THE DETERMINANTS OF SHORT-TERM DEPOSIT RATES IN AN IMPERFECTLY COMPETITIVE MARKET

by

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Abstract

This thesis studies the factors determining deposit rates of the deposit banks in Turkey. Emphasizing the role of risk components in price-setting behavior of banks, the study attempts to explain the heterogeneity between interest rates on deposits by global, domestic, and bank-specific risk factors. Further, competitive conditions are explored in the deposit market taking into account the reaction functions of banks, which are classified by their deposit sizes. The thesis contributes to the existing body of literature in two ways. First, novel to the economic literature, competition among the banks, which has been used to be measured by mainly the concentration ratios, is proxied by the average deposit rate of the rivals of a given bank under the assumption that competition takes place among banks with similar deposit size. Second, the two-step estimation process decomposes the deposit rates into risk elements and market structure. Covering the period from September 2013 to December 2016, the analysis investigates how deposit banks operating in the Turkish banking sector set deposit rates. In line with the expectations, riskiness of a bank is found to be associated with higher deposit rates. Further, the results show that banking organizations in deposit market operate under imperfect competition, and that the degree of competition varies across groups.

Keywords: Deposit rate, Rival rate, Competition, Size, Policy rate, Risk

Özet

Bu tez, Türkiye'deki mevduat bankalarının uyguladığı mevduat faizlerinin belirleyicilerini çalışmıştır. Risk unsurlarının bankaların fiyat belirleme davranışındaki rolünü vurgulayan çalışma; mevduat faizleri arasındaki heterojenliği küresel, milli ve banka bazında risk faktörleri ile açıklamayı çalışmıştır. Bununla birlikte, mevduat piyasasındaki rekabet koşulları bankaların mevduat büyüklüklerine bağlı olan reaksiyon fonksiyonları hesaba katılarak incelenmiştir. Bu tez literatüre iki şekilde katkıda bulunmaktadır. İlk olarak, ekonomi literatüründe sıklıkla yoğunlaşma oranı ile ölçülen rekabet koşulları, bir bankanın kendisine benzer büyüklükteki rakiplerinin ortalama mevduat faizi ile temsil edilmiştir. İkinci olarak, iki aşamalı bir tahmin süreci izlenerek mevduat faizlerini oluşturan risk unsurları ve piyasa yapısı ayrıştırılmıştır. 2013 Eylül ile 2016 Aralık arasını kapsayan analizde, Türk bankacılık sektöründe çalışan mevduat bankalarının nasıl mevduat faizi belirlediği incelenmiştir. Beklentilerle uyumlu olarak banka riskliliğinin yüksek mevduat faizleri ile ilişkili olduğu bulunmuştur. Ayrıca, sonuçlar mevduat piyasasındaki kuruluşların eksik rekabet altında çalıştığını ve rekabet derecesinin gruplar arasında değiştiğini göstermektedir.

Anahtar Sözcükler: Mevduat faizi, Rakip faiz oranı, rekabet, büyüklük, politika faizi, risk.

Contents

List of Tables

List of Figures

1 Introduction

Price-setting behavior of banking organizations has attracted much attention among policymakers and academics, who are motivated by investigation of the consequences of monetary transmission mechanism, the structure of the banking sector, the risk exposure, and the bank-specific factors. The underlying motivation of this study is to contribute to the existing literature on bank price-setting behavior by an analysis of macro and micro factors influencing the deposit rate determination in Turkish banking industry. Adoption of an unconventional measurement of competition in order to test the market conditions based on different clusters of banks is one contribution of this study. It is explored that the competition across size classes varies, and the size of the banks are proportional to the market power of these organizations. Further, the use of high frequency data matters significantly given the variable under investigation, interest rate paid on deposits, fluctuates quite frequently in Turkey.

Overall riskiness of a bank is highly important in deposit rate pricing. Most depositors do not easily switch banks for small differences in interest rates (Rosen, 2002). In fact, in Turkey, depositors are insensitive to higher interest rates, which can be a result of the bank failures in the last two decades (Akin et al., 2013). Rather, they prefer depositing in those banks which they perceived less risky. The banks viewed as unsafe, therefore, offer higher interest rates on deposits in order to attract depositors.

In this study, by differentiating the deposit rate from the benchmark interest rate, the heterogeneity in the pricing behavior is examined by controlling for the various risk indicators. Risky banks, - due to their liquidity position, capital holdings,

portfolio decisions, and foreign exchange holdings-, are considered to be more likely to fail, and so tend to pay higher risk premiums than the "safe" banks.

Size of a bank is a strong determinant in the risk perception of a depositor. The higher presumed risk of smaller banks is often due to their geographic and product concentrations (MacDonald and Koch, 2006). Furthermore, large banks which are endowed with large networks, efficient technologies, and great number of branches may more easily attract depositors. Moreover, larger banks may exploit economies of scale and scope to have lower cost structures (Rosen, 2007; Hannan and Prager, 2006). Thus, the larger the bank, the lower the deposit rate.

The studies concerning the competition in the deposit market are primarily based on the idea that banks compete to collect deposit. The conventional approach to investigating the impact of banking market conditions on deposit rates is to emphasize the level of concentration. Structure-conduct-performance paradigm states that the banks operating under less concentrated markets behave less competitively and so enjoy higher profits. The empirical measures of competition is, therefore, constructed mostly by using market share of banks (Hannan, 1991). Herfindahl-Hirschman Index and concentration ratios are the most frequently used instruments to capture the effects of changes in market concentration. The earlier work regarding the concentration proves that the market concentration is inversely related to deposit rates. Thus, highly competitive banks in a market are likely to offer higher rates to attract greater amounts of deposits (Berger and Hannan, 1989; Günalp and Çelik, 2006).

Considering a bank competes with the banks that have similar amounts of deposits, classifying the banks by their deposit sizes and testing their market power for each cluster are essential. In this way, the competitive pressure originating

from the price change of its rival on a bank's own price can be measured. Unlike the non-price strategy of competition in the credit market suggested by Altug and Usman (2006), pricing is considered as the main strategy of banks in deposit market in this study.

The interest rates on Turkish Lira (TL) denominated deposit accounts up to 3-month maturity from late 2013 until then end of 2016 are examined in this paper. As of November 2016 TL deposit accounts with maturities up to 3 months constituted the 73 percent of the total deposits, implying these are the most widely held deposit products. Then, it is reasonable to expect that these are the prime focus of competition among the banks.
The major goal of this study is to determine how interest rates paid on these short-term accounts paid by each bank are affected by the bank-specific and macro-financial risk factors, and observe the degree of competition within and across size classes.

The two-step procedure results imply that the macroeconomic risk elements are stronger determinants than bank-specific factors except for the bank size. The results also show that the short-term deposit market is imperfectly competitive, and the degree of competition is larger for the group of small banks. In other words, larger banks bid less and less aggressively.

The remainder of the study is organized as follows. The next section briefly discusses the existing literature. Chapter 3 describes a basic model for determining deposit rates by decomposing risk factors and competitive pressure. Chapter 4 summarizes the data, empirical specification, and methodology. Chapter 5 presents findings of the study. Finally, Chapter 6 summarizes the results and their policy

implications.

2 Literature Review

There are numerous studies explaining why the deposit rate of each bank differ. In the relevant literature, the interest rate pass-through, which may be defined as the transmission of monetary policy rates to deposit and loan rates, has been regarded as the fundamental component of the interest rate channel. The studies concerned with the adjustments of bank interest rates to the market interest rate suggest that bank interest rates pursue the market interest rate in the long run. In their seminal work, Karagiannis et al. (2010) examine the adjustment of retail rates (deposit and loan rates) in response to changes in wholesale rates for the Eurozone and the US by a novel method of general-to-specific model. The study reveals the fact that the money market rate is more effective than the central bank rate on retail rates of the Eurozone; whereas, the central bank rate works more effectively as a policy instrument in USA.

