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An Empirical Analysis of the Determinants of Net Interest Margins of Turkish Listed Banks: Panel Data Evidence from Post-Crisis Era[1]

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Borsa İstanbul'da İşlem Gören Bankaların Net Faiz Marjlarının Belirleyicilerinin Ampirik Analizi: Kriz Sonrası Döneminden Panel Verileri Kanıtları[2]

Abstract

The aim of this study is to explore both the bank-specific and macroeconomic drivers of net interest margins using panel data techniques for a sample of 12 deposit banks publicly traded on the Borsa Istanbul over the post-crisis period 2010-2015. Our panel data results suggest that while bank size and managerial efficiency affect net interest margins negatively and significantly, operating cost, credit risk, and implicit interest payments influence the NIMs positively and significantly in the post-crisis era. The results also imply that macroeconomic indicators such as economic growth and inflation do not have any significant effects on the NIMs.

Keywords : Banking, Net Interest Margins, Financial intermediation, Panel Data, Borsa Istanbul.

JEL Classification Codes : G21, O16.

Öz

Bu çalışmada, küresel finansal kriz sonrası (2010-2015) dönemde Borsa İstanbul (BIST)'a kote 12 mevduat bankasının panel verilerinden oluşan bir örneklem kullanılarak, banka net faiz marjlarının bankaya özgü ve makroekonomik belirleyicileri araştırılmıştır. Panel veri analiz sonuçları göstermektedir ki finansal kriz sonrası dönemde artan banka büyüklüğü ve yönetim etkinliği gibi finansal değişkenler banka net faiz marjlarını ters yönde etkilemektedir. Bununla beraber, artan işlem maliyetleri, kredi riski ve örtülü faiz ödemeleri ise banka net faiz marjlarında artışa neden olmaktadır. Sonuçlar makro göstergeler açısından incelendiğinde, ampirik bulgular ekonomik büyüme ve

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enflasyonun mevduat bankalarının faiz marjları üzerinde önemli bir etkisinin olmadığına işaret etmektedir.

Anahtar Sözcükler : Bankacılık, Net Faiz Marjları, Finansal Aracılık, Panel Veri, Borsa İstanbul.

1. Introduction

The latest financial crisis has fueled the heavily debated topic regarding the efficiency of the financial sector. Financial intermediation is of great importance for economic growth. The development of financial intermediation level is a good predictor of capital accumulation and long-term economic growth (King & Levine, 1993a, 1993b; Levine, 1997). Therefore, financial system especially banking sector collapse foregrounds the risks associated with efficiency of the banking sector. Financial markets and institutions emerge to cope with the frictions arising from information and transaction costs (Merton & Bodie, 1995; Levine, 1997; Tsuru, 2000). Banking sector is a main channel to ameliorate these costs particularly in developing countries. The efficient banking sector allocates financial resources to various promising investment opportunities, thereby promoting economic growth. The development and greater efficiency of banking sector affect the return on savings and investments. The spread between two returns signals the interest margins (Demirgüç-Kunt & Huizinga, 1999; Almeida & Divino, 2015). Ho & Saunders (1981) claim that interest rate margin indicates the transaction uncertainties (i.e. costs) faced by the banking sector. The level of net interest margins reflects how efficiently a bank performs in providing financial intermediation services, and covers the cost of financial intermediation. On the one hand, high margins are generally connected to inefficient and non-competitive banking sector (Aydemir & Guloglu, 2017). Higher margins also reflect the insufficient regulatory environment and high level of information asymmetries. Hence, the high level of net interest margins states the high risk (Claeys & Vander Vennet, 2008). On the other hand, the decline in interest margins doesn't always mean an improvement in efficiency. The decline in the net interest margin also mirrors the possible tax reduction or the higher default rate of loans (Demirgüç-Kunt & Huizinga, 1999; Lin et al., 2012).

Banks are main channel to transforming savings to investment in a bank-based financial system (Levine, 2002). In this context, Turkey has a bank-based financial system. The weight of the banking sector in the financial system is almost ninety percent (TCMB, 2014). Banks have a dominant role to direct financial markets. Turkish banking sector restructured after the domestic banking crisis in 2001. In the crisis era, a comprehensive reform package has been implemented, and successfully implemented, this package has made the Turkish banking sector resistant to external shocks (Ganioğlu & Us, 2014; Us, 2015). The recent worldwide financial crisis has adversely affected Turkish economy like other many emerging economies (Afşar, 2011).

This study contributes to the existing literature in several ways: First, this study is one of the few studies investigating the factors which influence the NIMs of Turkish banks. Second, our study is the first study, to our knowledge, to analyze the determinants of NIMs

in Turkish banking sector in the post-crisis era (2010-2015). Third, to better understand the relationship between bank size and interest margins, we use alternative proxies for banks size variable (i.e. total assets, total loans and total deposits). In other words, alternative bank size indicators are modelled separately in the NIMs analysis. Because of the fact that listed banks comprise a large part of Turkish banking industry in terms of asset size, we focus on these banks for this study. Analysis results of this study reveal that size measures, operating costs, managerial efficiency, implicit interest payments, and credit risk are the most significant factors of NIMs of deposit banks.

The remainder of to this study is organized as follows. In the next section the literature review on the factors influencing bank net interest is presented, dataset and methodology we used are demonstrated in Sections 3. Section 4 shows the empirical results and finally we have our conclusions in Section 5.

