Concentration and Competition in the Banking Sector of Turkey

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Abstract
The paper estimates the competitive conditions and concentration in the Turkish banking industry during the period 2002-2010. The period starts after implementation of the comprehensive reform in the banking sector and lasts until culmination of the global financial crisis. The concentration ratio and the Herfindahl-Hirschman index are applied to measure level of concentration. We found the banking sector to be almost non-concentrated with exemption of deposit market where we revealed a slight concentration. However, there is a clear trend of increasing concentration at all segments of the Turkish banking sector over the analysed period. The Panzar-Rosse model is used for estimation of competitive conditions in the banking market. Specifically, we use a panel with data for most of the Turkish banks to estimate the $H$ statistics. We concluded that the Turkish banking sector can be characterized as an industry with monopolistic competition that closely approaches monopoly. The results imply that banks in Turkey do not operate in a competitive environment and enjoy monopoly rents. Moreover, we revealed decreasing level of competition during the entire period of estimation. Such a market structure can pose a threat for efficient intermediation of funds through the banking sector and promoting of economic growth.

Keywords: Turkish banking industry, concentration ratio, Herfindahl-Hirschman index, Panzar-Rosse model

JEL Classification: D40, G21

Introduction
The financial sector in Turkey has been traditionally dominated by banks even though the banking sector experienced several systemic crises since late 1970s. The Turkish banking sector went through major consolidation during 1999-2003 in the aftermath of a failed disinflation programme (December 1999–February 2001), a devastating financial crisis and a renewed International Monetary Fund programme that brought about the recovery (Steinherr et al., 2004). After the banking and currency crises in November 2000 and February 2001, the government initiated a comprehensive Banking Sector Restructuring and Rehabilitation Program (Kibritçioğlu, 2005).

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The initial efforts were directed toward making extensive amendments in the Banking Law. In June 1999, a new Banking Act was passed, which, among others, called for the establishment of a new autonomous banking agency and the resumption of its operations, in September 2000 (Steinherr et al., 2004). The Banking Regulation and Supervision Authority (BRSA) was established as a regulatory and financial authority with administrative and financial autonomy in banking sector. Duties and authorities regarding the supervision and regulation of banks which were previously shared by the Treasury and the Central Bank in the past were transferred to BRSA which started its operations in August 2000 (The banks association of Turkey, 2009).

Table no. 1: Number of banks in Turkey

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
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<tbody>
<tr>
<td>Number of banks</td>
<td>54</td>
<td>50</td>
<td>48</td>
<td>47</td>
<td>46</td>
<td>46</td>
<td>45</td>
<td>45</td>
<td>45</td>
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<tr>
<td>Deposit banks</td>
<td>40</td>
<td>36</td>
<td>35</td>
<td>34</td>
<td>33</td>
<td>33</td>
<td>32</td>
<td>32</td>
<td>32</td>
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<tr>
<td>State-owned banks</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Privately-owned banks</td>
<td>20</td>
<td>18</td>
<td>18</td>
<td>17</td>
<td>14</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Banks in the SDIF*</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Foreign banks</td>
<td>15</td>
<td>13</td>
<td>13</td>
<td>13</td>
<td>15</td>
<td>18</td>
<td>17</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Dvlpt. and invest. banks</td>
<td>14</td>
<td>14</td>
<td>13</td>
<td>13</td>
<td>13</td>
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<td>13</td>
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</tr>
</tbody>
</table>

* Saving Deposit Insurance Fund (TMSF)

Source: Abbasoglu et al. (2007), Annual reports of Saving Deposit Insurance Fund (TMSF)

Table no. 1 shows development of number of banks active in Turkey over the period 2002-2010. Although one can observe a decrease in total number of banks from 54 to 45 this can be considered as a marginal reduction in comparison with decrease between 1999 and 2002. Whereas there were 81 banks and 7,691 bank branches in Turkey in 1999 the banking sector consisted only from 54 banks and 6,106 bank branches in 2002. It represents a drop of 33% for banks and 21% for branches. The change in total number of banks during the observed period can be fully attributed to reduction in category of domestically owned private banks. Other categories remained stable. As it is presented in Table no. 1 one can distinguish two main types of banks in the Turkish banking industry. While the deposit banks are traditional commercial banking institutions that collect deposits and provide loans to customers, the development and investment banks that are not licensed to accept deposits and provide other services typical for commercial banks.

Following the crisis in 2001 and the restructuring process, the banking sector showed a rapid growth of performance in 2002-2010 periods. In early 2004, relative macroeconomic stability appeared to have been achieved, and having gone through the worst, the sector appeared set for the next phase of consolidation and growth (Steinherr et al., 2004). The total assets and also their ratio to GDP rose. The numbers of branches and staff rapidly increased. In this period, the financial structure of the sector also became stronger. The shareholders’ equity of the sector increased. The risk management systems improved and public supervision became more effective in this period. It was, among others, reflected in the share of non-performing loans on total loans which substantially decreased. The positive developments recorded by the banking system in 2002-2010 period...
have several reasons, including the favourable domestic and international economic situation and the change in the risk management conception. Another important reason is the success of the “Banking Restructuring Program” (The banks association of Turkey, 2009).

From the perspective of impact of banks on real economy, maybe the most important result of the Turkey’s crisis at the beginning of the 21st century is the banks’ willingness to reallocate their assets from financing the government to providing needed capital to the private sector. On the other hand, companies shifted toward equity financing and away from debt financing in the post-crisis period. In other words, there was a sharp decline in reliance on bank credit in the post-crisis period.

