively correlate with interest returns but negatively affect bankruptcy risk and asset quality. While experienced, technologically proficient staff may enhance interest margins through improved productivity, aggressive loan targeting might increase non-performing loans and bankruptcy risk if credit risks are inadequately hedged.

Capital adequacy ratio shows negative relationships with interest returns, bankruptcy risk, and asset quality, suggesting that excessive capital might lead to missed growth opportunities. This finding aligns with previous research (Agusman et al., 2008; Blum, 1999; Brewer & Lee, 1986; Jacques & Nigro, 1997; Jahankhani & Lynge, 1980; Karels et al., 1989). While high capital adequacy typically indicates financial stability, our findings suggest suboptimal capital utilization.

High capitalization may negatively impact profitability through increased fixed and operating costs, potentially hindering development and credit expansion. This suggests that bank regulators should balance capital adequacy requirements with strategic monitoring and regular assessments, considering broader Basel II and III requirements to maintain both financial stability and operational performance.

## 5. Conclusions

This study provides novel insights into how competition dynamics, specifically multimarket contact, affect bank risk and performance in the Turkish banking sector. Examining 17 deposit banks operating continuously between 2012 and 2021, the research leverages Turkey's unique banking environment, characterized by recent geographical diversification and technological advancement.

While competition traditionally strengthens banks' resistance to financial crises and corruption through improved corporate governance and audit structures, our findings suggest a negative impact on financial performance. The expansion of branch networks in the Turkish banking sector may lead to customer attrition, adversely affecting profitability and bankruptcy risk through reduced lending. However, multimarket competition has positively influenced asset quality, potentially attributable to digitalization and technological development. Enhanced digital infrastructure has facilitated more efficient customer information management and inter-bank information flow. The declining NPL ratio indicates improved risk management effectiveness and asset quality.

Technology increasingly shapes the financial ecosystem and banking future. The COVID-19 pandemic has accelerated digital technology adoption across financial services, responding to growing customer demand for mobile and digital banking solutions. Banks prioritize digital transformation to remain competitive, attract customers, and reduce costs. While branches traditionally served as primary distribution channels, alternative channels—from ATMs to mobile banking—offer advantages in cost reduction, efficiency, and service quality. This digital paradigm shift has automated routine tasks, improved service speed and accuracy while generating cost savings.

Increasing digitalization expands codified information bases, enabling sophisticated data analytics and AI-driven decision-making. The banking sector's digitalization has yielded dual benefits: enhanced service quality and accessibility alongside reduced branch operations. The COVID-19 pandemic has further catalyzed innovations like remote account opening, demonstrating how digital transformation enables new service channels while optimizing operational costs.

Our analysis reveals that digitalization has reduced branch dependency, while multimarket contact has negatively impacted profitability, performance, and stability. Turkish deposit banks should therefore consider significant investments in e-banking infrastructure, optimizing resource allocation through customer technology adoption and traditional banking rationalization. Additionally, banks should encourage broader adoption of technological products such as mobile and internet banking.

These findings have important implications for:

- Financial regulators promoting economic development
- Researchers developing new models
- Bank management fostering healthy banking environments and improved performance

Policy recommendations include:

- Strategic branch expansion based on profitability and risk assessments
- Development of B2B business models to increase business volumes
- Adaptation of business models to enhance customer interactions and office operations
- Investment in cybersecurity and emerging technologies (e.g., ChatGPT, metaverse)
- Emphasis on e-banking infrastructure development
- Promotion of digital banking products

Future research could examine multimarket contact effects across different sectors or compare impacts between developed and developing countries, providing insights for regulatory frameworks.

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## Appendices

The calculation methodology used to measure MMC is discussed below and involves transforming unique firm-market-level data into a network of nodes and links. The nodes are banks, and the links are the number of markets in which both participate. Using the properties of the network, the MMC and its various derivatives can be efficiently calculated.

To calculate interbank contacts and construct the MMC index, the province is considered the relevant market. Multimarket contact in the Turkish banking market is calculated following Coccorese and Pellecchia (2009). The starting point for each year is the N × K matrix describing the geographical distribution of bank branches (where N is the number of banks and K is the number of markets. The number of markets refers to provinces), denoted as D. Its structure is as follows:

$$D=\begin{bmatrix} d_{11} & \cdots & d_{1K} \\ \vdots & \ddots & \vdots \\ d_{N1} & \cdots & d_{NK} \end{bmatrix}$$

Hence the generic term $d_{ij}$ (with j = 1,...,K) is the number of branches of bank i in market j. Then, another N × K matrix is constructed, denoted as C:

$$C=\begin{bmatrix} c_{11} & \cdots & c_{1K} \\ \vdots & \ddots & \vdots \\ c_{N1} & \cdots & c_{NK} \end{bmatrix}$$

Here, for the generic term, $c_{ij}$ = 1 if $d_{ij}$ > 0 and $c_{ij}$= 0 if $d_{ij}$ = 0. Therefore, A unit value of $c_{ij}$ means that bank i operates in market j.

Now with an N × N symmetric matrix M can be constructed as follows:

$$M = C.C^T = \begin{bmatrix} m_{11} & \cdots & m_{1N} \\ \vdots & \ddots & \vdots \\ m_{N1} & \cdots & m_{NN} \end{bmatrix}$$

Superscript T indicates the cycle.

$$m_{ij} = \sum_{l=1}^{K} c_{il} c_{jl} \quad (1)$$

The above formula represents the number of markets where bank I and bank j meet, while the diagonal term $m_{ii}$ represents the number of markets in which bank I operates. Hence, it follows that the sum of the off-diagonal terms of row I is the total number of contacts of bank i.