2. Literature Review

In literature, there are many studies which explore the factors (i.e. bank-specific and macro-economic and variables) affecting NIMs of deposit banks both in Turkey and abroad. The empirical studies about determinants of NIMs are based on pioneering study of Ho and Saunders (1981). Using data from a sample of 53 U.S. deposit banks and making a cross sectional regression analysis for each quarter during 1976Q4-1979Q4, Ho & Sounders (1981) employ a two-step procedure in order to examine the determinants of the bank interest margins in a model in which banks are considered as risk-averse dealers in the credit market. In the first step regressions, implicit interest rate usually is found to be positive and significant in explaining bank margins or spreads. In the same regression models, the opportunity cost and default premium measured by net loan charge-offs-to-total earning assets ratio do not have any significant effect on bank margins. In their regression models, the authors also assume that the constant term of regression model represents a pure margin and in the second step regressions, it is estimated that pure spread is positively and significantly associated with the volatility of interest rates. Saunders & Schumacher (2000) follow Ho and Saunders's (1981) two-stage estimation methodology and, conduct a global study as to which factors affect net interest margin within the time frame 1988-1995. They conclude that opportunity cost of reserves, the ratio of capital to total assets, interest rate volatility, implicit interest payments, and market power influence bank net interest margins positively in six countries of the EU (i.e. Spain, Switzerland, Germany, France, Italy, and the UK) and in the US.

Alternatively, Demirguc-Kunt & Huizinga (1999) use a single state regression. Based on a comprehensive cross-country dataset for eighty countries for the time period of 1988-1995, Demirguc-Kunt & Huizinga (1999) try to analysis whether the financial system's structure, specific banking characteristics, macroeconomic factors, legal and institutional indicators as well as tax rates influence NIMs of banks or not. According to their empirical estimation results, overhead-to-total assets ratio is the most important bank specific variable which influences banks' NIMs. Besides, in the same study, the authors report that the variables measuring the financial structure, banking characteristics, macroeconomic

conditions, legal and institutional arrangements, and taxation are important determinants in explaining the NIMs. In an international study on 14 OECD countries' banking industries, Hawtrey & Liang (2008) investigate the determinants of NIMs by utilizing various estimators such as ordinary least squares (OLS), random effects (RE), and fixed effects (FE), and feasible general least squares (FGLS) to check the robustness of the estimated results. According to their regression analysis covering the years between 1987 and 2001, interest margins-to-average total assets ratio is significantly and positively correlated with the variables like operational cost, bank capital, credit risk, implicit interest payments, interest rate volatility, and market power. Besides, total loans (in log values) and quality of management are found to be significant and negative in their studies. Garza-García (2010), focusing on the banking sectors of some advanced economies and emerging economies during the period between 2001 and 2008, find that NIMs are mainly influenced by the inflation, economic growth, the level of tax, operating costs, capital of bank, interest rate volatility, and size of bank for advanced economies. On the other hand, tax level, lagged NIMs, capital of bank, implicit interest payments, management efficiency, opportunity cost of holding liquid reserves, and credit risk are found as significant factors influencing NIMs of banks in emerging economies. In another study dealing with developed and developing countries' banking sectors, López-Espinosa et al. (2011) report that the variables such as the ratio of loan loss provisions over total loans, the ratio of loans over assets, and interest rate volatility positively and significantly influence NIMs. Their results also suggest that lower inflation rates are associated with lower NIMs.

Based on a sample of banks operating Central and Eastern European countries for the time period of 1999-2010, Dumičić & Rizdak (2013) study the relation between banks-specific, banking market specific and macroeconomic factors and NIMs using dynamic panel estimators. The estimation results suggest that past NIMs, managerial efficiency, income diversification, credit risk, interest rate of money market, Inflation, current account deficit, government debt are important driving factors of NIMs. They report, however, that concentration, funding risk measured by credit-to-deposit ratio, economic growth and capitalization do not have any significant effect on banks' NIMs. A comprehensive study of interest margins in banks operating in 18 bank-based and 5 market-based economies (23 EU countries) over the years 2001-2011 is conducted by Ly (2015). Empirical results from baseline regression show that liquidity position, bank size, the ratio of non-interest-income to gross revenues, the GDP growth rate, cost-to-income ratio, and market capitalization are negatively and statistically significantly related with NIMs. In other respects, bank capital, loans-to-assets ratio, deposits-to-assets ratio, off-balance sheet activity-to-assets ratio, concentration, foreign ownership, and banks' assets as a proportion of GDP affect NIMs positively and significantly. Findings from the subsamples regarding pre-crisis and post crisis period are mostly similar to baseline results. When the sample is split into two subgroups in terms of bank-based and market-based financial systems, the impacts of some industry-level and country-specific factors on NIMs vary. In four South Asian countries during the period from 1997 to 2012, Islam & Nishiyamaa (2016) explore the factors influencing the NIMs by employing both fixed and random effect estimators. Even though required reserve, liquidity risk, equity capital, and operating cost are found to be statistically

significant variables which positively affect NIMs, the variables such as GDP growth rate, the size of bank, and market power are found to be significant and negative in explaining the variations in NIMs.