The aim of this paper is to examine the degree of the competition and concentration in the Turkish banking industry during the period 2002-2010. We analyse competition and concentration after year 2002 when a complex reform of regulation and supervision of banks has been been implemented by the Turkish government. We use the concentration ratio and the Herfindahl-Hirschman index to estimate the degree of concentration of the Turkish banking industry. For finding the degree of competition it is applied the New Empirical Industrial Organization approach, especially the Panzar and Rosse (1987) approach based on panel data for commercial banks in Turkey.

The structure of this paper is as follows. After the introduction, a review of relevant literature is provided. The second section describes theoretical approaches to concentration and competition in banking. The third section introduces data and methodology used in the paper and fifth section presents empirical results and respective discussion. In last section we conclude the study with interpretation of main findings and some policy implications.

1. Literature review

Even there are many researches about the Turkish banking system, there are only several empirical studies that analysed competition and concentration in the banking sector in Turkey. Gunalp and Celik (2006) used the Panzar-Rosse $H$ statistic to assess the competitive environment of the Turkish banking industry over the period 1990-2000. The results indicate for the period under consideration that bank’s revenues behaved as if they were earned under conditions of a monopolistic competition. Also Abbasoglu et al. (2007) suggested that in spite of recent merger and acquisition activities, Turkey’s banking sector is still characterized as non-concentrated in the period 2001-2005. They also revealed that the $H$ statistics were always between zero and one, which can be interpreted as an evidence for the existence of the monopolistic competition in the Turkish banking sector even if the values of the $H$ statistics decreased from 2001 to 2005. Their findings do not show a clear relationship between concentration and competition.

Yayla (2007) found that concentration in the relevant markets shows a decreasing trend in the period of 1995-1999 and increasing tendency in 2000-2005. However, net interest margins which can be seen as the relevant prices in the sector had declined in both periods. Masood and Aktan (2010) examined competitive structures of 17 paramount banks in the Turkish banking sector over the period 1998-2008 and investigates factors that can explain differences in the degree of competitiveness. Their results indicate that Turkey banking sector is in an equilibrium state, actually they are in the long run equilibrium. The banks in Turkey are operating as a whole under conditions of monopolistic competition. They
observed market power resulting from high concentration levels in Turkey does not exclude the competitive behaviour. This suggests that the degree of competition in banking was affected by different factors for differences. They concluded that due to high concentration in the Turkish banking system in the last decade, the market power for the leading firms was reduced. Yaldiz and Bazzana (2010) calculated the average Lerner index 0.9674 in period 2001-2010, which indicator implies the banks in Turkey do not operate in a competitive environment, and enjoy monopoly rents. With this calculation of market power, it is seen that Turkey has a less competitive banking sector than, particularly, the EU economies. In a recent study Carbo et al. (2009) calculated the average Lerner index 0.16 for EU countries.

As regard to theoretical foundation and methodology the literature relevant to the present study builds also on papers dealing with other than only Turkey’s banking sector. For instance, Daley and Matthews (2012) analyzed competitive conditions in the Jamaican banking sector using Panzar-Rosse model. Hoxha (2013) investigates the effect of the market structure of the banking sector on the performance of manufacturing sectors of 37 countries of the world using H-statistic competition index and concentration ratio and Herfindahl-Hirschman index. Rezitis (2010) focuses on competition of the Greek banking sector employing Panzar-Rosse approach in the period 1995-2004. All the cited studies apply the same methodology and empirical procedures as the present paper.

As it is evident from the literature review, there has not been published any study that concurrently investigates concentration and competitive condition in the Turkish banking sector in recent years. Our paper, therefore, extends and revises the existing knowledge about crucial parameters of the banking industry up to culmination of the global financial crisis. Moreover, we apply the methodology that is most commonly used in international as well as national analysis of banking concentration and competition. Hence, the results on the Turkish sector are easily comparable with findings of other similar studies.

2. Theory of concentration and competition

Concentration and competition became a recurrent topic in the banking literature. Specifically, during the last decade a great deal of empirical work has attempted to measure the level of competition prevailing in banking markets. The conventional view which holds that increasing concentration may lead to undesirable exercise of market power, i.e. that concentration impairs competition, has been subject to an enormous amount of controversy (Gutiérrez de Rozas, 2007). Measures of concentration and competition are essential for welfare-related public policy toward the banking market. Concentration and competition are linked to product markets and geographical areas, in theory and in empirical analyses. Banks provide a multitude of products that do not serve a unique market, and defining a relevant market involves making a preliminary decision about potentially relevant structural characteristics, such as concentration and competition (Bikker and Haaf, 2000).

2.1 Measures of the concentration

The importance of concentration ratios arises from their ability to capture structural features of a market. Concentration ratios are therefore often used in structural models explaining competitive performance in the banking industry as the result of the market structure. As Bikker and Haaf (2002) note that a measure of concentration does not warrant conclusions about the competitive performance in a particular market. Even in a highly concentrated
market, competitive behaviour between the leading banks is still possible. Concentration ratios are also able to reflect changes in concentration as a result of the entry of a bank into the market or its exit from it, or caused by a merge.