The effect of monetary policy on bank lending in Turkey is examined by Akinci et al. (2013). Their findings prove the presence of a lending channel through interest rates. The results for Turkey indicate bank capital and liquidity play a major role in monetary transmission, whereas bank size is found to be insignificant contrary to the empirical studies in general.

Binici et al. (2016) conducts a similar research for Turkey to determine the effectiveness of the formally announced policy rates of central bank and the actual rates on the short-term deposit and loan rates. The inclusion of the operational framework of the interest rate corridor distinguishes this paper from the earlier

studies. The authors show that weighted average funding rate (WAFR) of the Central Bank of Republic of Turkey (CBRT) is the strongest determinant in the deposit rate pricing (compared to interbank rate and policy rates).

The issue of asymmetry between upward and downward price movements focusing on the setting of deposit rates by banks is addressed by Hannan and Berger (1991). They show that price rigidity is significantly higher in local deposit markets with decreases in deposit rates being more likely than rises in deposit rates corresponding to the fluctuations in the market interest rate. For the case of Turkish banking system, Binici et al. (2016) find no evidence of asymmetry between the deposit rate and the WAFR. More specifically, the effect of a change in the WAFR on the speed of deposit rate response is shown to be symmetric over both easing and tightening periods, proving a symmetric price setting behavior in deposit markets.

Competition arises as another significant element in the determination of the deposit rate, and is seen as a possible reason for the short term deviation of bank rates from the market interest rate. The mainstream economic theory suggests that as competition diminishes, the price rises. In this context, the structure-conduct-performance (SCP) hypothesis implies that higher market concentration results in higher market power, so larger profits, and hence lower deposit rates. To test the SCP hypothesis, researchers generally regress a proxy for bank performance like bank profitability on a measure of market concentration, that is, Concentration Ratio for n-bank or Herfindahl-Hirschman Index (HHI) (Degryse et al., 2009). Within the SCP paradigm, banks operating in more concentrated markets can set higher loan rates or lower deposit rates due to non-competitive behavior or collusion. The underlying assumption that market structure is exogenous is severely criticized.

Yet, numerous studies report a positive relationship between measures of market concentration and bank profitability. To illustrate, Berger and Hannan (1989) assert that banks operating in more concentrated markets offer lower deposit rates. Independent of alternative measure of concentration being used such as three-bank concentration ratio, their results show the negative effect of market concentration deposit rates. Despite frequent use of the concentration measure (as employed in the aforementioned study), additional variables are included to measure the impact of market structure. For example, Hannan and Prager (2006) consider the bank size as relevant. They find that the large banks generally offer lower interest rates on deposits and charge higher deposit-related fees than do smaller bank organizations. The fact that the larger banks may have greater access to wholesale funds compared to smaller banks might be an explanation for this result. Likewise, Rosen (2007) focuses on the bank size, yet, he also takes into account the "competitive pressure that a bank feels". The market size structure captures the change in deposit rate of a bank, when its' rivals (with the same size) move shares to another size. His main finding is that the impact of size structure follows an inverse-V shape in bank size. Rosen suggests that integrating the effects of the size structure on the asset side of the banks' balance sheet would be a better approach.

Studying cross-sectional differences in Italian banks' interest rates, Gambacorta (2008) contributes to the "bank lending channel" literature by introducing bank-specific control variables as well as macroeconomic factors, such as permanent and transitory income. The indicator deposit strength, ratio of deposits to the sum of deposits and bonds, is able to explain the heterogeneity in banks' price setting behavior. Especially, banks with a high proportion of deposits will adjust their deposit rate by less and slowly than banks which heavily rely on bonds.

In a theoretical study, where a bank is viewed as a risk-averse dealer, Ho and Saunders (1981) argue that maturity mismatch between assets and liabilities of banks leads interest margins to be interest rate volatility-sensitive. As an extension of this framework, Saunders and Schumacher (2000) investigate the determinants of net interest margins in six selected European countries and USA by decomposing bank margins into regulatory component including restrictions on deposit rates, reserve requirements, and capital-to-asset ratios; market structure component; and risk premium component. Their findings indicate that the high volatility of the money market rate increases both lending and deposit rates.

Similarly, by extending the dealership approach proposed by Ho and Saunders (1981), Angbazo (1997) incorporates the risk concept into interest rate spread function to test the hypothesis that banks with more risky loans and higher interest rate risk exposure would have wider interest margins. Specifically, he shows the net interest margin of commercial banks reflect default and interest risk premia.

The exchange rate risk in an emerging economy should also be taken into consideration in deposit pricing. Martinez Peria and Schmukler (2001) argue that currency risk affects the deposits denominated in domestic currency in a study, where they examine the market discipline in Argentina, Chile, and Mexico. They maintain that aggregate shocks that increase only currency risk should induce depositors to withdraw their peso deposits. Given the foreign exchange rate, especially for the US Dollar, is likely to reflect the external conditions and expectations of the market players, changes in the exchange rate is expected to be explanatory. As a matter of fact, Binici et al. (2016) show that the depreciation of Turkish Lira against US Dollar positively affects the domestic deposit rates.

Existing studies on Turkish banking industry have mainly focused on the issues regarding concentration and efficiency. Günalp and Çelik (2006), for instance, employ Panzar-Rosse methodology to examine the degree of competition in the Turkish banking system. They conclude that the banking industry behave under monopolistic competition for the period between 1990 and 2000, yet, they find no evidence of increase in monopolistic tendencies. Akin et al. (2013), similar to the findings of the research carried out for the Banks Association of Turkey by Coşkun et al. (2012), conclude that Turkish banking system engaged in monopolistic competition in pricing of both deposit and credit rates. The major contribution of Akin et al. (2013) to the literature is the analysis of demand and competition in the Turkish deposit and credit markets separately with a structural demand model. According to their results, depositors and borrowers regard the non-price characteristics, in particular, they tend to prefer banks with larger networks and more efficient technologies.

The role of regulation in the banking industry, as well, has been quite popular among the researchers besides the policymakers of the institutions regulating the banking organizations and antitrust policies. Jayaratne and Strahan (1998) examine the impact of branching deregulation on operating costs and loan losses and find that reduction in costs following the deregulation are passed along to borrowers in the form of lower loan rates. In a more representative study, Demirguc-Kunt et al. (2003) prove that tighter restrictions on bank entry and bank activities increase the cost of financial intermediation. Using bank-level data across 72 countries, they find that bank regulations hike net interest margins (in the absence of institutional framework).

3 Model

Theoretical models of bank behavior are the hedging hypothesis and the models derived from the microeconomics of the banking firm (Ho and Saunders, 1981). In the hedging hypothesis framework, the bank aims to match the maturities of assets and liabilities to avoid the refinancing risk that might emerge from the mismatch of maturities. Implicit assumptions used in these models are that interest rate fluctuations result in portfolio risk, and the bank hedges to minimize the risk of shareholders' wealth.

The models developed from the microeconomics of the (banking) firm usually assume that the objective function of the bank is to maximize either expected profit or the expected utility of profit as in Klein (1971); Monti (1972).

3.1 Risk Premium

The basic model used in this paper, similar to the dealership model of Ho and Saunders (1981), is based on the assumption that a representative bank is a risk-averse agent seeking out to mitigate its risk exposure in order to attract deposits. The bank compensates its high level of risk exposure by offering high deposit rate. Deposit rates paid by the commercial banks are generally higher than market interest rate, whether official rates set by the monetary authority or actual interest rates in money markets, depending on the default risk of these organizations. Consequently, the deposit rate of a bank i at time t can be described as the benchmark interest rate added by the risk premium of this certain bank.

$$r_{it} = r_t^b + \sigma_{it} \tag{1}$$

where r_{it} is the deposit rate offered by bank i, r_t^b is the benchmark rate, and σ_{it} is the risk premium.