There are several empirical studies focusing on the determinants of NIMs in a country-specific framework. For example, in the Chinese banking sector during 1996-2003, Zhou & Wong (2008) report that operational expense-to-total assets ratio, capital structure, size represented by volume of loans, the ratio of net noninterest expenses to total assets, opportunity cost of reserve, competition structure, and cost-to-income ratio are the important bank-specific factors which influence NIMs. Maudos & Solis (2009) find that average operating costs and market power which influence NIMs of banks positively and significantly are the most significant indicators in the Mexican banking sector during 1993-2005. In the Russian banking industry over the years 1999-2007, Fungáčová & Poghosyan (2011) conduct a comprehensive study employing static panel data analysis to explore the net interest margins drivers. When taken the overall sample into account, results from fixed effect estimator suggest that personnel costs, capital of bank have a positive influence on bank net interest margins, however, higher credit risk measured by non-performing loans, higher liquidity risk represented by liquid assets to demand liabilities, and greater bank size lead to decrease net interest margin. In addition these findings, after the data is subdivided in terms of bank ownership (i.e. state, foreign, and private-domestic), they report that NIMs is mostly driven by variables like equity-to-total assets ratio and personnel expenses. In conclusion, the authors point out that bank ownership type has great importance in analyzing the factor affecting NIMs of banks.

Ben Khediri & Ben-Khedhiri (2011), using panel random-effects estimator, investigate the NIMs of ten publicly traded commercial banks for the 1996-2005 period in Tunisia. The authors report that capital of bank, opportunity cost, operating costs, and management quality are statistically significant variables influencing the NIMs. In North Cyprus, Bektas (2014) investigates bank-specific and macro determinants of NIMs and spreads of twenty-four deposit banks by employing single-step regression approach between 2003 and 2009. His results show that the ratio of cost to total assets, credit risk, capital risk, market power measured by Lerner index, treasury securities rate are positively and significantly related to NIMs. But, Interest rate risk, central bank's reserve policy, and inflation rate have significant and negative impacts on NIMs. On a sample of seventeen commercial banks, Nassar et al. (2014) try to identify the drivers of bank margins of banks by using quarterly data from 1998 to 2013. According to the authors, the most significant factor affecting the NIMs of banks which operate in Honduras is operating costs. Using bank level data of twenty-six deposit banks, Hussain (2014) strives to study the drivers of NIMs in Pakistan for the 2001-2010 period. According to regression results, lagged spreads, soundness of bank, operating cost, industry concentration, relative market share, inflation, past real depreciation and growth rate of industry are positively and significantly correlated with NIMs. In addition to these findings, variables regarding past liquidity, bank size, the ratio of market capitalization to GDP, and diversification in revenue have negative and statistically significant effect on NIMs.

Factors which influence interest margins of Sri Lankan banks during 2002-2011 are investigated by Kumari (2014). Empirical analysis results suggest that the ratio of equity and reserves to total assets, the ratio of capital to risk-weighted assets, the ratio of fees and commissions received to total assets, credit risk, and operating cost are important in explaining variation in the NIMs. In the Serbian banking system, Marinkovića & Radovićb (2014) empirically investigate the impacts of bank-specific, banking industry and macroeconomic characteristics on NIMs of twenty-nine commercial banks during 2003-2010. Regression results obtained from OLS suggest that while concentration, capitalization affect NIMs positively and significantly, higher default risk and management quality lead to lower NIMs. In addition, the similar results reported for baseline regression model are obtained from the regression models when the banks are divided according to ownership structures. Besides, when the sample is divided into three sub-samples of large, medium and small banks for further analysis, findings obtained are similar in terms of management quality and bank capital when compared to baseline and ownership samples. In Bosnia and Herzegovina, Plakalović & Alihodžić (2015) study certain microeconomic and macroeconomic factors of NIMs during 2008-2013. According to the results from regression analysis, while higher operating costs-to-total earning assets ratio and higher inflation rate lead NIMs of banks to increase significantly, an increase in liquidity level causes NIMs to decrease significantly.

Some recent studies like Kansoy (2012), Yuksel & Zengin (2017), and Aydemir & Guloglu (2017) also examine the determinants of NIMs in Turkish banking industry. Kansoy (2012), trying to analyze the factors which affect NIMs of banks in Turkish banking industry during 2001:Q4-2012:Q1, takes into account ownership structure of banks and uses static and dynamic panel estimators. His results indicate that the main drivers of NIMs are credit risk, operational costs, and operation diversity. Besides, the author emphasizes that the effects of some determinants of NIMs vary based on ownership structure. Yuksel & Zengin (2017) employ multivariate adaptive regression splines (MARS) analysis which is a form of regression analysis to test the impact of bank-specific variables and macroeconomic conditions on NIMs of deposit banks. Their findings indicate that revenue diversification, non-performing loans, size of bank, and exchange rates are significantly negatively correlated with NIMs of deposit banks in Turkey. In another study focusing on Turkish banking industry, Aydemir & Guloglu (2017) point out the importance of liquidity risk and credit risk in determining bank spreads. The empirical findings of the cross-country and single-country studies dealing with the determinants of NIMs diverge considerably due to the differences in the samples, analyzed periods, examined countries, and estimation methods. Consequently, both mixed results reached in prior literature and the limited number of studies for Turkish banking industry have encouraged us to re-investigate this issue further.