Dividing the above sum by the number of banks encountered by bank I (given by the number of positive elements in row I minus 1) yields the average number of contacts for the bank. For illustrative purposes, the first indicator of multimarket contact for bank I is calculated as follows:

$$MMC1_i = \frac{\sum_{j \neq i} m_{ij} \delta_{ij}}{\sum_{j \neq i} \delta_{ij}} \quad (2)$$

This one here.

$$\delta_{ij} = \begin{cases} 1 & if \quad m_{ij} > 0 \\ 0 & if \quad m_{ij} = 0 \end{cases}$$

The lower and upper values of the MMC1 index depend on the distribution of banks across provinces. Theoretically, the minimum is zero if a bank has a monopoly in the markets in which it operates and the maximum is equal to the number of provinces, provided that all banks meet in all markets (provinces). Under normal conditions, the MMC1 index for single-market banks is equal to 1 (unless they are monopolistic).

In line with the common method of calculating multimarket contact linkages, the MMC1 index is calculated considering only the number of contacts between firms. However, for a bank, each competitor may not be of the same importance as they have different market shares and are of different sizes. Therefore, as a robustness check, the other two indicators of multimarket contact is also calculated.

The MMC2 index is weighted by an index that measures the number of contacts, $m_{ij}$, between any pair of banks and their similarity (in terms of market share) in all provinces where they meet. In fact, industrial organization theory[1] argues that symmetry between firms can facilitate collusion (Barla, 2000; Compte et al., 2002). The N × K matrix S, the share of bank i in market j, is calculated as follows:

$$S_{ij} = \frac{d_{ij}}{\sum_{i=1}^{N} d_{ij}} \tag{3}$$

The similarity index between banks i and j is calculated as the sum of the absolute differences of their market shares for the provinces where they meet:

$$SI_{ij} = \sum_{l=1}^{K} \left| s_{il} - s_{jl} \right| . c_{il} . c_{jl} \;{}^{2} \tag{4}$$

The SI index theoretically ranges between zero (which is the case when firms have the same market share in each market) and the number of markets where banks meet[3] and is smaller the more similar two banks are in terms of their market shares. To obtain a measure that increases with similarity and ranges between 0 and 1, we consider the following transformation of the SI:

$$\acute{w}_{ij} = \frac{m_{ij} - SI_{ij}}{m_{ij}} \tag{5}$$

The relevant matrix for the calculation of multimarket contact is as follows:

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[1] Industrial organization theory is particularly interested in the interdependence of firms in the market and the link between market conditions, firm behavior and economic performance.

[2] In the formula, $c_{il}$ and $c_{jl}$ function as indicators that allow to identify the markets where the two banks meet.

[3] Assume that banks i and j meet in 3 markets and in each of them bank i's market share is close to 1 and bank j's market share is close to 0. As a result, the SI similarity index will be close to 3.

$$\acute{M} = \begin{bmatrix} \acute{m}_{11} & \cdots & \acute{m}_{1N} \\ \vdots & \ddots & \vdots \\ \acute{m}_{N1} & \cdots & \acute{m}_{NN} \end{bmatrix} = \begin{bmatrix} m_{11}.\acute{w}_{11} & \cdots & m_{1N}.\acute{w}_{1N} \\ \vdots & \ddots & \vdots \\ m_{N1}.\acute{w}_{N1} & \cdots & m_{NN}.\acute{w}_{NN} \end{bmatrix},$$

The new measure of multimarket contact, the MMC2 index, is calculated as follows:

$$MMC2_i = \frac{\sum_{j \neq i} \acute{m}_{ij}\delta_{ij}}{\sum_{j \neq i} \delta_{ij}} \quad (6)$$

This one here.

$$\delta_{ij} = \begin{cases} 1 & if \quad \acute{m}_{ij} > 0 \\ 0 & if \quad \acute{m}_{ij} = 0 \end{cases}$$

The second (weighted) measure of multimarket contact, the MMC3 index, takes into account only the size of competitors. Given a matrix of market shares S, the weight is calculated as follows:

$$\grave{w}_{ij} = \frac{\sum_{l=1}^{K} s_{il}.c_{il}.c_{jl}}{m_{ij}} \text{ [4]} \quad (7)$$

The share of the above formula again varies between 0 and the number of markets where banks i and j meet and increases with the size of competitors. Therefore, it is normalized by the maximum $m_{i_j}$ , so that it varies between 0 and 1.

The matrix to be considered for the calculation of the third multimarket contact index is as follows:

$$\dot{M} = \begin{bmatrix} \dot{m}_{11} & \cdots & \dot{m}_{1N} \\ \vdots & \ddots & \vdots \\ \dot{m}_{N1} & \cdots & \dot{m}_{NN} \end{bmatrix} = \begin{bmatrix} m_{11}.\dot{w}_{11} & \cdots & m_{1N}.\dot{w}_{1N} \\ \vdots & \ddots & \vdots \\ m_{N1}.\dot{w}_{N1} & \cdots & m_{NN}.\dot{w}_{NN} \end{bmatrix},$$

and the MMC3 index is calculated as follows:

$$MMC3_i = \frac{\sum_{j \neq i} \dot{m}_{ij}\delta_{ij}}{\sum_{j \neq i} \delta_{ij}} \quad (8)$$

This one here.

$$\delta_{ij} = \begin{cases} 1 & if \quad \dot{m}_{ij} > 0 \\ 0 & if \quad \dot{m}_{ij} = 0 \end{cases}$$

[4] By construction, $MMC1_i \geq MMC2_i$. These can be equal if all competitors that bank i faces have the same market share.