

**AN EMPIRICAL STUDY OF THE MEASUREMENT OF  
THE LEVEL OF COMPETITION IN THE TURKISH BANKING  
SYSTEM USING PANZAR-ROSSE METHODOLOGY**

*TÜRK BANKACILIK SİSTEMİNİN REKABET SEVİYESİNİN  
PANZAR ROSSE MODELİ ÇERÇEVESİNDE  
ÖLÇÜLMESİNE YÖNELİK AMPİRİK BİR ARAŞTIRMA*

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**Abstract**

*As the dynamics of competition and the impacts of globalization on banks have begun to change after the restructuring program in the Turkish banking sector, measuring the competitive behavior of banks has gained an increasing interest. In this paper we adopt the Panzar-Rosse model developed by “New Industrial Organization Approach” to assess the competitive conditions for deposit banks in Turkey. We used panel data for the period 2002-2010. By using disaggregated annual data from 31 banks, the empirical results of this study suggest that deposit banks operate under monopolistic competition as the cases of monopoly and perfect competition are rejected for the Turkish banking sector. It also appears as private deposit banks seem to enjoy even more market power. When we preview the empirical results briefly, we find that the deposit banks in Turkey can be characterized as monopolistically competitive despite its oligopolistic structure, thus supporting the market power hypothesis. We also show that the reduction in the number of banks, as a result of ongoing restructuring program in the sector and the associated increase in concentration during 2002-2010, was accompanied by a decline in the intensity of competition.*

**Keywords:** *Competition, Market Power, Panzar-Rosse Model, New Industrial Organization, Turkish Deposit Banks.*

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**Öz**

*Türk bankacılık sektöründeki artan rekabet, kriz sonrası yeniden yapılandırma uygulamaları neticesinde hızlanan küreselleşmeyle beraber finansal piyasalar arasındaki entegrasyona hız vermiştir. Bankacılık sektöründe rekabet düzeyinin ölçülmesine olan ilgi sektördeki yoğunlaşmanın artmasına paralel olarak son derece önem kazanmıştır. Bu nedenle çalışmada, panel veri kullanılarak 2002-2010 döneminde Türk mevduat bankalarının firma davranışına bağlı olarak rekabet düzeyinin tahmin edilmesi amaçlanmıştır. Bu amaç doğrultusunda mevduat bankalarının rekabet seviyesinin tahmini için “Yeni Endüstriyel Organizasyon Teorisi” kapsamında geliştirilmiş olan Panzar-Rosse modeli kullanılmıştır. Çalışmada 31 bankanın yıllık veri seti kullanılmış ve elde edilen ampirik sonuçlar bankacılık sektörünün monopolcü rekabet koşullarında faaliyet gösterdiğini ortaya koymuş ve tam rekabet ile tekeli koşullar reddedilmiştir. Özel mevduat bankalarının ise piyasa gücünü ellerinde tuttukları görülmektedir. Ampirik bulgular değerlendirildiğinde; Türk bankacılık sektörünün oligopolistik yapısına rağmen sektördeki firma davranışının tekeli rekabet ile tanımlandığı ortaya çıkmıştır bu da pazar gücü hipotezini desteklemektedir. Ayrıca, 2002-2010 yılları arasında yoğunlaşmadaki artış ve sektörün yeniden yapılanması nedeniyle banka sayısında ortaya çıkan azalma rekabetteki yoğunluğun azalmasını da beraberinde getirmektedir.*

**Anahtar Kelimeler:** Rekabet, Pazar Gücü, Panzar-Rosse Modeli, Yeni Endüstriyel Organizasyon, Türk Mevduat Bankaları.

**INTRODUCTION**

Globalization has caused the competition to gain new dimensions and its content to change. It is the fact that the market place is no longer restricted to a particular geographic location. Therefore the marketplace has become global as the smallest of organizations compete on an international level. In order to provide firms the necessary conditions to survive and benefit from the global competitive advantage, it is essential to define the relative competitive position of their home country.<sup>1</sup> In the field of competition the researches focus on two essential views such as; under the traditional “competition-fragility” view, more bank competition weakens market power, decreases profit margins, and results in reduced franchise value. These encourage the banks to take on more risk to increase returns. “Under the alternative “competition-stability” view, more market power in the loan market may result in higher bank risk as the higher

<sup>1</sup> ÖNSEL, Ş. , F. ÜLENGİN, G. ULUSOY, E. AKTAS, Ö. KABAK and İ. TOPÇU (2008) , “New Perspective On The Competitiveness of Nations”, *Socio-Economic Planning Sciences*, No:42, p.222.