Bikker and Haaf (2000) divide the structure of concentration indices on discrete or cumulative. Discrete measures of concentration correspond to the height of the concentration curve at an arbitrary point. The \( k \) bank concentration ratio, for instance, belongs to this class of discrete measures. Practical advantages of discrete measures are simplicity and limitation of required data. Cumulative measures of concentration, on the other hand, explain the entire size distribution of banks, implying that structural changes in all parts of the distribution influence the value of the concentration index. Cumulative measures of the concentration include e.g. the Herfindahl-Hirschman Index \((HHI)\), the comprehensive industrial concentration index, the Rosenbluth Index and the Hall-Tideman Index as well as the Entropy Measure.

In this paper, we measure competition of the Turkish banking sector by the \( k \) bank the concentration ratio and the Herfindahl-Hirschman index. The concentration ratio \((CR)\) shows the degree to which an industry is dominated by a small number of large firms or made up of many small banks. It has been frequently used indicator in previous empirical studies dealing with concentration of any kind of industry. The fundamental advantages of \( CR \) are natural simplicity and requirement for just basic data. If we only sum up market shares of the \( k \) largest banks in the market \( CR \) can be depicted as:

\[
CR_k = \sum_{i=1}^{k} s_i \tag{1}
\]

It is evident from Eq. (1) that \( CR \) treats equally the \( k \) largest banks but neglects small banks operating in the industry. Al-Muharrami (2009) states that there is no rule for the determination of the value of \( k \), so the number of banks included in the concentration index is a rather an arbitrary decision. The concentration ratio may be considered as one point on the concentration curve, and it is a one-dimensional measure ranging between zero and unity. The index approaches zero for an infinite number of equally sized banks and it equals unity if the banks included in the calculation of the concentration ratio make up the entire industry.

The Herfindahl-Hirschman index is the most widely treated summary measure of concentration in the theoretical literature and often serves as a benchmark for the evaluation of other concentration indices. Bikker and Haaf (2000) defined \( HHI \) as the sum of the squares of the bank sizes measured as market shares. Often called the full-information index because it captures features of the entire distribution of bank sizes, it takes the form:

\[
HHI = \sum_{k=1}^{n} \left( \frac{q_k}{Q} \right)^2 = \sum_{k=1}^{n} r_k^2 \tag{2}
\]

where \( n \) is the number of banks in the banking sector, \( q_k \) is the volume of the output of the bank \( k \), \( k = 1, 2, \ldots, n \), \( Q \) is the volume of the output of the banking sector and \( r_k \) is the share of the output of the bank \( k \) to the output of the banking sector.
Contrary to CR, HHI reflects different size of banks. Larger banks are assigned by a greater weight than smaller banks. Furthermore, HHI counts with each that operates in the market, so that arbitrary cut-offs and insensitivity to the share distribution are avoided. The HHI index ranges between \( \frac{1}{n} \) and 1, reaching its lowest value, the reciprocal of the number of banks, when all banks in a market are of equal size, and reaching unity in the case of monopoly (in a market with only one bank). Sometimes the value of the HHI is multiplied by 10000 and then HHI indices in the range below 1000 show a very low concentration, in the range 1000–1800 show a moderate concentration, in the range above 1800 show a very high concentration of the banking system, whereas the index value equal to 10000 shows a full concentration (monopoly).

2.2 Measures of the banking competition

The literature on the measurement of the competition can broadly be divided into two branches: the (non-formal) structural approach and the (formal) non-structural approach (Bikker and Haaf, 2000). The structural approach centres on the Structure-Conduct-Performance paradigm (SCP) or the efficiency hypothesis. For the SCP, the collusive behaviour among large firms due to a highly concentrated market is the main driver of market over performance. On the other hand, the efficiency hypothesis, implicitly assumes the presence of economies of scale through which large firms achieve increased efficiency and improved performance. Thus, if a firm is more efficient than the rest (e.g., due to a lower cost structure) it could gain market share by reducing prices, and hence, market structure is endogenously shaped by firms performance so that concentration is a result of the superior efficiency of the leading firms. The traditional SCP paradigm and the efficiency hypothesis integrate measures of concentration and competition. Formal derivations of this class of relationships provide evidence of the theoretical appropriateness of both the HHI and the CR as measures of concentration in structural models (Deltuvaitė et al., 2007).

There are three main non-structural models proposed in the literature: Iwata (1974), Bresnahan (1982) and Panzar and Rosse (1987) models. Their derivations are based on oligopoly theory of the Industrial Organisations approach (Bresnahan and Iwata model), or on the comparative static properties of reduced form revenue equations (Panzar-Rosse approach). Whereas both the Bresnahan and the Panzar-Rosse methods were applied to banking sectors in Europe, application of the Iwata model posed difficulties, given the lack of necessary micro-data on the structure of cost and production for quite many banks operating in the European banking markets.

2.2.1 Panzar-Rosse model

According to Panzar and Rosse (1987) the banks’ competitive behaviour is primarily determined by the comparative static properties of reduced-form revenue equations. The Panzar and Rosse (PR) model is the first technique issued on the new theory of industrial organization and applied to the case of banks. The PR model obtained measurements of market power, as well as competition conditions in a sector, by studying the impact of variations in production factors prices over revenues of the sector’s entities. The Panzar and Rosse approach is based on the idea that banks employ different strategies based upon the
price, in response to changes in input costs of the market structure in which they operate (Mensi, 2010).