Given the analysis based on the decomposition of risk factors, risk free interest rate may be used within this framework rather than benchmark interest rate. It should be regarded that the risk free interest rate, which is the return available to an investor in a security guaranteed to offer this return, can be captured by the yield on high quality government bonds or the borrowing rate of the central bank. Both the government and the central bank are less likely to default and fail to repay their debt. A modified version of the Equation 1, therefore, can be constructed as the following.

$$r_{it} = r_t^f + \sigma_{it} \tag{1'}$$

where r_{it} is the deposit rate offered by bank i, r_t^f is the riskless interest rate, and σ_{it} is the risk premium.

Due to general tendency towards employing benchmark interest rate instead of (officially announced) risk free interest rate see Binici et al. (2016), the initial representation is used in the remainder of the study.

The risk premium can be explained by several risk elements, both bank level and macro-financial factors, and bank-specific variables. The following formulation specifies the empirical equation the deposit rate of each bank as a function of risk components (including liquidity risk, foreign exchange risk, capital risk, bank's security portfolio, deposit size of each bank, exchange rate volatility, and the global risk appetite) and benchmark interest rate.

$$r_{it} = \alpha_0 + \alpha_1 r_t^b + \alpha_2 X_{it} + \alpha_3 Y_t + \varepsilon_{it} \tag{2}$$

with X_{it} is the bank-level variables and Y_t represents the macro-level variables. In this setting, riskiness of a bank is associated with higher risk premium, and hence higher deposit rates.

3.2 Market Structure

In deriving the relationship between the deposit rates and market structure, the following assumptions are made.

- Government securities are free of default risk and are in perfectly elastic supply to an individual bank. Since the expected return and risk characteristics of such assets are independent of individual bank decisions, banks are price-takers in the market for government securities (Klein, 1971).
- Product differentiation in bank deposits within and across groups exists (Hannan, 1991). That is, once classified by the size of deposits, deposit market is a set of closely related products that are more substitutable among each other than with goods outside the group. The larger banks tend to have competitive advantages over smaller banks in the form of greater preference of depositors towards larger banking organizations given their proximity and accessibility with large number of branches and automated teller machines, lower transaction costs, higher reliability, and so on. Smaller banks are likely to price more aggressively given the fact that larger banks enjoy a number of advantages such as alternative funding sources (non-deposit liabilities) at lower cost, wider depositor base due to reputation, and greater accessibility, which suggest that price elasticity of deposit is lower for larger banks.
- Banks are able to exercise some market power in deposit market as they face relatively inelastic deposit supply function. Depending on the degree of product differentiation, elasticity of supply of deposits take a finite value

(Hannan, 1991; Hannan and Liang, 1993).

- Banks simultaneously determine prices for their differentiated products, and each bank competes in its own class. This offers that the degree of competition across different classes vary and different groups have different pricing strategies.

Based on the assumptions listed above, in order to construct a test regarding the market structure, the conjectural variation concept should be introduced into the analysis. Bank i in group s_k - classified according to its deposit size-, is likely to react to the change in the prices of other banks in the group s_k.

$$r_{-it} = f(r_{jt}) \tag{3}$$

where $i, j \in s_k$, and $s_k \subset S$ for k=1,2,3. S is the size class of banks, constructed by dividing the banking sector into three classes according to the deposit size.

In other words, bank i forms a conjecture in the variation of prices of the other banks with similar sizes and response accordingly. The conjectural variation of bank i, the weighted average of the deposit rate of other banks with similar size of deposit, is calculated as follows.

$$r_{-it} = \frac{\sum_j (\text{deposit}_{jt} \times r_{jt})}{\sum_j \text{deposit}_{jt}} \tag{4}$$

with j is a bank other than i in the same class of size.

Deposit rate estimates from Equation 2 should vary over time and across size classes depending on variations in the market structure. The degree of competi-

tion, then, may be estimated by the following regression equation in which predicted values of deposit rate is regressed on the conjectural variation in prices of the competitors. This will allow the decomposition of the macro-economic and bank-specific factors from market structure dependent component.

$$\hat{r}_{it} = \beta_0 + \beta_1 r_{-it} + \mu_{it} \tag{5}$$

If perfect competition were to prevail, fluctuations in the other banks' pricing would affect the price-setting of the bank i by one-to-one. Full product differentiation, or no interdependence in price setting, on the other hand, requires no change resulting from the conjectural variation of the banks in the same class. In other words, $\hat{\beta}_1 = 1$ means that the banks engage in a perfectly competitive market, and $\hat{\beta}_1 = 0$ implies that deposit market is fully differentiated.

It should be also noted that the degree of competition is expected to decline as the bank size increases. A bank endowed with great amount of deposits is unlikely to suffer from substantial fluctuations in its deposit amount compared to a smaller bank. Since larger banks depend less on deposits as opposed to smaller banks (given the cheaper source of wholesale funds), the degree of competition is low within the big deposit class, and it is high in the small deposit class.

4 Data and Methodology

4.1 Data

In this study, the relationship between the deposit rates of banking organizations and competitive conditions is investigated by highlighting the risk element. The period of analysis is from September 2013 to the end of 2016. The sample consists of 3594 observations on 21 deposit banks. The variables employed in the thesis are generally at weekly frequency, and are collected from several sources including weekly and monthly reports of the liquidity and interest rate risk analyses filed by each deposit bank, CBRT, Bloomberg, and Credit Suisse.

All banking organizations disclose their financial statements regularly to the banking authorities. Therefore, the bank specific indicators, which are total loans, total deposits, the net foreign exchange position, holdings of the government debt securities, interest sensitive assets and liabilities, and average deposit rate of each bank are derived from the reports of "Banks Monitoring System" in close consultation with the supervisors of the CBRT. Given the fact that the interest rates paid on Turkish Lira deposits are under investigation, deposits and loans denominated in TL are used. The macroeconomic and financial variables are extracted from the Bloomberg. Further, the risk appetite index of Credit Suisse is utilized.

The following sections cover the variables employed in the estimation process under the separate categories of bank-specific elements and macrofinancial conditions. For convenience, a list of these variables and their sources are provided in Table 1.

Table 1: Variable Definitions

Symbol	Variable	Source	Frequency
r_{it}	Average interest rate paid on deposits up to 3-month	CBRT	Weekly
HHI_t	Herfindahl-Hirschman index	CBRT	Weekly
LTD_{it}	Liquidity risk	CBRT	Weekly
$BONDS_{it}$	Securities portfolio	CBRT	Weekly
$SIZE_{it}$	Bank size (of deposits)	CBRT	Weekly
CAP_{it}	Capital risk	CBRT	Monthly
FX_{it}	Forex risk	CBRT	Weekly
FIN_t	Banking sector risk	EIU	Monthly
$WAFR_t$	Benchmark interest rate	CBRT	Weekly
$USDVOL_t$	Exchange rate implied volatility	Bloomberg	Weekly
RA_t	Global risk appetite	Credit Suisse	Weekly

4.1.1 Bank-Specific Factors

Data categorized under the bank level covers both the risk elements and the firm-specific descriptive factors such as bank size and its holdings of government debt securities. Risk factors originating from a bank's use of funds and/or resources of funds are represented by the indicators: liquidity risk, capital risk, and foreign exchange risk.

Commonly confused terms liquidity and capital may be differentiated as follows. Liquidity risk is the risk of a bank's funding leaving the bank short of funds. Or equivalently, it is the risk of large amount of withdrawals by the depositors and the investors leading the bank to sell off its assets at an unfavorable price.

Capital, can be defined as a bank's 'own funds', serves as a buffer for a bank with risky assets. That is, capital absorbs both expected and unexpected losses which might expose the bank to balance sheet insolvency. The bank with a high proportion of unstable or 'flighty' sources of funding, therefore, needs to hold more liquid assets such as cash, central bank reserves or government bonds in order to mitigate the liquidity risk that it might face. And, the bank with more risky assets - like unsecured loans - should hold more capital to cushion the potential losses that might arise due to the default of these loans.