*interest rates charged to loan customers make it harder to repay loans, and exacerbate moral hazard and adverse selection problems. Both views have received some degree of empirical support using different measures for the level of competition or market power*".<sup>2</sup> Therefore the level of competition in banking sector and its relationship with market concentration are more appertaining issues now than in earlier times.<sup>3</sup>

Competition arises from the necessity to share the scarce resources against the unlimited needs. When considered in terms of the firms, the degree of the firm to affect the prices in the market is highly dependent on the competition level of the market. To sustain competitive power in every field of the globalized markets, it has also gained great importance in banking sector which is the locomotive of the financial industry.

The measurement of competitive behavior in banking sector requires the usage of right indicators however various researchers act with various indicators. There are two major methodologies for measuring the level of competition. One of them is the traditional structural approach that is carried out within the frameworks of the Structure-Conduct-Performance (SCP) paradigm and the Efficient Structure Hypothesis (ESH). And the other alternative method which has the advantage of using bank-specific data illustrates the estimation of the "Panzar-Rosse (H-statistic)". These approaches emphasize the analysis of the competitive conduct of banks in measuring competition. Recently, studies of the banking industry have seen an increase in the application of the Panzar-Rosse methodology. The Panzar-Rosse methodology is commonly accepted to be a well-designed model to compare competition across banking markets. In fact, data requirements are quite low, and the necessary data are readily available in many countries.<sup>4</sup> This paper reviews the level of competition of the deposit banks in Turkish banking sector using annual data from the years 2002-2010 and employing the tests developed by Panzar-Rosse model. The article's conclusion is that for the period under consideration, deposit banks in Turkey earned revenues as if they were under conditions of monopolistic competition. This result seems to be consistent with the findings of previous studies investigating the level of competition of deposit banks in the Turkish banking system as well as the findings of most studies performed for the EU banks.

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<sup>2</sup> BERGER, A.N., L.F. KLAPPER and R. TURK-ARİSS (2008), *Banking Structures and Financial Stability*, Wharton Working Paper Series, p.19.

<sup>3</sup> SHAFFER,S. (2004), "Patterns of Competition in Banking", *Journal of Economics and Business*, No: 56, p.288.

<sup>4</sup> DEGRYSSE, H., K. MOSHE and S. ONGENA (2009), *Micro Econometrics of Banking: Methods, Applications and Results*, Oxford University Press, p.36.

We intended to match the original infrastructure of Panzar-Rosse model and the functional form of the estimation equation as purely as possible. Although there are various fundamental researches for measuring the level of competition among banks, there exist lack of studies which focus on the banks in developing markets. This paper aims to fulfill this gap in the given literature. The rest of the article proceeds as follows. Section 2 describes the theoretical background of competition and presents the summary of related literature. It surveys the various alternative methods of measuring the level of competition and evaluates their advantages and disadvantages. Section 3 gives information about the approach used in the study and the analytical framework. In section 4, the research data, estimation methodology. It evaluates the available empirical evidence of the model. The final section concludes.

## **1. THEORETICAL BACKGROUND**

It is very important to increase the competitive power and provide sustainability in every field of a globalizing world and it has gained considerable importance in the financial sector and the banking sector that is a pioneer in financial sector as well. In the following sections, the competition theory with all of its basic components will be discussed to increase the explanatory power of used methodology and the empirical findings.

### **1.1. Competition Theory**

The competition is a concept which the debates continue about its definition and the different meanings are attributed to it in different environments. In broadest sense, the competition is known as a mutual struggle made by different people or organizations operating in a specific field to sustain the same goal.<sup>5</sup>

The competition is highly associated with the competitive power.<sup>6</sup> Competitive power mostly used as competitiveness, is a dynamic concept related to economic policies and institutions used to increase the economic growth and the inter-trade of countries. However, because it is a controversial issue, it is quite difficult to measure the competitive power in terms of the companies or the economy. The difficulty of the issue comes from that it is almost impossible to objectively measure some part of factors not only affect

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<sup>5</sup> ALTUNTUĞ, N. (2007), *Küresel Rekabet Ortamında Ayırt Edici ve Sürdürülebilir Üstünlükler Bağlamında Temel Yetenek Tabanlı Stratejiler ve Bir Uygulama*, Yayınlanmamış Doktora Tezi, p.111.