Assumptions of the model are long-term market equilibrium, moreover, Panzar and Rosse assumed that performance of banks is affected by actions of other market participants. Further assumptions are homogeneous cost structure and price elasticity of demand greater than unity. Maximizing profits at the bank as well as industry level is a condition for obtaining the equilibrium output and number of banks in the market. It means that bank \( i \) maximizes its profits where marginal revenue equals marginal cost:

\[
R_i^*(x_i, n, z_i) - C_i^*(x_i, w_i, t_i) = 0
\]

where \( R_i \) is the total revenue, \( C_i \) is the total expenses, \( x_i \) is the output of bank \( i \), \( n \) is the number of banks, \( w_i \) is a vector of \( m \) factor input prices of bank \( i \), \( z_i \) is a vector of exogenous variables that shift the bank’s revenue function and \( t_i \) is a vector of exogenous variables that shift the bank’s cost function. In addition, if the market is in equilibrium, the zero profit constraint should hold at the market level:

\[
R_i^*(x^*, n^*, z) - C_i^*(x^*, w, t) = 0.
\]

Variables marked with * represent equilibrium values. The market power is measured by the extent to which a change in factor input prices \( \delta w \) is reflected in the equilibrium revenues \( \delta R_i^* \) earned by bank \( i \). Panzar and Rosse define a measure of competition, the \( H \) statistic as the sum of the elasticities of the reduced form revenues with respect to factor prices:

\[
H = \sum \left( \frac{\partial R_i^*}{\partial w_{ik}} \right) \frac{w_{ik}}{R_i^*}.
\]

The estimated value of the \( H \) statistic ranges between \(-\infty < H \leq 1\). In particular, the \( H \) statistic is non-positive if the market structure is a monopoly, a perfectly colluding oligopoly, or a conjectural-variation, short-run oligopoly. In such a case, an increase in input prices will increase the marginal cost of the bank and reduce equilibrium output as well as total revenue accordingly. Panzar and Rosse proved that under monopoly, an increase in input prices will increase marginal costs, reduce equilibrium output and subsequently reduce revenues; hence \( H \) will be zero or negative. If \( H \) lies between zero and unity, the market structure is characterized as the monopolistic competition. Under monopolistic competition, total revenues increase less than proportionately to changes in input prices, since the demand facing individual banks is inelastic. Assuming some sort of product differentiation between the outputs of the different banks, the profit maximizing firms are confronted with a falling aggregate demand curve and behave like monopolists, which results in equalizing marginal costs and marginal revenues in the equilibrium state. By market exit and entry of imperfect substitutes, the demand curve always shifts in a way that the monopolist just earns zero profits (Panzar and Rosse, 1987). The \( H \) statistic is unity if the market structure is characterized as perfect competition. Under this condition, any increase in input prices will increase both marginal and average costs without changing the equilibrium output of any individual bank. The \( H \) statistic is also equal to one for a natural
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monopoly operating in a perfectly contestable market and a sales-maximizing bank subject to break-even constraints. Table no. 2 summarizes the discriminatory power of $H$.

<table>
<thead>
<tr>
<th>$H$</th>
<th>Description</th>
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<tbody>
<tr>
<td>$H \leq 0$</td>
<td>Monopoly equilibrium or perfect cartel</td>
</tr>
<tr>
<td>$0 &lt; H &lt; 1$</td>
<td>Monopolistic competition</td>
</tr>
<tr>
<td>$H = 1$</td>
<td>Perfect competition</td>
</tr>
</tbody>
</table>

Source: Authors’ compilation

An important feature of the $H$ statistic is that it must be performed on observations that are in long-run equilibrium, as suggested in previous studies such as Bikker and Haaf (2002), Claessens and Laeven (2004), Casu and Girardone (2006), Matthews et al. (2007), Fu (2009) and Rezitis (2010). This suggests that competitive capital markets will equalize risk-adjusted rates of return across banks such that, in equilibrium, rates of return should be uncorrelated with input prices (Matthews et al., 2007). The equilibrium test is carried out with the return on assets (or equity), replacing bank revenue as the dependent variable in the regression equation for the $H$ statistic. The $E$ statistic is derived from the equilibrium test and measures the sum of elasticities of rate of return with respect to input prices (Fu, 2009). If the $E$ statistic is equal to zero, it indicates long-run equilibrium, while $E < 0$ reflects disequilibrium.

The advantage of the PR model is that it uses bank-level data and allows for bank-specific differences in production function (Claessens and Laeven, 2004). An important advantage of the PR methodology is that it does not require the price of production and data on quantities that are difficult to obtain. In this case is assumed input and revenue prices are easy to obtain. Mensi (2010) mention another advantage of the model, that the PR model allows the inclusion of specific bank factors in the production function as well as it allows for the examination of the differences which may arise between banks at the level of size (small vs. large banks) or at the level of ownership (domestic vs. foreign banks or public vs. private banks).

The $H$ statistic reflects the average behaviour of banks in each market, in the case that the bank operates in several markets. On the whole, the authors judge the $H$ statistics as a statistic which does not lack efficiency, despite its simplicity and transparency. Bikker and Haaf (2000) establish four conditions in order for the approach to be retained, (i) banks operate for their long-term equilibrium, (ii) performance of banks is influenced by actions of other market players, (iii) the structure of the cost is homogeneous, and (iv) demand price elasticity is superior to 1. Its drawback is it assumes that the banking industry is in long-run equilibrium, but a separate test exists whether this condition is satisfied. In case of short-run, but not long-run equilibrium, the parameter $H$ represents a one-tail test in the sense that a positive value rejects any form of imperfect competition, but a negative value is consistent with a variety of possibilities, including short-run competition (Shaffer, 2004). As we have access to bank-level information and as we want to study differences among banks, we choose for the PR model (Claessens and Laeven, 2004).