Capital (Solvency) Risk

Capital plays a major role in the risk-return trade-off at banks. Increasing capital lowers risk by cushioning the volatility of earnings, limiting growth opportunities, and reducing the likelihood of bank failure. It reduces expected returns to shareholders as well since debt is cheaper than equity. Decreasing capital, on the other hand, increases risk by increasing financial leverage and the probability of bankruptcy. Yet, it also increases potential returns (MacDonald and Koch, 2006).

A number of guidelines aiming at limiting risks have been implemented for a long time. A capital requirements scheme suggested by Bank of International Settlement (BIS) in 1988 has been adopted by banks all around the world (Choudhry,

2012). The scope of regulations extended progressively afterwards. More recently, internationally agreed standards set by Basel Committee on Banking Supervision (BCBS) aim to raise the resilience of the banking sector by strengthening the regulatory capital framework. Basel III (2011) standards are built on three pillars:

- Pillar 1 determines quantitative requirements for given risks, and introduces more capital buffers. Besides fixed standards for a certain risk exposure, how much capital is required may be derived by using models of expected and unexpected losses.
- Pillar 2 intends to encourage banks to develop end use better risk management methods in monitoring and managing risks. Supervisory review will increase the likelihood of an early intervention if capital does not sufficiently absorb risks inherent in business activities. It will ensure each bank has sound internal processes to evaluate the adequacy of its capital based on a thorough assessment of its risks (Bessis, 2011).
- In the Pillar 3, information disclosure is enhanced to maintain the key objective of BCBS, market discipline. Regulatory disclosure requirements enable market participants to access key information on a bank's regulatory capital and risk exposures to improve transparency.

In principle, the amount of capital that a bank should hold must be able to absorb all expected losses, and leave enough room for the bank to continue operating (Choudhry, 2012).

One of the key ratios used in considering how much capital a bank needs is the capital adequacy measure, which is obtained by the division of capital to total assets. Capital-to-assets ratio is able to capture the riskiness of a bank as capital

may absorb potential losses on the bank's assets. Consequently, high leverage, equivalently, low capital-to-assets ratio, is riskier since a bank holds less capital to absorb losses and less likely to repay its liabilities. Regulatory institutions impose minimum capital requirements on banks, yet, they often endogenously prefer holding more capital due to additional credit-exposures (Saunders and Schumacher, 2000). However, holding equity capital rather than debt is costly, and so banks with higher capital ratios try to cover some of this cost by increasing net interest margins, or exerting downward pressure on deposit rate.

Liquidity Risk

Many banks, during the early period of the global financial crisis, faced difficulties since they did not manage their liquidity in a prudent manner in spite of being endowed with adequate capital levels (Basel III, 2013). After the crisis, market participants witnessed how quickly liquidity can evaporate, and that illiquidity can last more than expected. Due to wide-spread stress experienced by the banking sector, central bank intervention to support the functioning of money markets and individual financial institutions became necessary.

After an immediate response by publishing Principles for Sound Liquidity Risk Management and Supervision in 2008, Basel Committee developed key reforms regarding liquidity framework by two minimum standards for funding liquidity.

The Liquidity Coverage Ratio (LCR) is designed to promote the short-term resilience of a bank's liquidity risk profile by ensuring that it has enough high-quality liquid assets to survive for one month under a significant stress scenario.

The Net Stable Funding Ratio adds to the LCR and has a time horizon of one year, in which banks are encouraged to fund their activities with more stable sources of funding. Banking Regulation and Supervision Agency (BRSA) in Turkey asked banks to calculate their LCR's from 2014 onwards, and specified a minimum requirement in 2015 separately for Turkish Lira and foreign exchange. NSFR will become a minimum standard by January 2018.

Considering the fact that the liquidity transformation is closely related to deposit collection and lending facilities of the banks (Kashyap et al., 2002), the most frequently used indicator of liquidity is the ratio of total loans to total deposits. Loan-to-deposit ratio is also closely monitored by the bank investors as it offers hints regarding the long run or structural liquidity position of a given bank. If loan-to-deposit ratio is too high, the bank may not have sufficiently stable sources for the unforeseen stressed conditions, implying higher risk for the bank and higher deposit rate the bank will have to offer.

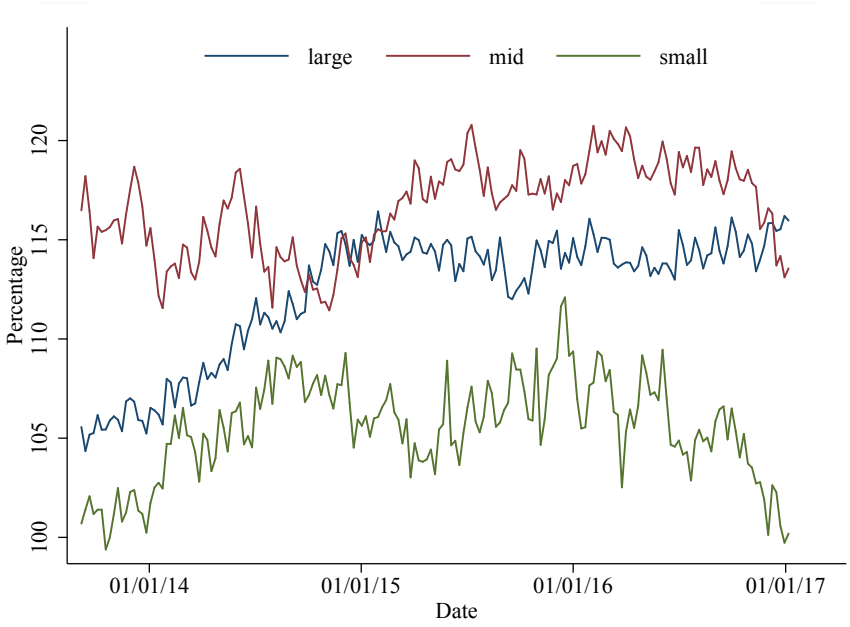
Acharya and Mora (2015) claim that during the global financial crisis of 2008, as lending growth outpaced deposit growth, the US banking system suffered from illiquidity and sought to adopting aggressive pricing measures to attract deposits. This was followed by the competition in deposit collection. In Turkey, Alper et al. (2016) find that banks with poor quality in terms of liquidity highly demand deposits, and that a loan-to-deposit ratio greater than 110% is a significant determinant in deposit pricing.

The loan-to-deposit ratio of deposit banks used in this analysis was approximately 110% at the end of 2016, which indicates that a relatively high share of the banks'

loans are not covered by deposits and banks rely on additional sources of money to create loans.

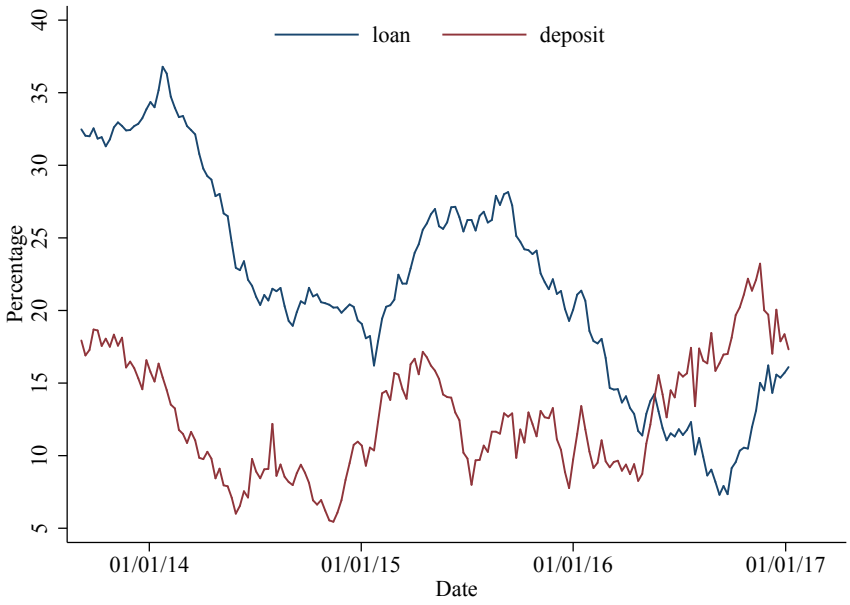
Figure 1 illustrates the average loan-to-deposit ratio across different size groups of banks. The increasing ratio in the middle of 2016 is accompanied by increases in deposit rates as stated in Alper et al. (2016) since banks with liquidity problems started to price more aggressively.