<sup>6</sup> ELMACI, O and N. KURNAZ (2004), *Sürdürülebilir Rekabet Gücüne Yönelik Vizyon Araştırmalarında Faaliyet Tabanlı Maliyetleme Yaklaşımı*, Selçuk Üniversitesi, IV. Ulusal Üretim Araştırmaları Sempozyumu, Ekim, Konya, p.1.

but also determine the competitive power (e.g. product quality, power of innovation, the capacity to respond to consumer needs etc).<sup>7</sup>

Competitiveness is often related to the long-term performance of large corporations and economies in the firm level, industry policies, and the macroeconomic level for the competitive positions of national economies.<sup>8</sup> In the academic context, the international competitive power has been defined from the two points of view: Macro (country) point of view and Micro (business and industry) view. Micro-level approach examines the competition among businesses in the country and effects of this competition at national / international market while macro-level approach focuses on position of country in international competition.<sup>9</sup> As used in micro-economic point of view, the analysis on level of competition begins with a brief examination of industrial organization.<sup>10</sup>

*Industrial Organization-Based Competition Theory (IO)*: In this theory, the proceeds coming to company is determined by structure of industry where the company finds itself in it. This approach includes industry's basic features thought to be an impact on the proceeds of company; value and existence of barriers against launching, number and relative size of companies, presence of product differentiation in the industry, and general flexibility of current demand for that industry.<sup>11</sup> Another school of competition theory is the "Chamberlain Competition Theory". This theory of competition tries to explain competition like IO, with behavior or strategy of company and improvement of performance. "Schumpeterian Theory" is another view of competition that handles the behavior of company in a different way because it assumes that the competition is not stable. Therefore it is very difficult to estimate the result of competition in this theory. The empirical literature in IO is a well-established covering a period of at least 50 years. Within this period, two distinct methodological frameworks for empirical IO can be discerned, namely the SCP paradigm and the NEIO.<sup>12</sup>

<sup>7</sup> KARAGÖZ, K. and A. ŞEN (2010), "Döviz Kuru Rejimi- Ticari Rekabet Gücü İlişkisi: Türkiye İçin Ampirik Bir Analiz", *Akademik Bakış Uluslararası Hakemli Sosyal Bilimler E-Dergisi*, No:21, p.4.

<sup>8</sup> MAN, T.W.Y, T. LAU and K.F. CHAN (2002) , "The Competitiveness of Small And Medium Enterprises A Conceptualization With Focus On Entrepreneurial Competencies", *Journal Of Business Venturing*, No:17, p.125-126.

<sup>9</sup> ÇİVİ, E. (2001), "Rekabet Gücü: Literatür Araştırması", *Yönetim ve Ekonomi Dergisi*, No:8(2), p.21-24.

<sup>10</sup> LEE, C. (2007), *SCP, NEIO and Beyond*, ICSEAD Working Paper, p.9.

<sup>11</sup> BARNEY, J. (1986), "Types of Competition and the Theory of Strategy: Toward an Integrative Framework", *Academy of Management Review*, Vol.11(4), p.792.

<sup>12</sup> Lee 2007, p.14.

### 1.1.1. Firm Behavior and Markets of Competition

The relationship between firm behavior and market structure has been a central focus of study in the field of industrial organization (IO).<sup>13</sup> The price and production decisions of a firm are influenced by both the internal organization of the firm as well as market structure which is dealt with the behaviors of buyers and sellers.<sup>14</sup> Analyzing the structure of financial markets is a critical issue for the competition phenomenon, because it provides information regarding the potential dangers in the competition.<sup>15</sup> Besides institutions must carry out competition analysis in order to determine all powers affecting survival, growth and profitability of company in their environment and also analyze them.<sup>16</sup> In theory of economy, the market conditions in terms of competition are summarized below.