3. Methodology and Data

3.1. Methodology

In this study we employ a sample of twelve listed banks for the period 2010-2015 to determine the link between macro-economic and bank-specific variables and interest margins of deposit banks. Given prior banking studies (e.g. Islam & Nishiyama, 2016; Nassar et al., 2014; Kumari, 2014; Hussain, 2014; Ben Khediri & Ben-Khedhiri, 2011; Fungáčová & Poghosyan, 2011; Maudos & Solís, 2009; Zhou & Wong, 2008; Hawtrey & Liang, 2008; among others) regarding factors influencing interest margins of banks, We estimate the following linear regression model:

$$NIM_{by}=\alpha_0 + \alpha_1 BSV_{by} + \alpha_2 MI_y + \mu_b + \epsilon_{by} \quad (1)$$

In which indices b and y indicate bank and year, respectively. NIM_{by} is the dependent variable defined as net interest margins of bank b at year y; α_0 is a constant term; BSV_{by} denotes bank-specific variables; MI_y stands for macroeconomic indicators; μ_b is unknown bank-specific random effect and ϵ_{by} is a random disturbance; The coefficients α_1 and α_2 are the parameters to be estimated. The definition and summary statistics for bank net interest margins and the regressors employed in order to investigate the connection between bank-specific and macroeconomic factors and NIMs are reported in Table 1 and Table 2, respectively.

Table: 1
Variable Description and Expected Influences

Name of Variables	Symbol	Description	Expected sign
Panel A: Dependent variable			
Net interest margins	NIMs	Interest revenue less interest expense/total assets	
Panel B: Bank-specific determinants			
Bank size	LTA	Natural log of banks' total assets	+/–
Bank risk aversion	BRA	Equity capital/total assets	+/–
Operating costs	OPEC	Operating expenses/total assets	+
Opportunity cost	LATA	Liquid assets/total assets	+/–
Managerial efficiency	MANEFF	Operating expenses /total generated revenues	–
Credit risk	CRISK	Loan loss provisions/total loans	+
Implicit interest payments	IIP	Operating expenses less non-interest revenue/total assets	+
Panel C: Macro determinants			
Inflation	INF	Yearly change in CPI in logs	+
Real GDP growth	GDP	Yearly change in the real GDP in logs	+/–

3.2. Data

Our sample contains 12 listed deposit banks (The list of deposit banks is presented in Appendix 1) in Turkey. As of 31 December 2015, these banks hold over 77.22% of total assets of the banking sector. The listed investment and participation banks are excluded from our sample because of their different characteristics. Regarding to the ownership structure of the banks, we classify 2 public domestic banks, 5 private foreign banks, and 5 private domestic banks. Our financial data source for the bank-specific variables is obtained from the Turkish Banking Association (TBA). The macroeconomic indicators (i.e. inflation rate and GDP growth) are taken from the Central Bank of the Republic of Turkey (CBRT) database.

In this study, the NIMs of banks are our dependent variable and it equals interest revenue less interest expense over total assets. The net interest margins can be defined as the charges required by the bank in the process of financial intermediation (Poghosyan, 2013). This ratio, which is related to the banks' traditional borrowing and lending activities, reflects not only the operational efficiency of banking system but also the level of competition of the banking industry (Kumari, 2014; Demirguc-Kunt et al., 2003). Accordingly, the expected influence of banks specific and macroeconomic factors on NIMs of deposit banks can be explained as follows:

- Size of bank (LTA): this determinant is represented by the natural logarithm of assets as proxy of size and it is employed to take account of potential impacts of scale differences on NIMs of banks. On the one hand, as asset size of banks increases, banks' interest margins may be expected to decrease owing to scale efficiencies (Demirguc-Kunt et al., 2003; Zhou & Wong, 2008; Poghosyan, 2013; Kumari, 2014; among others). On the other hand, banks having greater transaction volume are more likely to incur high levels of risk and this stimulates them to charge higher margins (Maudos & Solís, 2009). So the influence of size of bank on NIMs is ambiguous. Despite the fact that banks total assets is used as an indicator of bank size in banking, in this study we employ loans and deposits as well as total assets as alternative proxies for bank size for robustness check of our results.
- Bank risk aversion (BRA): we measure degree of risk aversion as equity over total assets. As this ratio increases, the degree of risk aversion for banks increases. Managers in banks having low capital ratio tend to increase their risky assets portfolio (e.g. loans or securities) and they may impose additional margins in exchange for taking more risk (López-Espinosa et al., 2011; Demirguc-Kunt et al., 2003; Hawtrey & Liang, 2008; Kumari, 2014). In such case, bank risk aversion indicator is expected to have a positive effect on NIMs. However, managers in banks with higher capital ratio may be involved in less risky activities, leading to lower margins (Zhou & Wong, 2008; Poghosyan, 2013). In this situation a negative sign for BRA is expected.
- Operating costs (OPEC): this variable is used to assess whether the level of efficiency of banks is related to NIMs and it is measured as operating expenses-to-total assets ratio. Less efficient banks with higher operating costs are more likely to apply an extra interest margin (Hawtrey & Liang, 2008; Poghosyan, 2013; Islam & Nishiyama, 2016). Accordingly, high operating costs may cause banks to choose to work with high interest margins.
- Opportunity cost (LATA): this ratio, which is employed to measure the association between management of liquidity and NIMs, is represented by the liquid assets-to-total assets ratio. As discussed in Demirguc-Kunt et al., (2003), banks with higher liquidity ratio could set lower interest margins compared to the banks with weak liquidity position. Holding high levels of liquidity may be correlated with lower interest margins in view of competition in the deposit

market. However, an increase in banks' liquid assets not only reduces their liquidity risk, but also leads to higher opportunity costs of keeping large amounts of liquidity, which in turn may results in higher margins (Hawtrey & Liang, 2008; Ben Khediri & Ben-Khedhiri, 2011; Poghosyan, 2013; Nassar et al., 2014; Islam & Nishiyama, 2016; among others). Hence the predicted sign of opportunity cost is not clear.