Figure 1: Mean Loan-to-Deposit Ratios by Size Classes



Annual deposit and loan growth in whole banking industry is displayed in Figure 2. With the aggressive competition of deposit collection, the deposit growth catches up with the loan growth.

Figure 2: Year-over-Year Growth of Total Loans and Total Deposits



Foreign Exchange Risk

Foreign exchange (forex) risk, also referred to as exchange rate risk, is the risk emerging from an unexpected change in the exchange rate. Specifically, forex risk may be defined as the potential loss in an organization's assets and liabilities due to currency movements (Papaioannou, 2006). Catão (1998) argues that a change in the exchange rates or in the US dollar denominated interest rate have an immediate effect on the cost of liabilities, whereas its impact on the assets side comes with a lag. This means that those banks that fail to increase deposit rates in line with rises in exchange rate will instantly face deposit outflow.

Net Open Forex Position is the division of the difference between forex assets and forex liabilities in the balance-sheet to total loans. A bank with an open position

in foreign exchange, mostly US Dollar, is heavily vulnerable to sudden changes in the exchange rate. As in the case of the 1994 financial crisis, the banks with open position had difficulties in repaying, and even some went bankrupt. Similarly, the drastic open position of banks played major roles in the financial crises of November 2000 and February 2001, which ended up with the bankruptcy of more than 20 banks. Consequently, the increase in the net foreign exchange position of a bank is associated with an elevated forex risk; therefore, it is positively related to the deposit rate.

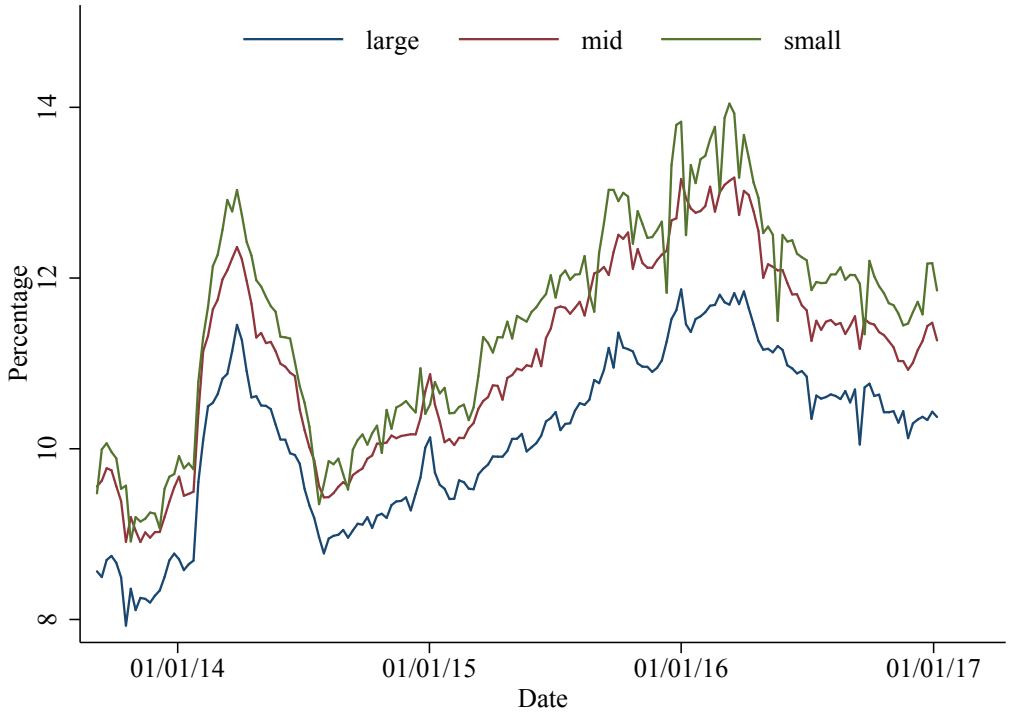
Bank Size

The size of a bank is considered to be a relevant indicator as the size reflects a bank's transactions that is exposed to the operational risk. Larger the size of a bank, lower the deposit rate that it should offer. Larger organizations are viewed as more reliable, with a low probability of failure, by the depositors (Hannan and Hanweck, 1988). Likewise, Rosen (2007) infers an inverse relationship between the size and the deposit rate because of the fact that large banks may take advantage of economies of scale and scope to achieve lower cost structures. Park and Pennacchi (2009) argue that significant funding advantages, that are unavailable to small banks, of larger institutions compensate loan operating cost disadvantages. This implies that the bank size inversely affects the deposit rate. The size of total deposits, as a result, is expected to have a negative effect on the deposit rate paid by the banks.

When divided into three groups by deposit size, the mean deposit rate of each size class is depicted in Figure 3. In line with the empirical literature, during the

period of analysis, small banks offer higher deposit rates on average.

Figure 3: Mean Deposit Rates by Size Classes



In the second part of the study, in order to differentiate the competitive conditions across groups, banks are divided into three size classes: small banks (less than 15 billion TL in total deposits), mid-size banks (more than 15 billion TL and less than 70 billion TL in total deposits), and large banks (more than 70 billion TL in total deposits). Bank size is assumed to be affecting the pricing strategy as well as the price level of a given bank.

Securities Portfolio

Another micro-level data analyzing the composition of a bank's assets is the securities that are owned by the bank. Funds secured by banks are invested in a range

of earning assets by risk characteristics or uncertainty (Klein, 1971). Contrary to the private securities (loans), the government securities are free of default risk. In particular, these assets function as a secondary reserve which may be liquidated immediately in the presence of an unexpected deposit loss. High prevalence of economic uncertainty is characterized by the low tendency of banks' extending loans to the real sector. Banking organizations prefer investing in the government debt securities with riskless high return rather than private securities.

Government securities-to-deposits ratio is integrated into the analysis in order to examine the bank behavior in the face of uncertainty (given the fact that government debt securities constitute the largest share in the securities portfolio in a bank). Being a substitute for loans, government debt securities stock of banks are inversely related to deposit rates.

4.1.2 Macrofinancial Conditions

Macroeconomic environment and financial conditions as well as bank-specific elements play a major role in determination of the deposit rates.