• **Perfect Competition:** In this type of competition it is assumed that companies have large number of buyers and sellers do not affect the market price. The entrance and exit to market should be free as there are many companies at the market.<sup>17</sup> The competition at this market forces the companies to make production in long term with minimum average cost and zero profit.<sup>18</sup> If the economic analysis includes this kind of market structure, it depends on the effort to describe ideal situation. The concept of competition used herein is different from the general definition known as struggling made by companies which want to increase profit levels at the market. Because everything at this market (producer, consumer and goods) is identical, any competition is not in question.<sup>19</sup>

• **Monopolistic Competition:** There is full competition at the monopolistic competition market and the companies are able to enter and exit from the market easily.<sup>20</sup> The permanent increase in the number of companies in

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<sup>13</sup> Lee 2007, p.9.

<sup>14</sup> BEGG, D., S. FISCHER and R. DORNBUSH, *Economics*, Mc GrawHill, 8th edition [Ed. by SERİN, V. (2000), *Mikro İktisat*, Alkım Kitabevi, İstanbul, p.124].

<sup>15</sup> BIKKER, J.A., L. SPIERDIJK and P. FINNIE (2007), *Market Structure, Contestability and Institutional Environment: the Determinants of Banking Competition*, DNB Working Paper, No: 156, De Nederlandsche Bank, Amsterdam, p.12-15.

<sup>16</sup> SNYMAN, R. and C.J. KRUGER (2004), "The Interdependency Between Strategic Management And Strategic Knowledge Management", *Journal Of Knowledge Management*, No: 8(1), p. 13.

<sup>17</sup> Serin, p. 125.

<sup>18</sup> ERTEK, T. (2008), *İktisada Giriş*, Beta Yayınevi, İstanbul, p.109.

<sup>19</sup> ORHAN, O.Z. and S. ERDOĞAN (2008), *Mikro İktisadi Analize Giriş*, Palme Yayıncılık, p.185.

<sup>20</sup> Ertek 2008, p.126.

this structure is to eliminate the opportunity of maximum profit in the short-run. For this reason, each company is contented with normal profit in the long-run.<sup>21</sup>

• **Oligopolistic Competition:** It is very difficult to enter oligopoly market on the contrary to perfect competition and monopolistic competition. The underlying reason is the existing difficulties such as the need of big amount of capital, technological knowledge and obtainment of patent rights.<sup>22</sup>

• **Monopoly:** It is the market in which goods have no close substitution and are sold by sole company. Entrance and exit to market is strictly prevented.<sup>23</sup> So, all the dominance of market is in the hands of company.

Under perfect competition, an increase in input prices raises both marginal costs and total revenues by the same amount as the rise in costs. Under a monopoly, an increase in input prices will increase marginal costs, reduce equilibrium output and consequently reduce total revenues.<sup>24</sup> When the structures mentioned above are considered in financial sector; competition in this sector matters because any form of market failure or anti-competitive behavior on the part of banks have long term influences on banks' efficiency and profitability.<sup>25</sup>

When we classify banking sector in terms of competitive structure, because it is not possible to allow banks freely enter or exit market because of superior management licensing, capital needs and other regulations in terms of competition, perfect competition is not suitable for banks.<sup>26</sup> On the other hand, it is not possible to refer competitive structure of banking sector as a monopoly with same reasons banned by other industries. The banking services are not public institutions that enable any condition of monopoly. Therefore, the position in which banks are involved appears more as oligopolistic structure.

Main elements forming the competition constraint in the banking sector are market entry obstacles, cartel agreements, merger and acquisitions which have become an increasing trend in financial sector in recent years. The sunk costs form an obstacle on the entry pressure to the market at least in the short

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<sup>21</sup> Orhan and Erdoğan, p.210.

<sup>22</sup> Ertek 2008, p.131.

<sup>23</sup> Orhan and Erdoğan 2008, p.199.

<sup>24</sup> CLAESSENS, S and L. LAEVEN (2004), "What Drives Bank Competition? Some International Evidence", *Journal of Money, Credit, and Banking*, No:36, p.567.

<sup>25</sup> GODDARD, J. and J.O.S. WILSON (2008), *Measuring Competition in Banking: A Disequilibrium Approach*, [www.eief.it/files/2007/10/s\\_20071105.pdf](http://www.eief.it/files/2007/10/s_20071105.pdf), Erişim Tarihi: 11.09.2011.