3. Methodology and data

Empirical studies often differ in selection of dependent variable in estimation of $H$ statistics. Traditionally, a gross interest income or total income are applied. By contrast,
some of the recent studies such as Bikker et al. (2009) or Rezitis (2010) use net income as a dependent variable. We take into consideration a substantial growth of non-interest income during recent years and, therefore, we prefer to use total revenue rather than only interest revenue. This approach is in accordance with other studies, e.g. Casu and Girardone (2006), Pererera et al. (2006) or Rezitis (2010). They argue that higher competition in banking industry reduces differences between interest and non-interest income as banks struggle for profits in both segments. Some arguments in favour of total revenues based on analysis of net interest margin determinants are raised also in Dohnal (2012). The existence of accounting differences across years is an additional argument in favour of a broader view of bank revenues (Staikouras and Koutsomanoli-Fillipaki, 2006). According Gutiérrez de Rojas (2007) we used as the dependent variable in Eq. (6) the ratio of the net income to total assets.

\[
\ln NITA_{it} = \alpha_0 + \alpha_1 \ln PL_{it} + \alpha_2 \ln PK_{it} + \alpha_3 \ln PF_{it} + \beta_1 \ln ASSET_{it} + \nonumber
+ \beta_2 \ln BR_{it} + \beta_3 \ln RISKASS_{it} + \varepsilon_{it},
\]

where \( NITA_{it} \) is ratio of net income to total assets, \( PL_{it} \) is ratio of personnel expenses to number of employees, \( PK_{it} \) is ratio of other expenses to fixed assets and \( PF_{it} \) is ratio of annual interest expenses to total loanable funds (deposits + tradable securities + subordinated instruments). Bank-specific and market-specific variables include: \( ASSET_{it} \) is sum of total assets, \( BR_{it} \) is he ratio of the number of branches of a bank to the total number of branches of all banks, \( RISKASS_{it} \) is the ratio of provisions to total assets and \( i \) denotes the bank \((i = 1, \ldots, N)\), \( t \) denotes time \((t = 1, \ldots, T)\).

\( PL_{it} \), \( PK_{it} \) and \( PF_{it} \) correspond to the three input prices, i.e., labor, capital and funds. Consistently with the intermediation approach, we assume that banks use all the three inputs. Other explanatory variables are chosen to account for bank-specific and market-specific factors. Similar variables are also used in Matthews et al. (2007) or Fu (2009).

The total asset variable \( (ASSET_{it}) \) is included to take account of possible scale economies. The ratio of the number of branches of each bank to the total number of branches of the whole banking industry variable \( (BR_{it}) \) is used in order to account for bank size. Branching has been viewed as a means for maintaining market share by providing consumers with close-quarter access to financial services, mitigating to some extent price competition. The provisions to total assets variable \( (RISKASS_{it}) \) is a measure of the riskiness of the bank’s overall portfolio. It is used to account for firm specific risk and it is expected to be positively correlated to the dependent variables, since higher provisions should lead to higher bank revenues. An increase in provisions is a diversion of capital from earnings, which could have a negative effect on revenue. In contrast, a higher level of provisions indicates a more risky loan portfolio and therefore a higher level of compensating return. All variables are expressed in logarithmic form.

The model assumes a one-way error component as described by

\[
\varepsilon_{it} = \mu_i + \varphi_i, \nonumber
\]

where \( \mu_i \) denotes the unobservable bank-specific effect and \( \varphi_i \) denotes a random term which is assumed to be IID. The \( H \) statistic is given by

\[
H = \alpha_1 + \alpha_2 + \alpha_3. \nonumber
\]
For obtaining equilibrium conditions the model is defined as follows:

\[
\ln \text{ROA}_{it} = \alpha_0 + \alpha_1 \ln \text{PL}_{it} + \alpha_2 \ln \text{PK}_{it} + \alpha_3 \ln \text{PF}_{it} + \beta_1 \ln \text{ASSET}_{it} + \\
+ \beta_2 \ln \text{BR}_{it} + \beta_1 \ln \text{RISKASS}_{it} + \eta_{it}
\]

\[E = \alpha_1 + \alpha_2 + \alpha_3 = 0.
\]  

(9)

The panel data for this analysis comprises almost 90% of the Turkish banking market. These statistics consist of annual data from banks and cover the period from 2002 to 2010. The dataset has been collected from the annual bank reports and BankScope database and it consists of 30 banks over 9 years. Due to some missing observations we have an unbalanced panel of 270 bank-year observations. To allow for heterogeneity across the banks, we use an error-component model, with the bank-specific error components estimated as fixed effects.

4. Empirical results and discussion

We analyse concentration and competition of the Turkish banking industry between 2002 and 2010. As it was mentioned before, 2002 is a milestone of Turkish banking system because of some important regulation decisions have been taken by the government.

4.1 Concentration of the Turkish banking sector

We analyse the market concentration of the Turkish banking sector in the period 2002-2010. In paper we calculate two common measures of concentration, which are the concentration ratio and Herfindahl-Hirschman index. We use the three largest bank concentration ratio (CR3) and the five largest bank concentration ratio (CR5) and HHI. It is calculated market concentration of the whole banking sector and also we calculated concentration in credit market and deposit market separately. CR3 and CR5 of whole banking sector are defined as the ratio of the total assets of the three and five largest banks to the total assets of all the banks in a given year. Concentration of the Turkish credit market is measures as the ratio of the total loans of the three and five largest banks to total loans. And concentration of the deposit market is calculated as the ratio of the deposits of the three (five) largest banks to total deposits.