- Managerial efficiency (MANEFF): this determinant, represented by operating expenses to gross revenues ratio, is included to our regression equation to capture the efficiency in bank management. A bank is likely to require a greater margin in exchange for its excellent service to its clients (Kumari, 2014; Bektas, 2014; Islam & Nishiyama, 2016). On the other hand, a bank with lower managerial efficiency offers higher loan rates and lower deposit rates to its costumers (López-Espinosa et al., 2011; Kasman et al., 2010; Ben Khediri & Ben-Khedhiri, 2011). Obviously, by virtue of the fact that a rise in this indicator means a decline in managerial efficiency, we may expect higher managerial efficiency to take a negative sign in our NIM model in the context of Turkish listed banks.
- Credit risk (CRISK): this indicator, which is defined as loan loss provisions-to-total loans ratio, is included in the regression to investigate the link between credit risk and NIMs. Banks can demand extra margins if the borrowers have difficulties in repaying the credit they receive, i.e. banks with more problem loans is likely to try to compensate the credit risk they faced by demanding higher NIMs (Maudos & Solis, 2009; Poghosyan, 2013; Nassar et al., 2014; Bektas, 2014; among others). Hence a positive correlation is expected between credit risk measure and NIMs.
- Implicit interest payments (IIP): this variable, measured by operating expenses less non-interest revenue divided by total assets, reflects that the banks may reward their depositors through implicit interest payments (e.g. offering free services) without explicitly paying an interest rate to the depositors. This also means that banks make additional payments to their depositors because of competition in the market for deposits (Hawtrey & Liang, 2008; Maudos & Solis, 2009; Ben Khediri & Ben-Khedhiri, 2011; Gounder & Sharma, 2012). Consequently, an increase in the implicit interest payments of deposit banks is more likely to influence NIMs positively.
- Inflation (INF); this variable equals the yearly change in Consumer Price Index in logarithms. Boyd et al. (2001) demonstrate that domestic banking systems of the countries having a higher level of inflation are underdeveloped. Inflation causes an increase in net interest margins due to the aggravation of information asymmetries (Huybens & Smith, 1999; Boyd et al., 2001). Higher inflation requires more transactions and branch networks, and cause higher costs and interest margins (Demirgüç-Kunt & Huizinga, 1999). Perry (1992) notes that the relation between inflation and bank net interest margins may change depending on whether the inflation is anticipated or unanticipated. Bank management can adjust its interest rate quickly and increase its interest margins if inflation is

anticipated. But then if inflation is not anticipated, bank management is likely to be sluggish to adjust interest rates, which may adversely affect net interest margins due to the increase in inflation-related costs (Perry, 1992; Pasiouras & Kosmidou, 2007). Thus, the expected sign of INF is positive.

- Real Gross Domestic Product Growth (GDP); this indicator is measured by the yearly change in the real GDP in logs. Economic growth can improve business performance by enhancing the business activity and improved business performance lowers the default rates and risk premium. These reductions motivate banks to decrease their net interest margins. The negative effect of economic growth on bank spreads exists because of default effect (Brock & Rojas Suarez, 2000; Demirgüç-Kunt et al., 2004; Tan, 2012; Tarus et al., 2012; Claeys & Vander Vennet, 2008). On the other hand, the positive association can be explained through market power. If borrowers' demand for credit is rising, banks increase the lending rate to maintain the deposit rate (Tan, 2012). Hence the expected sign of GDP is not clear.

Summary statistics on NIMs and summary statistics for the other banks-specific and macroeconomic independent variables employed in our analysis is reported in Table 2. The net interest margins (NIMs) of publicly listed banks in our sample vary between 2.58% and 5.92% with a mean of 3.86% and a standard deviation of 074% during 2010-2015. Given prior banking studies in the literature review section in our paper, the mean of NIMs for listed banks in Turkey seems to be higher when compared to other countries such as Russia (1.84%), Honduras (2.2%), Tunisia (3.28%), Bosnia and Herzegovina (3.53%), and Sri Lanka (3.67%). This result is highly likely to reflect high intermediation costs for Turkish banks.

Table: 2
Descriptive Statistics

	NIMs	LTA	BRA	OPEC	LATA	MANEFF	CRISK	IIP	GDP	INF
Mean	.0386	10.75	.1145	.0273	.3141	.5004	.0281	.0544	0506	.0769
Median	.0374	10.93	.1137	.0250	.3114	.4841	.0249	.0525	.0411	.0822
SD	.0074	.5574	.0218	.0074	.0611	.1068	.0118	.0122	.0262	.0082
Min.	.0258	9.41	.0573	.0176	.1977	.3333	.0117	.0294	.0211	.0627
Max.	.0592	11.44	.1928	.0488	.5103	.8385	.0614	.0779	.0876	.0852
Obs.	71	71	71	71	71	71	71	71	71	71

The pair-wise Pearson correlation matrix of the dependent and independent variables that we use in model specification in Eq. (1) is provided in Table 3. As shown in Table 3, while our dependent variable, NIM, has significant negative correlation with LTA and LATA, it is found to be significantly and positively related to CRISK, OPEC, IPP, and INF at 1% significance level. In the correlation matrix, the biggest value is found to be .67. In an additional analysis, the VIF analysis is conducted to formally diagnose whether a multicollinearity problem exists among regressors in the NIM model. As reported in the last column of Table 3, the biggest value for VIF is 3.48. Finally, the absence of multicollinearity problem between the regressors is supported by the correlation and VIF analysis.