<sup>26</sup> ARAI, M.Y. and N. YOSHINO (2006), *Concept of Competitiveness: Focusing on the Financial Sector*, Discussion Paper, p.1-10.

term.<sup>27</sup> Besides, the existence of the asymmetrical information in the banking sector not only causes failure in the markets, but also constitutes an important determinant of the market structure and competition in the banking sector. The banks inevitably have payment difficulties on a scale when the information is shared asymmetrically and misdirect risk undertaking occur as those trigger the systematic crisis.<sup>28</sup>

As in other industries, the level of competition in the financial sector has significant impact on the efficiency of the production of financial services, the quality of financial products and the degree of innovation in the sector.<sup>29</sup> When studying bank competition, the researchers either take the number of banks as an indicator of the level of competition or compare two polar situations, namely, monopoly and perfect competition. A lower level of bank competition reduces social welfare in two ways. First, the amount of collateral demanded by banks is higher, which causes a higher social loss in the case of liquidation. Second, and even more crucial, the extent of credit rationing increases.<sup>30</sup>

In analyzing the role of bank competition, specific characteristics of the banking industry, such as its market structure, also affect various dimensions of other sectors in the economy. Extreme - monopoly or perfect competition- may be the most desirable market structure for the banking sector. In advocating policies affecting the level of bank competition, the regulator faces a tradeoff. While more competition is likely to lead to a larger quantity of credit, more market power should increase banks' incentives to produce information on prospective borrowers, thus leading to a higher quality of the applicant pool.<sup>31</sup>

When the trade-off between competition and financial opportunities is considered, competition should be strong as much as possible in order to support sustainable welfare and economic development, however the level of competition should not be too strong to prevent the financial stability, innovations and the credit facility so that the competition should stay at its optimum level. For this reason, it is required to measure the competition in order

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<sup>27</sup> EMEK, U. (2005), *Bankacılık Sisteminde Rekabet ve İstikrar İkileminin Analizi: Türkiye Örneği*, Yayınlanmamış Doktora Tezi, Ankara Üniversitesi Sosyal Bilimler Enstitüsü, Ankara, p. 10-11.

<sup>28</sup> Emek 2005, p. 2-7.

<sup>29</sup> Claessens and Laeven 2004, p.565.

<sup>30</sup> HAINZ, C. (2003), "Bank Competition and Credit Markets in Transition Economies", *Journal of Comparative Economics*, No: 31, p. 224.

<sup>31</sup> CETORELLI, N. (2001), "Competition Among Banks: Good or Bad?", *Economic Perspectives*, p.46.

to take together current level with optimum level.<sup>32</sup> Indeed, the phenomenon of competitive analysis for the structure of financial markets is important because it provides information about the potential hazards of competition.<sup>33</sup>

The theoretical effect of competition on banking outcomes has been addressed by a number of models. In the following section we discuss the "traditional" and "new" empirical methods of measuring the level of competition specifically applied to banking industry.

### 1.1.2. Models of Measuring the Competitive Behaviour

In the academic sphere there has been great interest in measuring the level of competition in financial markets. Therefore, in recent years there have appeared a substantial number of studies that use different indicators of competition (e.g., Lerner index, Panzar-Rosse's Method, Bresnahan's Mark-Up Test, Conjectural Variation Parameter) with empirical applications whose purpose have been to analyze the level of competition and the firm behaviour in banking sector.<sup>34</sup>

When the literature is considered, studies that are conducted to measure the competition are divided into two major groups: structural studies and non-structural models. The structural approach to modeling competition consists of the Structure-Conduct-Performance (SCP) paradigm and the efficiency hypothesis, as well as a number of formal approaches that are rooted in Industrial Organization theory. The SCP assumes a link between market structure, behavior of banks and profitability.<sup>35</sup> The shortcomings of the SCP and ESH approaches have been addressed by the *new empirical industrial organization* (NEIO), which assesses the strength of market power by examining the deviations between observed and marginal cost pricing, without explicitly using any market structure indicator.<sup>36</sup>

#### 1.1.2.1. Structure-Conduct-Performance Model

The SCP paradigm became the dominant framework for empirical literature in IO between the early 1950s until the early 1980s. Its influence only began to

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<sup>32</sup> Emek 2005, p.10-11.