Table no. 3: Concentration of the Turkish banking sector (total assets)

<table>
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<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
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<th>2009</th>
<th>2010</th>
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<tbody>
<tr>
<td>CR3</td>
<td>40.38</td>
<td>42.92</td>
<td>42.56</td>
<td>45.63</td>
<td>42.15</td>
<td>40.87</td>
<td>40.75</td>
<td>41.71</td>
<td>40.96</td>
</tr>
<tr>
<td>CR5</td>
<td>58.43</td>
<td>60.27</td>
<td>59.17</td>
<td>60.83</td>
<td>62.61</td>
<td>61.88</td>
<td>62.37</td>
<td>63.00</td>
<td>62.81</td>
</tr>
<tr>
<td>HHI</td>
<td>855.38</td>
<td>921.62</td>
<td>931.91</td>
<td>962.14</td>
<td>954.18</td>
<td>931.61</td>
<td>941.59</td>
<td>981.72</td>
<td>964.99</td>
</tr>
</tbody>
</table>

Source: Authors' calculation

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Table no. 3 illustrates the market concentration of the Turkish banking sector in period from 2002 to 2010. In general, CR and HHI show a trend of modest increase, meaning that market concentration changed appreciably over the sample period. Concentration ratio of the three largest banks achieves the average value about 42% and the value HHI does not achieve 1000. The Turkish banking market could be described as almost non-concentrated market over the period of 2002-2010.

Concentration of the Turkish credit market in period 2002-2010 is presented in Table no. 4. Table shows the credit market concentration is similar to concentration of banking sector. The concentration ratio demonstrates moderate decrease in the credit market concentration. The value of the HHI indices in the range below 1000 shows non-concentration market. Therefore, the Turkish credit market can be characterized as almost non-concentrated.

### Table no. 4: Concentration of the Turkish banking sector (total loans)

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR3</td>
<td>41.20</td>
<td>39.94</td>
<td>37.42</td>
<td>41.14</td>
<td>41.08</td>
<td>40.23</td>
<td>40.32</td>
<td>37.80</td>
<td>38.10</td>
</tr>
<tr>
<td>CR5</td>
<td>62.04</td>
<td>59.48</td>
<td>57.42</td>
<td>58.57</td>
<td>60.56</td>
<td>59.55</td>
<td>60.07</td>
<td>58.26</td>
<td>59.56</td>
</tr>
<tr>
<td>HHI</td>
<td>914.54</td>
<td>879.75</td>
<td>859.39</td>
<td>901.38</td>
<td>935.58</td>
<td>918.20</td>
<td>939.78</td>
<td>925.69</td>
<td>943.68</td>
</tr>
</tbody>
</table>

Source: Authors’ calculation

Next, Table no. 5 illustrates concentration of the deposits market in Turkey in period 2002-2010. It seen that the deposits market is more concentrate than the Turkish credit market in this period. The HHI exceeds the value 1000 and the deposits market can be characterized as slightly concentrated, because the value of HHI is between the 1000 and 1800. Concentration ratio reaches the average value about 45%, which also show slightly concentrated market. Therefore, we conclude that the Turkish deposits market is modestly concentrated and concentration was increasing during analysed period.

### Table no. 5: Concentration of the Turkish banking sector (total deposits)

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR3</td>
<td>43.03</td>
<td>45.09</td>
<td>45.40</td>
<td>47.57</td>
<td>44.83</td>
<td>44.21</td>
<td>44.13</td>
<td>46.03</td>
<td>46.63</td>
</tr>
<tr>
<td>CR5</td>
<td>61.40</td>
<td>62.64</td>
<td>64.18</td>
<td>65.92</td>
<td>64.42</td>
<td>64.17</td>
<td>64.95</td>
<td>65.85</td>
<td>66.55</td>
</tr>
<tr>
<td>HHI</td>
<td>960.22</td>
<td>1041.00</td>
<td>1117.50</td>
<td>1093.20</td>
<td>1072.21</td>
<td>1063.91</td>
<td>1071.77</td>
<td>1107.30</td>
<td>1133.31</td>
</tr>
</tbody>
</table>

Source: Authors’ calculation

4.2 Competition in the Turkish banking sector

Following the empirical literature on competition in banking markets, the reduced form equations specified in Eq. (6) and Eq. (9) are estimated using a panel data framework since the data are both a cross section and time series. We estimated competitive conditions for the Turkey’s banking sector using the fixed effects estimation approach.

The first point of the analysis of competition is to test if the Turkish banking market is in the long-run equilibrium. We followed similar procedure as Stavárek and Řepková (2011) and estimated regression equations for two 5-year sub-periods (2002-2006 and 2006-2010). We also run seven rolling regressions of a 3-year window in order to reveal periods of
market disequilibrium. We report only elasticities required to the equilibrium test (Eq. 11). The remaining parameters are available upon request. The result for $\ln ROA$ as described by Eq. (9) suggests that market equilibrium may not hold over the full sample. Nevertheless, the banking market was in equilibrium in most of the sub-periods. In the whole period the market is in disequilibrium. However it does not undermine the results of the PR model in this case because, as argued by Shaffer (2004) or Matthews et al. (2007), the equilibrium restriction that $E=0$ is necessary only for the case of perfect competition. On the other hand, presence of monopolistic competition and monopoly is not conditioned by this restriction. Therefore, such a finding would be incorrect only if it were disclaimed that the Turkish banking sector was perfectly competitive.