Benchmark Interest Rate

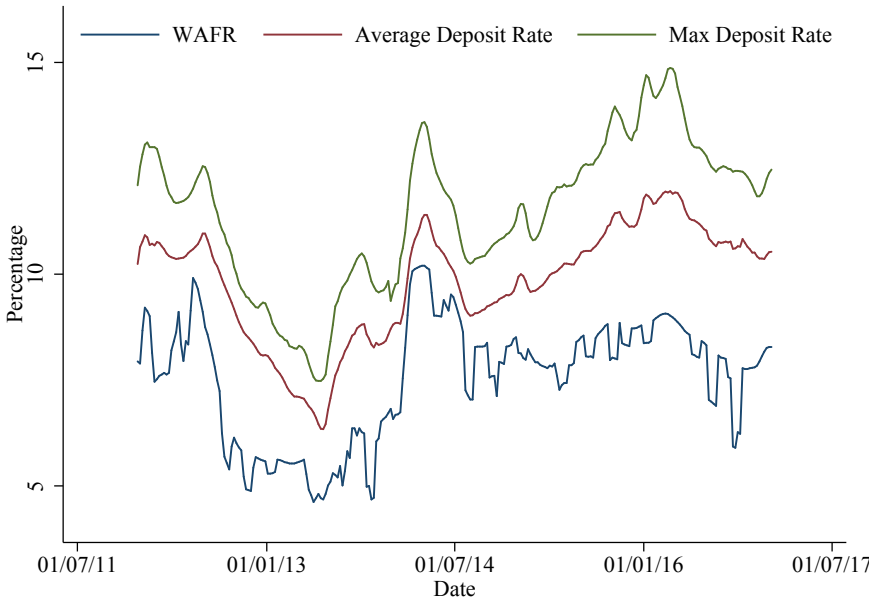
Transmission of monetary policy, through market interest rates, is another significant element that deposit banks consider while pricing deposits and loans. Due to its highly low probability of default, interest rate imposed by a central bank may be seen as a risk-free interest rate. Although a number of policy instruments of the CBRT - such as announced policy rates of funding rate and borrowing rate, and effective rate of weighted average funding rate - complicates the determination of a proxy for risk-free rate, in a recent paper (Binici et al., 2016) it is found that

WAFR is the most notably determinant of short-term deposit rates.

Composed of weekly funding and overnight funding, the WAFR is an important component of the cost of total funding of the banks. Since the banking organizations in Turkey is the net borrower from the central bank, which often uses WAFR to control monetary policy stance through changes in funding composition, it is included as an explanatory variable in empirical analysis.

Figure 4 displays the three series: the maximum interest rates paid on deposits; the average deposit rates; and the weighted average funding rate (WAFR), which is known to be effective policy rate, of the Central Bank of Republic of Turkey over the period of analysis. As expected, the (average) deposit rates take values between the maximum interest rates and the WAFR. Despite the recent reductions in the policy rates, and so the WAFR, however, the average deposit rate seems to move closer to the maximum deposit rate and diverge from the WAFR. In fact, the stronger correlation between the average deposit rate and the maximum deposit rate further indicates the possibility of an increased level of competition in the banking market.

Figure 4: Evolution of the Deposit Rate in Turkey



Banking Sector Risk

Retrieved from Bloomberg at monthly frequency, Banking sector risk score is designed by the Economist Intelligence Unit for measuring and comparing risk across countries. The Country Risk Model provides risk scores ranging from low risk (0) to high risk (100) and ratings of six categories, which are sovereign debt, currency, banking sector, political, economic structure, and overall country risk. According to the model, banking sector risk measures the risk of a systemic crisis whereby banks holding more than 10% of total bank assets become insolvent and unable to pay back their obligations to depositors and/or creditors.

This indicator is utilized to capture the overall soundness of the Turkish banking sector. An increase in the risk score implies worsening of the fragility of the banking organizations in the face of general risk, and hence an increase in deposit rates.

Exchange Rate Volatility

Exchange rate risk in the form of USD/TL volatility is included into the analysis in order to account for the external conditions and market expectations. 3-month implied USD/TL volatility is extracted from Bloomberg database, calculated by equating Black-Scholes formula to the European option price. Implied volatility rather than historical (realized) volatility of the exchange rate is taken into consideration in order to incorporate the future investment decisions of depositors and expectations regarding the economic outlook.

Although implied volatility does not predict the direction in which price change will go, highly volatile USD/TL rate - which is usually accompanied by weak domestic economic outlook, and hence elevated risk perception- implies higher currency risk for banks. Deposit rates, therefore, should be higher to attract depositors. Further, US Dollar is viewed as a significant investment instrument in Turkey, especially when economic fundamentals worsen. Outweighing the alternative of depositing in Turkish Lira in the household portfolio indicates that the exchange rate dynamics play a central role in pricing behavior of the banks.

Risk Appetite

The Global Risk Appetite Index (GRAI) of Credit Suisse measures the attitude of investors towards risk. Produced by Wilmot et al. (2004), GRAI index compares the risk that is in the form of past price volatility and excess returns across assets. The index is based on daily data on 64 global assets of bonds and equities in

developed and developing economies. Serving as a significant measure of investor sentiment, bad news lead the risk appetite to fall into "panic", whereas good news shift it to "euphoria" mode.

Improving market sentiment, or increasing risk appetite, will induce investors to choose more "risky" instruments than relatively "safer" alternative methods of savings like depositing their money into banks. Therefore, GRAI, which is transformed into weekly data, is expected to be negatively related to the deposit rates.

Market Structure

The traditional proxy to test the market structure in the banking sector has been the HHI and/or Concentration ratios (for n banks). HHI is calculated by the sum of squared market shares of each firm in an industry:

$$HHI = \sum_i \left(\frac{deposit_i}{\sum_i deposit_i}\right)^2 \tag{6}$$

On the other hand, n-bank concentration ratio takes into account n banks only. More specifically, it is the sum of the market share percentage held by the largest specified number of firms in an industry. To illustrate, the three-firm concentration ratio is calculated as the following.

$$CR_3 = \left(\frac{\sum_{j=1}^{3} deposit_j}{\sum_{i=1}^{N} deposit_i}\right) \tag{7}$$

where $deposit_j$ is the amount of deposits of the jth largest bank, and N is the number of banks operating in the industry.

Both measures are generally employed by regulators to evaluate the competitive effects of mergers and acquisitions, and by researches examining the market conditions in an industry. HHI gives heavier weights to firms with large market shares than to firms with small shares because of squaring the markets shares. This feature of the HHI implies that the greater concentration of output (deposits in this context) in a small number of firms (a high HHI), the greater the probability that competition in a market will be weak (Rhoades, 1993). In the standard economic theory, structure-performance hypothesis implies that market concentration (higher values of HHI) leads to prices less favorable to depositors. Therefore, it is expected to observe an inverse relation between market concentration and deposit rates.

It should be noted that the conventional measure of market concentration ignores the separate layers and groups in a market. Rather, it treats the organizations as a whole, and tests the degree of competition disregarding the differences in market powers of firms. Rival rate notion, therefore, is incorporated into this analysis to account for the group differences based on the assumption that each size competes against those in the same size group. With this notion, the reaction of each bank to the change in the average rate of the rest of the banks with similar size can be measured.

The empirical model variables, their proxies, and the expected coefficient signs are reported in Table 2.

Table 2: Empirical Model Variables

Variable	Proxy	Expected coefficient sign
Liquidity risk	$^{\text{Loans}}/_{\text{Deposits}}$	+
Capital risk	$^{\text{Capital}}/_{\text{Assets}}$	-
Forex risk	$^{\text{(Net forex position)}}/_{\text{Loans}}$	+
Size	Natural logarithm of bank deposits	-
Bonds	$^{\text{(Government securities)}}/_{\text{Deposits}}$	-
Exchange rate volatility	Volatility of USD/TL rate	+
Banking sector risk	EIU Banking sector risk score of Turkey	+
Risk appetite	Credit Suisse GRAI	-
HHI	Sum of squared market shares of deposits	-
Rival rate	Weighted average deposit rate in the same size class	+

Summary statistics for all variables included in the analysis are listed in Table 3. Note, in particular, that deposit rate increases on average over time despite the decline in weighted average funding rate, indicate a relatively great increase in the importance of competition in deposit market.