<sup>33</sup> BIKKER, J.A. and L. SPIERDIJK (2001), *Measuring and Explaining Competition In The Financial Sector*, Utrecht School of Economics Tjalling C. Koopmans Research Institute, Discussion Paper Series, p.2.

<sup>34</sup> MAUDOS, J. and J. J.F. de GUEVARA (2007), "The Cost of Market Power in Banking: Social Welfare Loss vs. Cost inefficiency", *Journal of Banking & Finance*, No: 31, p.2104.

<sup>35</sup> GROENEVELD, J.M., and W.W. BOONSTRA (2005), *Competition in a Highly Concentrated Banking Sector Theoretical, Empirical and Practical Considerations For The Netherlands*, Rabobank Report, p.3.

<sup>36</sup> MATTHEWS, K. and J. THOMPSON (2005), *The Economics of Banking*, John Wiley and Sons Ltd, 2nd edition, p.176.

wane in the 1980s with the emergence of game theory of oligopolistic markets known as the “New Industrial Organization” (NEIO).<sup>37</sup>

The SCP model is originally developed by Bain (1951, 1954 and 1956).<sup>38</sup> According to the paradigm; structure refers to market structure (seller concentration, degree of product differentiation and barriers of entry); conduct refers to a firm's behavior (pricing strategies, collusion, and advertising). Some have interpreted conduct as whether firms collude or compete. Finally, the performance refers to the outcome or the equilibrium assessed in terms of allocated efficiency (profitability and price-cost margin).<sup>39</sup> Between the late 1970s and early 1980s, the empirical literature on SCP began taking a different dimension. The theoretical work of Mason's colleague Chamberlin has inspired both Mason and Bain to study empirically how the pricing and production policies of firms (essentially the large ones) are determined.<sup>40</sup> Harold Demsetz (1974)'s influential critique of the SCP hypothesis in 1974 prompted scholar to examine the relationship between profitability and profitability. “*Demsetz argued along the ‘Chicago School’ lines that the observed profitability-concentration relationship could be due to large firms in high-concentration industries having high profits due to their large market shares. The empirical evidence supporting this alternative (profitability-sales) hypothesis seems to be stronger in inter- industry studies compared to intra industry studies*”.<sup>41</sup>

SCP model can be estimated using either industry aggregate data, as originally derived by Bresnahan (1989) and previously applied by Shaffer (1989, 1993, 1996), Shaffer and Di Salvo (1994) and others. An early version of this test was estimated using firm-specific data for the Japanese flat glass industry by Iwata (1974).<sup>42</sup>

SCP paradigm would predict that competition is substantially imperfect in many banking sectors.<sup>43</sup> Hence, the theory predicts that the degree of monopoly and the scale of the banking industry will influence its overall performance and that the influence is not unidirectional, as performance will also influence the conduct and structure. The hypothesis argues that higher

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<sup>37</sup> Lee 2007, p.1.

<sup>38</sup> ISERN, J. (2008), *Cross-Country Analysis of The Effects of E-Banking and Financial Infrastructure On Financial Sector Competition: A Schumpeterian Shift?*, Nova Southeastern University, Dissertation, p.16.

<sup>39</sup> Lee 2007, p.3-4.

<sup>40</sup> Lee 2007, p.2.

<sup>41</sup> Lee 2007, p.12 [See, Schmalensee (1989), p. 984]

<sup>42</sup> SHAFFER, S. (2004), “Patterns of Competition in Banking”, *Journal of Economics and Business*, No:56, p.292.

<sup>43</sup> Shaffer 2004, p.288.

concentration in the banking market causes less competitive bank conduct and leads to higher bank profitability (but lower performance from a social point of view). Monopoly will lead to higher prices and a loss of efficiency compared with a competitive environment. So few and large firms will be more likely to engage in anticompetitive behavior.<sup>44</sup>

To test the SCP hypothesis, researchers typically use a measure of bank performance, for example, bank profitability, on a proxy for market concentration, that is, an n-bank concentration ratio or a Herfindahl-Hirschman Index (HHI).<sup>45</sup> SCP hypothesis postulates that greater profits or higher concentration on the whole enables the banks' collusion.<sup>46</sup>