In Eq. (6), the coefficients of the unit price of labour is negative and statistically insignificant at any conventional level of significance, while the coefficient of the unit price of capital and unit price of deposits are positive in full sample and in first sub-period and negative in the second sub-period. We can see substantial differences between the sub-periods under estimation. The sign of the coefficient of $\ln ASSET$ variable is positive in full sample and in the first sub-period and negative in the second sub-period. The coefficient of the $\ln RISKASS$ variable is positive and statistically insignificant.

### Table no. 6: Equilibrium tests (rolling sample) dependent variable $\ln ROA$

<table>
<thead>
<tr>
<th></th>
<th>$\ln PL$</th>
<th>$\ln PK$</th>
<th>$\ln PF$</th>
<th>Sum</th>
<th>$H_0$: $E=0$</th>
<th>Eq./Diseq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002-2010</td>
<td>-0.1495</td>
<td>-0.0728</td>
<td>-0.1432</td>
<td>-0.3655</td>
<td>$F(1,184) = 4.192^b$</td>
<td>Diseq.</td>
</tr>
<tr>
<td>2002-2006</td>
<td>-0.1104</td>
<td>0.1702</td>
<td>-0.3608</td>
<td>-0.3010</td>
<td>$F(1,95) = 0.7595$</td>
<td>Eq.</td>
</tr>
<tr>
<td>2006-2010</td>
<td>-0.3336</td>
<td>-0.4287</td>
<td>0.0715</td>
<td>-0.6908</td>
<td>$F(1,99) = 2.5335$</td>
<td>Eq.</td>
</tr>
<tr>
<td>2002-2004</td>
<td>0.3288</td>
<td>0.4146</td>
<td>-0.5954</td>
<td>0.1480</td>
<td>$F(1,49) = 0.0284$</td>
<td>Eq.</td>
</tr>
<tr>
<td>2003-2005</td>
<td>-0.2767</td>
<td>-0.7276</td>
<td>0.1401</td>
<td>-0.8642</td>
<td>$F(1,47) = 8.7026^c$</td>
<td>Diseq.</td>
</tr>
<tr>
<td>2004-2006</td>
<td>-0.2898</td>
<td>-0.7286</td>
<td>0.1086</td>
<td>-0.9098</td>
<td>$F(1,44) = 11.016^c$</td>
<td>Diseq.</td>
</tr>
<tr>
<td>2005-2007</td>
<td>-0.1587</td>
<td>-0.4079</td>
<td>0.4247</td>
<td>-0.1419</td>
<td>$F(1,45) = 0.1350$</td>
<td>Eq.</td>
</tr>
<tr>
<td>2006-2008</td>
<td>-0.2241</td>
<td>-0.2127</td>
<td>0.4307</td>
<td>-0.0061</td>
<td>$F(1,48) = 0.0001$</td>
<td>Eq.</td>
</tr>
<tr>
<td>2007-2009</td>
<td>-0.2120</td>
<td>-0.0297</td>
<td>-0.3911</td>
<td>-0.6328</td>
<td>$F(1,50) = 2.9760$</td>
<td>Eq.</td>
</tr>
<tr>
<td>2008-2010</td>
<td>-0.2008</td>
<td>-0.1721</td>
<td>-0.3620</td>
<td>-0.7349</td>
<td>$F(1,50) = 3.1171$</td>
<td>Eq.</td>
</tr>
</tbody>
</table>

$a, b, c$ denote significance at 1%, 5% and 10% level, t-values in parentheses. 
**Source:** Authors’ calculation

The positive effect of the riskiness of the bank’s overall portfolio supports the argument that higher risk commands a higher compensating return. The coefficient of the $\ln BR$ variable is negative and statistically significant for full sample and the second sub-period, which indicate that banks with a greater number of branches generate lower revenues. Or in other words, the effect of $\ln BR$ suggests that the increased cost of maintaining a higher branch network dominates the negative effects of maintaining market share. The coefficient of the $\ln BR$ variable is positive and statistically insignificant for the first sub-period. The results obtained from the regression analysis are presented in Table no. 7.

The null hypothesis that the bank fixed effects are jointly zero ($H_0$: $z_F=0$) is rejected at the 1% significance level for the full sample as well as for the second sub-sample and the 5% significance level for the first sub-sample. This indicates the usefulness of the fixed effects panel model and suggesting that the base levels of the dependent variables differ.
Table no. 7: Test of competitive conditions dependent variable lnNITA

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.0578 (-0.6233)</td>
<td>-0.5211* (-1.8041)</td>
<td>-0.0916 (-1.0942)</td>
</tr>
<tr>
<td>lnPL</td>
<td>-0.0025 (-0.5938)</td>
<td>-0.0000 (-0.0083)</td>
<td>-0.0056 (-1.4495)</td>
</tr>
<tr>
<td>lnPK</td>
<td>0.0349* (6.2997)</td>
<td>0.0148 (0.8079)</td>
<td>-0.0089 (-1.6628)</td>
</tr>
<tr>
<td>lnPF</td>
<td>0.0068 (1.3750)</td>
<td>0.0232* (2.1493)</td>
<td>-0.0018 (-0.6132)</td>
</tr>
<tr>
<td>lnASSET</td>
<td>0.0040 (0.6591)</td>
<td>0.0413* (2.0489)</td>
<td>0.0064 (1.1779)</td>
</tr>
<tr>
<td>lnRISKASS</td>
<td>-0.0157* (-3.0382)</td>
<td>0.0040 (0.3777)</td>
<td>-0.0193* (-2.8834)</td>
</tr>
<tr>
<td>lnSKASS</td>
<td>0.0127* (2.5391)</td>
<td>0.0018 (0.1835)</td>
<td>0.0132* (2.1299)</td>
</tr>
</tbody>
</table>