Table: 3
Correlation Matrix between NIMs and Its Determinants

Variables	1	2	3	4	5	6	7	8	9	10	VIF
(1) NIMs	1										-
(2) LTA	-.42[a]	1									2.32
(3) BRA	.05	-.13	1								1.19
(4) OPEC	.65[a]	-.62[a]	.12	1							3.48
(5) LATA	-.28[b]	.50[a]	-.004	-.49[a]	1						2.06
(6) MANEFF	.10	-.64[a]	.04	.67[a]	-.57[a]	1					2.68
(7) CRISK	.48[a]	-.28[b]	.13	.31[a]	-.15	.11	1				1.25
(8) IIP	.62[a]	-.61[a]	-.06	.71[a]	-.57[a]	.63[a]	.32[a]	1			3.23
(9) GDP	-.007	-.18	.11	.21	.27[b]	.06	.13	-.13	1		2.42
(10) INF	.31[a]	-.01	.22	.10	-.10	-.10	.08	.12	-.49[a]	1	1.77

Note: [a] and [b] indicate significance at 1% and 5% level.

4. Empirical Results

We employ some specification tests like F-test, Breusch-Pagan LM test, and Hausman test to determine appropriate estimation technique. According to the specification tests results in Table 4, we prefer the random effect estimate of Equation (1) (Pooled-OLS and fixed effects results are also included in Appendix 2). Before reporting our findings obtained from NIM models we check the econometric properties of our model specification (i.e. autocorrelation, heteroskedasticity and cross section dependence in our bank sample).The results taking into account logarithm of total assets as a size indicator is presented in the first column of Table 4. Second and third columns in Table 4 present the results from alternative proxies for banks size such as logarithm of total loans and logarithm of total deposits, respectively.

The results obtained from baseline regression (i.e. Regression I) demonstrate that the coefficient of bank size (LTA) is statistically significant at 5% level with a negative sign, showing that an increase in assets size of banks reduces bank margins i.e., banks with larger assets tend to have lower interest margins compared to banks with lower assets. The negative impact of bank size on NIMs is in keeping with the findings of Demirguc-Kunt et al., (2003), Zhou & Wong, (2008), Kasman et al., (2010), Poghosyan (2013), and Ly (2015). However, our finding with respect to banks size seems in contradiction with findings of Maudos & Solís (2009). It is also empirically tested if the negative association between bank size and NIMs of banks holds when we employ different proxies regarding the variable of bank size in regressions in columns 2 and 3 of Table 4. More specifically, in column 2 of Table 4, Eq. (1) is re-estimated by the logarithm of total loans instead of the logarithm of total assets. Similarly, we replace the logarithm of total assets with the logarithm of deposits, another proxy for bank size, in column 3 of Table 4 for more robust results. It appears that results obtained from our baseline specification (in columns 1 of Table 4) are robust to alternative proxies for the variable of banks size. In other words, our findings reported in columns 2 and 3 of Table 4 confirm that the findings of our baseline regression reported in first column of Table 4 remain valid.

As for the impact of bank risk aversion (BRA) on NIMs of banks, BRA has a negative impact on NIMs, suggesting that better capitalized banks have lower NIMs. This finding that BRA is negatively linked with NIMs is similar to the results of Zhou & Wong (2008) and Poghosyan (2013), but different from that of Hawtrey & Liang (2008), Maudos & Solís

(2009), and Ly (2015). However, this negative link between BRA and NIMs is not statistically significant.

As expected, operating cost (OPEC) variable compared to the other variables used in this study is explicitly the most significant driver of NIMs as formerly found by Nassar et al. (2014), Demirguc-Kunt & Huizinga (1999), and Hawtrey & Liang (2008). The estimated coefficient for OPEC represented by banks' efficiency level is found to be significant and positive, reflecting the fact that higher operating expenses causes banks to have higher NIMs. Economically speaking, one percentage point increase in this ratio will increase NIMs by almost 0.63 percentage point in the first regression. This finding that the OPEC is positively and significantly linked with NIMs parallels the findings of Zhou & Wong (2008), Ben Khediri & Ben-Khedhiri (2011), Gounder & Sharma (2012), Plakalović & Alihodžić (2015) and Kumari (2014), among others.