Table 3: Descriptive Statistics

Variable	2014		2015		2016	
	mean	SD	mean	SD	mean	SD
Deposit rate (%)	10.3969	1.1741	11.2150	1.2364	11.8305	1.2135
WAFR (%)	8.9506	.9267	8.4319	.3767	8.364	.4305
Loan-to-deposit ratio (%)	109.7215	19.415	111.9187	20.068	111.8194	18.2185
Government securities-to-deposit ratio (%)	21.4721	11.1719	18.682	10.0633	19.1302	10.4037
Bank deposits (TL Billion)	41.9619	44.2545	50.0955	52.97	56.86621	60.794
Net forex position-to-loan ratio (%)	-.9611	1.4331	-1.1514	1.8767	-.5907	1.6869
Capital-to-asset ratio (%)	23.1302	8.5065	23.5414	8.1380	20.7611	7.2629
Banking sector risk score	46.6731	.4693	46.8654	.8998	47.6793	1.1126
Exchange rate volatility	11.153	1.876	14.3581	1.3587	12.6992	1.6371
Risk appetite	.1136	1.0246	-.6257	1.6264	-.6746	1.6286
HHI	959.1962	7.5943	958.5674	4.8198	971.3081	6.3402

4.2 Empirical Specification & Methodology

In order to isolate the effect of competitive behavior on pricing, initially, the impacts of macroeconomic and bank-level factors on deposit rates are controlled. In the second step, the market structure's influence on deposit rate determination is investigated considering the size class concept.

The empirical specification is the following.

$$\begin{aligned} r_i =& \alpha_0 + \alpha_1 LTD_i + \alpha_2 BONDS_i + \alpha_3 \text{SIZE}_i + \alpha_4 CAP_i \\ &+ \alpha_5 FX_i + \alpha_6 FIN + \alpha_7 r^b + \alpha_8 USDVOL + \alpha_9 RA + \varepsilon_i \end{aligned} \tag{8}$$

Dependent variable, r_{it}, is the interest rate offered on deposit account by bank i. In order to avoid a potential endogeneity problem and mitigate the simultaneous effects of independent variables, lags of the independent variables are incorporated. r^b is the average funding (benchmark) rate; LTD and BONDS are the ratios of loans to deposits and government securities to deposits of bank i, respectively; FX is the net foreign exchange position-to-loans ratio; CAP is the ratio of capital to assets; SIZE is the natural logarithm of total deposits; USDVOL is the implied exchange rate volatility; FIN is the Banking sector risk score; RA is the measure of global risk appetite.

The implications of the empirical model 8 is tested by using pooled time-series cross-section OLS with panel-corrected standard errors. It is realistic to expect different variances for the different cross-sections, or banks. When computing the standard errors and the variance-covariance matrix, this procedure assumes that error terms for banks and/or markets are heteroscedastic and contemporaneously correlated (Berger and Hannan, 1989).

Afterwards, predicted values of deposit rates obtained by the estimation of 8 are utilized as a dependent variable to investigate the competitiveness in the deposit market. Consequently, the following regression is run in the second step.

$$\hat{r}_{it} = \beta_0 + \beta_1 r_{-it} + \mu_{it} \tag{9}$$

with $\hat{r}_{it}$ is the deposit rate estimates controlled for risk factors, and r_{-it} is the measure of the reaction of bank i to the change in the pricing of its competitors that operate in the same class.

The categorical variables of deposit size are also used in the second step of estimation in order to examine the variation in the degree of market conditions across size classes.

5 Results

Before reporting the estimation results, some serial correlation tests should be performed to determine a general specification.

$$\begin{aligned} r_{it} =& \alpha_0 + \alpha_1 LTD_{it} + \alpha_2 BONDS_{it} + \alpha_3 \text{SIZE}_{it} + \alpha_4 CAP_{it} \\ &+ \alpha_5 FX_{it} + \alpha_6 FIN_t + \alpha_7 r_t^f + \alpha_8 USDVOL_t + \alpha_9 RA_t + \varepsilon_{it} \end{aligned} \tag{10}$$

Based on the specification that uses current values of independent variables Equation 10, Wooldridge test (Wooldridge, 2002) reveals that null hypothesis of no first-order autocorrelation in panel is rejected. This result confirms the need for a dynamic specification, and this is why the lagged values of independent variables are employed rather than their current values as in Equation 11.

$$\begin{aligned} r_{it} =& \alpha_0 + \alpha_1 LTD_{it-1} + \alpha_2 BONDS_{it-1} + \alpha_3 \text{SIZE}_{it-1} + \alpha_4 CAP_{it-1} \\ &+ \alpha_5 FX_{it-1} + \alpha_6 FIN_{t-1} + \alpha_7 r_{t-1}^f + \alpha_8 USDVOL_{t-1} + \alpha_9 RA_{t-1} + \varepsilon_{it} \end{aligned} \tag{11}$$

The results of the regression explaining the heterogeneity of deposit rates by risk components is summarized in Table 4. First and third columns the results obtained through OLS with panel-corrected standard errors. Second and fourth columns are the estimation results of fixed effects model. Time dummies are not included into fixed-effects since macroeconomic and financial variables display variation over time and not across banks.

For comparison with the existing literature, the first two columns report the findings of regressions that include the conventional test element of market structure, namely HHI. The empirical results imply that, contrary to the previous studies and expectations, increasing market concentration does not result in lower deposit rates since the coefficient on HHI is positive. This finding seems suspicious especially given the fact that first and second regressions have results not consistent with expectations. Therefore, it is considered as a sign to adopt a more complex and differentiating indicator for separate segments of deposit market should be used rather than a comprehensive measurement of market concentration.

First column shows that solvency risk (capital ratio), open position in foreign exchange of banks, and overall health of the banking sector are statistically insignificant. Moreover, results in the second column indicate that coefficients on size and the overall soundness of the banking sector are opposite to what is expected. This is why HHI is excluded in the rest of two regressions, and rival rate is included in the second step of estimation.

Third and fourth columns of the Table 4 are the first stages of a two-step estimation procedure. Column (3) shows that effective policy rate has a quite strong impact on the deposit pricing behavior of the banks. Monetary transmission channel, therefore, functions effectively. In line with the mainstream economic theory, larger banks offer lower deposit rates compared to smaller banks. Despite the recent deposit competition resulting from the poor liquidity position of banks, the loan-to-deposit ratio appears to have a limited, yet significant effect. Currency risk in the form of exchange rate volatility explains the price setting to a large extent. Higher capital ratio and greater holdings of the government securities of banks are

found to be inversely affecting the deposit rates as expected. Net foreign exchange position of banks has an insignificant effect on price-setting behavior of banks. The reason for that might be that open position of banks in foreign exchange cannot capture the risk exposure emanating from exchange rate fluctuations because in Turkey BRSA encourages banking organizations to engage in hedging through off-balance sheet transactions. In fact, banks can close out their open position in foreign exchange by derivative acquisitions and sell-offs. Increased risk perception in the banking sector is associated with higher deposit rates overall. Meanwhile, rise in risk appetite in global level corresponds to a large decline in deposit rates through channeling household investment to more risky instruments rather than depositing.

Fourth column in Table 4 reports the results obtained by fixed effects model. The coefficients of the independent variables are mostly similar in sign and magnitude to the those estimated through time-series and cross-section OLS. Yet, size is found to be positively related to deposit rates, contrary to the empirical evidence. The coefficient on the loan-to-deposit ratio is positive, but, it is statistically insignificant. Further, the banking sector risk score affects deposit pricing impartially according to fixed effects estimation.

Under the assumption of heteroscedastic and contemporaneously correlated disturbances, initial method (pooled OLS) is favored for the second step of estimation regarding the competitive conditions. Fixed-effects estimation results are used too for robustness check.