H0: $g_f = 0$

H0: $H=0$  \[ F(29, 204) = 2.4338^a \]  \[ F(29, 84) = 1.4516^a \]  \[ F(29, 84) = 7.6584^a \]

H0: $H=1$  \[ F(1, 204) = 22.5159^a \]  \[ F(1, 84) = 3.4735^a \]  \[ F(1, 84) = 4.0819^a \]

H1: $H=1$  \[ F(1, 204) = 13449.15^a \]  \[ F(1, 84) = 2229.97^a \]  \[ F(1, 84) = 15446.73^a \]

H 0.0391  0.0380  -0.0163

a,b,c denote significance at 1%, 5% and 10% level, t-values in parentheses

Source: Authors’ calculation

A significance test on the sum of the input elasticities shows that the $H$ statistic lies between zero and unity in the full sample and in the first sub-period. The results show that Wald statistic for testing the null hypotheses $H=0$ and $H=1$ can both be rejected at the 1% significance level for full sample, which indicates the monopolistic competition. For the first sub-sample the null hypotheses $H=1$ can be rejected at the 1% significance level and null hypothesis $H=0$ can be rejected at the 10% significance level, which also indicates monopolistic competition. By contrast, the $H$ statistic in the second sub-period is non-positive, which indicates monopoly.

We can conclude that the Turkish banking industry can be characterized as the monopolistic competition in the period 2002-2010. From our analysis of competition is evident that intensity of competition decreased over the estimated period. We find the monopoly in the banking industry in the second sub-period. Our result is in consistent with the empirical literature, which estimated competitive condition in the Turkish banking sector.

Conclusions

The aim of the paper was to examine the degree of concentration and competition in the Turkish banking industry during the period 2002-2010, which covers the years after the financial crisis and implementation of banking reform in Turkey. Using the concentration ratio of the three and five largest banks and the Herfindahl-Hirschman index we find that the Turkish banking sector is almost non-concentrated. This is mainly the case of credit market and banking assets. On the other hand, the results for deposits suggest that the largest banks take up a greater share of the market. The conclusion on low degree of concentration can be somewhat surprising as the total number of banks in Turkey decreased from 54 to 45 (-16%) over the period of estimation due to acquisitions and liquidation of some “bad banks” and mergers with foreign banks.

Next, we apply the Panzar-Rosse model to estimate the competition conditions in the Turkish banking sector. In detail, the $H$ statistic computed for the full sample is 0.0391, the...
$H$ statistic for the first sub-period (2002-2006) is 0.0380, and the $H$ statistic for the second sub-period (2006-2010) is -0.0163. Hence, we can conclude that the Turkish banking sector operated in monopolistic competition in the first sub-period (initial post-reform stage) and under monopoly in the second sub-period (subsequent post-reform stage). When we focus on the entire period of estimation the Turkey’s banking sector seems to operate in the environment of monopolistic competition. However, the value of the $H$ statistic is close to zero and, therefore, the market competition approaches the state of monopoly. In summary, our results imply that banks in Turkey do not operate in a competitive environment, and they seek and utilise monopoly rents.

As argued by Chan et al. (2007), increases in the HHI generally indicate a loss of pricing power and a decrease in competition, whereas decreases imply the opposite. Thus, we can conclude that our findings show such a relationship between concentration and competition. An increase of the concentration indicators went hand in hand with decrease in competition in the Turkey’s banking industry over the analysed period. We can also argue that our findings on low but increasing concentration and low and even decreasing competition are, to a large extend, consequences of the turning regulatory reform in the banking sector and very tight and prudent supervision policies.

Whereas the new regulatory and supervision framework contributed significantly to relative stability, soundness and strength of the Turkish banking sector, performance of the banking sector is much less impressive when judged from a developmental and income distributional perspective. Low competition in the banking sector brings obvious limitations as banks cannot sufficiently contribute to the financing of the real economy, as it is evident in a low share of savings and fixed capital investment on GDP. As argued by Bakir and Önis (2010) the move toward a ‘regulatory state’ is an intensely political process. Finally, rent-seeking elements may persist in the new pro-regulation system, which may limit the degree of progress achieved with respect to effective regulation exercised over the banking system and financial intermediation provided by banks. In the context of the Turkey’s banking sector, the regulation fails to encourage investment-oriented lending and control consumption-oriented lending. In result, low competition prevents the banking sector from achieving a balanced allocation of disbursed credits and promoting sustainable economic growth.

A disadvantage of the Panzar Rosse approach is its assumption that banks provide one banking product only. Hence, it does not allow us to distinguish between different products or geographical markets, which by the way would also be hampered by a lack of required data, e.g. bank-level interest rates and production figures. Therefore we suggest use other models for further development, e.g. Bresnahan model can play a supplementary role, as it allows the investigation of submarkets, due both to its nature and to its data requirements.

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References