Table: 4
The Results of Random Effect Panel Data Model

	Regression-I	**Regression-II**	**Regression-III**
Intercept	.0667**	.06538**	.0715***
	(.0260)	(.0261)	(.0261)
Bank-specific determinants			
Total assets (LTA)	-.0033**		
	(.0015)		
Total loans (LTL)		-.0014**	
		(.0007)	
Total deposits (LTD)			-.0016**
			(.0007)
Bank risk aversion (BRA)	-.0293	-.0295	-.0262
	(.0267)	(.0263)	(.0273)
Operating cost (OPEC)	.6258***	.6303***	.6204***
	(.1093)	(.1116)	(.1036)
Opportunity cost (LATA)	-.0062	-.0084	-.0074
	(.0146)	(.0148)	(.0144)
Managerial efficiency (MANEFF)	-.0509***	-.0508***	-.0521***
	(.0127)	(.0128)	(.0123)
Credit risk (CRISK)	.1073*	.1076*	.1062
	(.0649)	(.0645)	(.0661)
Implicit interest payments (IIP)	.2062***	2064***	.2074***
	(.0592)	(.0598)	(.0599)
Macro determinants			
Real GDP growth	-.0110	-.0111	-.0104
	(.0256)	(.0257)	(.0248)
INF	.1023	.1013	.1001
	(.0809)	(.0808)	(.0816)
Specification tests' results			
F-test(p_value)	0.0117	0.0148	0.0051
Breusch-Pagan LM test(p_value)	0.0272	0.0284	0.0257
Hausman test(p_value)	0.7776	0.9471	0.7079
Wooldridge's Autocorrelation test(p_value)	0.0216	0.0194	0.0173
Levene, Brown and Forsythe's Heteroskedasticity test(p_value)			
W0	0.1316	0.1310	0.1515
W50	0.5182	0.5153	0.5373
W10	0.1316	0.1310	0.1515
Pesaran CD test(p_value)	0.8903	0.8909	0.9647
R^2	0.7964	0.7967	0.7962
Adj. R^2	0.7663	0.7667	0.7661
Wald Chi-Squared(p_value)	0.0000	0.0000	0.0000
Number of Obs.	71	71	71
Number of banks	12	12	12

*Note: Standard errors of coefficient estimates that are robust to autocorrelation within panels are given in parentheses. *, ** and *** denote that the statistics are significant at the 10%, 5% and 1% level, respectively.*

Regarding liquidity position, we find that the bank's opportunity cost indicator (LATA) measured by the ratio of liquid assets-to-total assets is negatively correlated with NIMs of deposit banks. This means that deposit banks are not likely to pass their liquidity risks to their customers during the period under consideration. This result is similar to those of Demirguc-Kunt et al., (2003) for a sample of seventy-two developed and developing countries; Fungáčová & Poghosyan (2011) for Russia; Bektas (2014) for North Cyprus; Plakalović & Alihodžić (2015) for Bosnia and Herzegovina; Ly (2015) for EU banks; and Islam & Nishiyama (2016) for India. It, however, is different from the findings of Nassar et al. (2014) for Honduras; Islam & Nishiyama (2016) for Bangladesh and Pakistan; Marinković & Radović (2014) for Serbia; and Ben Khediri & Ben-Khedhiri (2011) for Tunisia. However, the coefficient representing the association between opportunity cost measure and NIMs is statistically insignificant.

As expected, the effect of managerial efficiency (MANEFF) on NIMs is negative and is highly significant. A statistically significant negative association between the MANEFF and the NIMs implies that as the MANEFF increases, the level of NIMs of deposit banks in our sample decreases. The result that managerial efficiency is negatively and significantly linked with NIMs is supported by previous studies such as Ly (2015), Gounder & Sharma (2012), Hawtrey & Liang (2008), Kasman et al., (2010), Dumičić & Rizdak (2013), among others.

At a level of significance of 10%, there is a positive and statistically significant relationship between credit risk (CRISK) and NIMs, indicating that higher credit risk leads to higher NIMs. It appears that Turkish banks tend to take necessary precautions concerning the bad loans either by increasing the loan interest rates or by decreasing the deposit interest rates. As a result, this causes them to achieve higher interest margins. This finding is consistent with the findings of Maudos & Solis, 2009, Kasman et al. (2010), Garza-García (2010) for developed countries, Bektas, (2014), and Gounder & Sharma (2012), but inconsistent with Dumičić & Rizdak, (2013), Marinkovića & Radovićb (2014), and Garza-García (2010) for developing countries.

As expected and In line with Maudos & Solis, (2009), Hawtrey & Liang (2008), and Kasman et al. (2010), the ratio of implicit interest payments to total assets (IIP) has a positive influence on the NIMs of deposit banks, suggesting that higher IIP is correlated with higher NIMs. This influence is significant at 1% level, which means that banks impose additional interest margins known as implicit interest payments with the aim of compensating for the costs associated with banking services.

Turning to macroeconomic indicators, as in Nassar et al. (2014), the association between economic growth (GDP) and NIMs is found to be negative but insignificant. Our results, which appear in Table 4, also show that there is a positive relation between inflation (INF) and NIMs. However, this relation is not significant in explaining changes in NIMs for the period analyzed. Similar results with reference to INF are reported by Islam & Nishiyamaa (2016).

5. Conclusion

When taken summary statistics into account, it appears that net interest margins of publicly quoted banks in Turkey are relatively higher than those of other countries, meaning that the costs of financial intermediation are high. High interest margins are likely to affect negatively not only the increase in savings of depositors, but also investments of firms and individuals in the country. Therefore, a surge in the cost of financial intermediation may cause economic growth rate to diminish. Striking an optimal balance between the deposit rate and lending rate is of great importance for both a more efficient banking system and a better economic growth.

In the Turkish context, we try to analyze the impact of bank-specific and macro determinants on bank net interest margins over the post-crisis period 2010-2015 by employing panel data estimation technique. Based on the findings of the econometric analysis, we conclude that banks specific determinants such as implicit interest payments, credit risk, managerial efficiency, operating cost, and bank size are the paramount drivers of banks' net interest margins. In particular, while higher operating cost, credit risk, and implicit interest payments significantly enhance bank net interest margins; higher size and managerial efficiency tend to lower net interest margins. Besides, when taken into consideration the macroeconomic indicators, neither inflation rate nor the rate of economic growth has an important influence on net interest margins of deposit banks in the post-crisis era.