Table 4: Regression results for deposit rate

	(1) OLS	(2) FE	(3) OLS	(4) FE
HHI_{-1}	0.0464***	0.0430***		
	(9.02)	(27.52)		
LTD_{-1}	0.00478***	0.00776***	0.00389***	0.00294
	(5.79)	(4.32)	(4.56)	(1.49)
CAP_{-1}	-0.00269	-0.00786***	-0.00586*	-0.0129***
	(-1.18)	(-3.51)	(-2.45)	(-5.26)
$BONDS_{-1}$	-0.0369***	-0.00138	-0.0345***	0.00883**
	(-19.99)	(-0.48)	(-16.41)	(2.81)
FX_{-1}	0.00212	0.00923	0.0107	0.0393**
	(0.25)	(0.74)	(1.22)	(2.86)
$SIZE_{-1}$	-0.175***	2.417***	-0.179***	2.594***
	(-14.84)	(27.23)	(-14.00)	(26.61)
FIN_{-1}	0.0101	-0.122***	0.216***	0.0575***
	(0.21)	(-8.18)	(4.20)	(3.88)
$USDVOL_{-1}$	0.154***	0.107***	0.149***	0.103***
	(8.43)	(18.85)	(6.65)	(16.49)
$WAFR_{-1}$	0.743***	0.698***	0.602***	0.571***
	(15.47)	(48.28)	(10.88)	(37.86)
RA_{-1}	-0.315***	-0.252***	-0.241***	-0.183***
	(-11.03)	(-28.92)	(-7.20)	(-19.94)
Constant	-41.74***	-44.58***	-5.262*	-10.89***
	(-9.26)	(-31.54)	(-2.13)	(-14.01)
Observations	3594	3594	3594	3594
R^2	0.588	0.786	0.533	0.740
Adjusted R^2		0.784		0.738

z statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Bank dummies included in FE estimation but not shown.

In the second stage, the predicted values of the deposit rate from the third and the fourth regression results are regressed on the conjectural variation of the competitors in the same size class. In order to differentiate the degree of competition across size classes, class is integrated into the regression analysis.

Table 5: Regression results for market structure

	(1) $\hat{r_i}^{OLS}$	(2) $\hat{r_i}^{OLS}$	(3) $\hat{r_i}^{FE}$
Rival rate	0.603***		0.647***
	(24.70)		(78.89)
Rival rate$_S$		0.572***	
		(20.44)	
Rival rate$_M$		0.550***	
		(19.77)	
Rival rate$_L$		0.529***	
		(17.21)	
Constant	4.444***	4.997***	3.857***
	(16.80)	(16.04)	(41.18)
Observations	3594	3594	3594
R^2	0.556	0.585	0.776
Adjusted R^2			0.775
Coefficient tests[a]			
Rival rate$_S$ = Rival rate$_M$		0.000	
Rival rate$_S$ = Rival rate$_L$		0.000	
Rival rate$_M$ = Rival rate$_L$		0.000	

z statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

S: size small, M: size mid, L: size large

Bank dummies included in FE estimation but not shown.

[a] p-values for test of equality across size classes.

Table 5 summarizes the regression results based on the predicted values of the third and fourth regressions in Table 4. In the first column, predicted values of the pooled OLS model are regressed on the rival rate of each bank without class consideration. Column (2), with the dependent variable obtained from pooled OLS estimation results, includes the size class into analysis, and interaction terms are used to test the market conditions across different clusters. Predicted values of

fixed-effects estimations are used as the dependent variable in the final column of Table 5.

As demonstrated in Table 5, the coefficient of conjectural variation, rival rate, is smaller than unity for all cases, implying an imperfect competition in deposit market. Columns (1) and (3) ignore the separate layers in the deposit market, yet both indicate that banks do not fully respond to the actions of their competitors. Although size class is not included in these estimations, their findings are important for robustness check.

Column (2) integrates size segments into the study. In line with the expectations, the coefficient is the largest for the small size group, proving the assumption that small banks bid more aggressively. The degree of competition in deposit market is higher for mid-size banks compared to larger ones as well. Finally, the banks with largest market share do not react the change in price of its competitors as much as the banks in other sizes do, indicating they are able to exercise market power more intensely. The test on the equality of coefficients of size classes is strongly rejected so that the inverse relationship between size clusters and the degree of competition is statistically significant.

As discussed earlier, the reason might be that larger banks do not rely on deposits as much as smaller banks in terms of source of funds. Further, the depositors do not switch their banks very frequently due to their loyalty to; and reputation, reliability, and proximity of larger banks.

6 Summary and Conclusion

In this study, a basic model designed to explain how banks set deposit interest rates is employed. The risk premium of a bank - spread between the deposit rate and the benchmark rate - resulting from global, national, and bank-specific factors are examined. Market conditions are also included in the analysis under the assumption that banks compete the others in the same cluster. In the first stage of the two-step empirical analysis, effective policy rate, used to represent the monetary stance, is the strongest determinant in explaining the deposit rates. Although all the bank-level variables play central role in deposit pricing, estimation findings show that size is the dominant factor through its effects on deposit rate level and the competitive conditions. Consistent with the existing body of literature, an expansion in bank size is negatively associated with the deposit rate. This is why it is considered that risk premium itself is composed of "size premium" to a large extent.

As argued by Vives (2001), size offers the possibility of exploiting scale economies from overhead in administrative and back-office operations, technology, and in investment banking type operations like fund management. Size, also, enables banks to realize scope economies of combining different product lines. Moreover, a large bank may be too big to fail, and creditors of a too-big-to-fail bank expect a public bailout since the failure would present a general threat to the financial stability. Thus, large banks may enjoy advantages in pricing deposits and have larger room to affect regulation. Jacewitz and Pogach (2013) find that even after controlling for common risk variables largest banks received a discount on risky deposits of almost 40 basis points compared to smaller banks, in line with subsidy provided to too-big-to-fail institutions between 2006 and 2008.

Second step of the estimation carries out the test of market structure. After constructing a response function for each bank as a reaction to its rivals in the same size class, the degree of competition within size groups and across groups is examined. All three size classes are found to be imperfectly competitive, and it is shown that the size is inversely related to the competitive pressure. In a nutshell, the results suggest that smaller banks offer higher interest rates and compete more aggressively.

The policy implication of the results is that monitoring external factors besides the bank-specific indicators is relevant for assessing the influences of monetary transmission on deposit rates. Considering the upward movement in deposit rates despite the monetary easing period of 2016, overall risk factors other than bank-specific characteristics may affect the price-setting of the deposit banks.

Estimation results lead us also to speculate about the implications of varying market conditions across size classes and the potential agreements which may arise within groups. Since the banks with similar deposit size compete, banks that operate in the same size class are more likely to collude. In fact, an actual case of infringement of competition in banking sector provides real-life evidence for this argument.

The decision of Turkish Competition Authority on whether 12 banks operating in Turkey violate the act of Protection of Competition through making agreements and/or engaging in concerted practices related to deposit, loan and credit card services from 2007 to 2011; and fines given to these banks upon the said decision in March 2013 are important in supporting the findings provided by this study

since most of the banks penalized are categorized under the large class. Specifically, their collusive behavior in deposit market through specifying and offering lower rates on deposits was evaluated as an action infringing the competition. Policymakers and regulatory institutions, therefore, might evaluate the competitive conditions regarding the fact that competition within the size class and across size groups may differ, and similar price-setting behavior of similar-sized banks may induce them to engage in collusive behavior.

This might be another reason for the outcome of market structure determinants such as HHI and CR being not in line with usual direction in the literature. If prevails, collusion prevents competition, leaving related determinants meaningless or insignificant in the estimations.

This study can be extended by integrating the ownership dimension. Existing literature highlights the ownership of banks operating in Turkish banking industry (Akinci et al., 2013; Alper et al., 2016; Akin et al., 2013). It remains the subject of future research to investigate the heterogeneity of price-setting behavior of banks by differentiating them into groups by ownership. For instance, depositors may consider public banks less likely to fail or more likely to be compensated in any event of failure compared to private banks, which leads those banks to pay lower deposit rates. Also, general budget institutions are required to deposit in the government-owned banks, which may reduce the dependence of state banks on retail deposits, and hence lower deposit rates applied by these banks. Discriminating banks into foreign and domestic groups would be useful as well, given the discussions on the efficiency of these organizations. New entrants especially foreign banks, offer higher rates by "welcoming deposit rate" campaigns quite often, may be seen as another segmenting criterion for different pricing behavior.

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