As for the main message of our study, the analysis results emphasize that bank management should take a variety of precautions to diminish operating costs and implicit interest payments as well as the riskiness of the credit portfolio for a more efficient banking system, i.e. such information might help the bank managers to take actions that enhance the efficiency of banking system. For example, deposit banks with higher operating costs could be more cost efficient by reducing the costs of their professional services they offer to their customers. This may mean that as operating costs decrease, the banks may become more competitive. Secondly, managers in banks having high credit risk profile should make necessary arrangements to minimize the asymmetric information problems between the banks and their customers by developing new applications that will better evaluate the creditworthiness of the borrowers before supplying credit. Lastly, bank management should focus on applications that will encourage clients to use internet banking or the ATM services to reduce implicit interest payments. Otherwise, deposit banks are highly likely to increase net interest margins to finance the implicit interest payments.

Our study has some limitations. First of all, the results obtained from this study should be interpreted for the banks traded on the Borsa Istanbul and not generalized for all commercial banks operating in Turkish banking system. Secondly, in this study the ownership structures of publicly quoted banks are not taken into consideration. Lastly, our study does not take into account the impact of the recent financial crisis on bank interest margins, as we focus on the post-crisis period. In the future studies on the interest margins, the issue can be examined in more detail.

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Appendix: 1
The List of Deposit Banks

Table: 5
Turkish Listed Deposit Banks 2010-2015

BANK	CODE
Akbank T.A.Ş.	AKBNK
Alternatifbank A.Ş.	ALNTF
Denizbank A.Ş.	DENIZ
Finansbank A.Ş.	FINBN
ICBC Turkey Bank A.Ş.	ICBCT
Şekerbank T.A.Ş.	SKBNK
Türkiye Garanti Bankası A.Ş.	GARAN
Türk Ekonomi Bankası A.Ş.	TEBNK
Türkiye Halk Bankası A.Ş.	HALKB
Türkiye İş Bankası A.Ş.	ISATR
Türkiye Vakıflar Bankası T.A.O.	VAKBN
Yapı ve Kredi Bankası A.Ş.	YKBNK

Appendix: 2
The Estimation Results From Pooled OLS and Fixed Effects Estimators

Table: 6
Regression Results from Pooled-OLS Model

	Regression-I	Regression-II	Regression-III
Intercept	.0501** (.0010)	.0499** (.0179)	.0516** (.0171)
Bank-specific determinants			
Total assets (LTA)	-.0024** (.0015)		
Total loans (LTL)		-.0010** (.0004)	
Total deposits (LTD)			-.0011** (.0004)
Bank risk aversion (BRA)	-.0157 (.0194)	-.0157 (.0193)	-.0140 (.0196)
Operating cost (OPEC)	.7251*** (.1462)	.7248*** (.1463)	.7269*** (.1437)
Opportunity cost (LATA)	.0037 (.0137)	.0022 (.0137)	.0030 (.0134)
Managerial efficiency (MANEFF)	-.0494*** (.0113)	-.0494*** (.0114)	-.0505*** (.0111)
Credit risk (CRISK)	.1145** (.0489)	.1145** (.0490)	.1132** (.0486)
Implicit interest payments (IIP)	.2310*** (.0628)	.2314*** (.0632)	.2329*** (.0630)
Macro determinants			
Real GDP growth	-.0259 (.0238)	-.0260 (.0238)	-.0252 (.0231)
INF	.0665 (.0742)	.0661 (.0742)	.0647 (.0741)
Specification tests' results			
F-test(p_value)	216.11***	212.58***	258.15***
R^2	0.8071	0.8067	0.8092
Number of Obs.	71	71	71
Number of banks	12	12	12

*Note: Standard errors of coefficient estimates that are robust to heteroskedasticity and autocorrelation are given in parentheses. *, ** and *** denote that the statistics are significant at the 10%, 5% and 1% level, respectively.*

Table: 7
Regression Results from Fixed Effects Model

	Regression-I	**Regression-II**	**Regression-III**
Intercept	.2025* (.1014)	.1912* (.1031)	.2344** (.0872)
Bank-specific determinants			
Total assets (LTA)	-.0150 (.0091)		
Total loans (LTL)		-.0061 (.0040)	
Total deposits (LTD)			-.0078** (.0035)
Bank risk aversion (BRA)	-.0421 (.0550)	-.0433 (.0556)	-.0318 (.0477)
Operating cost (OPEC)	.3025* (.1637)	.3290* (.1638)	.3087 (.1739)
Opportunity cost (LATA)	-.0212 (.0161)	-.0298 (.0203)	-.0288 (.0167)
Managerial efficiency (MANEFF)	-.0405** (.0152)	-.0415** (.0151)	-.0444*** (.0129)
Credit risk (CRISK)	.1369 (.0774)	.1314 (.0782)	.1583* (.0721)
Implicit interest payments (IIP)	.1806** (.0645)	.1786** (.0663)	.2031** (.0778)
Macro determinants			
Real GDP growth	-.0272 (.0230)	-.0257 (.0228)	-.0311 (.0187)
INF	.1147 (.0711)	.1141 (.0720)	.0891 (.0655)
Specification tests' results			
F-test(p_value)	63.46***	68.56***	83.59***
R^2 (within)	0.6915	0.6867	0.7083
Number of Obs.	71	71	71
Number of banks	12	12	12

*Note: Standard errors of coefficient estimates that are robust to heteroskedasticity and autocorrelation are given in parentheses. *, ** and *** denote that the statistics are significant at the 10%, 5% and 1% level, respectively.*