*Herfindahl Hirschman Index*: Concentration is the outcome of strong competition and is referred to as the efficient structure hypothesis.<sup>47</sup> Despite various theoretical assumptions and estimations, the debate still is on whether the concentration is a sufficient indicator.<sup>48</sup> The empirical banking literature has also shown that concentration is generally a poor measure of competition.<sup>49</sup> The concentration ratios which are used as an indicator in the measurement of the competition level correlate both with the product markets and geographical area.<sup>50</sup>

HHI, with its simplest form, has been expressed as follows;

$$HHI = \sum_{i=1}^n (S_i)^2 \quad (1.1)$$

HHI is composed of the total of the squares of market shares ( $S_i$ ) of "n" units of banks operating in a market. If the market shares are expressed as 100 in the total, HHI index gets the value of "0" and "at most 10.000".<sup>51</sup> The competition structure in the market takes shape according to the intervals in the index values such as: [0 - 199 (Perfect Competition Market, 51 or more banks having the same market share), 200 - 999 (Weak Oligopoly, 11 - 50 banks having the same market share), 1000- 1.799 (Strong Oligopoly, 6 - 10 banks

<sup>44</sup> Mathews and Thompson 2005, p.172-174.

<sup>45</sup> Degryse et al 2009, p.28.

<sup>46</sup> Maudos and Guevara 2007, p.2106.

<sup>47</sup> Mathews and Thompson 2005, p.174.

<sup>48</sup> TUNAY, B (2009), "Türk Bankacılık Sektöründe Rekabet ve Kırılganlık", *Bankacılar Dergisi*, No 68, p.33.

<sup>49</sup> BIKKER, J., S. SHAFFER and L. SPIERDIJK (2009), *Assessing Competition with the Panzar-Rosse Model: The Role of Scale, Costs, and Equilibrium*, Utrecht School of Economics Discussion Paper Series, p.2.

<sup>50</sup> Emek 2005, p.75-77.

<sup>51</sup> BIKKER, J. A (2004), *Competition and Efficiency in a Unified European Banking Market*, Edward Elgar, Cheltenham, p.49-72.

having the same market share), 1.800 - 10.000 (Monopoly, 1 - 5 banks having the same market share)]<sup>52</sup>

Since the value of HHI is not used in our estimations, to provide complementary data for the reader, the statistics are calculated for deposit banks in Turkey. In this study the HHI level appears to be in the highest levels of weak oligopoly close to monopolistic levels. (See, Appendix 1) When the domestic market is considered, the sector shares which fell after the 2001 crises in the Turkish banking sector have started to rise as of 2003, till the year of 2005. While HHI values have gradually increased; the sector has come to the limits of an oligopolistic structure. However, as of the year of 2006, with the increase of the entry of the foreign capital banks to the Turkish banking sector, it is possible to say that the competition accelerated and the sector remained in a weak oligopolistic structure. In the year of 2009, HHI value has started to rise again and has increased to 985.28. (See, Appendix 1) This situation refers to a decrease in the competitive power in the Turkish deposit banks.

Despite various indicators, the empirical literature on SCP began taking a different turn between the late 1970s and early 1980s. The emergence of more formal (mathematical) theorizing in the field of industrial organization which led to an empirical methodology in IO very different from that adopted in the most SCP studies. This approach is today known as the 'New Empirical Industrial Organization' (NEIO).<sup>53</sup>

### 1.1.2.2. Panzar-Rosse Methodology and Other Non- Structural Models

Panzar- Rosse method is one of the critical outcomes of NEIO theory. In order to assess the market structure in detail and identify the degree of concentration, different types of measurements for the competitive degree of banks are used in the literature. The Panzar-Rosse method is a common method which is employed to examine the banks' behavior in competition.<sup>54</sup> The method proposes the estimation of a bank specific revenue function in terms of the bank factor prices. The sum of the elasticities of revenue with respect to factor prices is known as the H-statistic.<sup>55</sup>

<sup>52</sup> YETİM, S. and O. GÜLHAN (2005), *Avrupa Birliği Tam Üyelik Sürecinde Türk Bankacılık Sektörü*, Ankara, Xerox Doküman Merkezi, p.80.

<sup>53</sup> Lee 2007, p.12.

<sup>54</sup> MULYANIGSIH, T. and A. DALY (2011), *Competitive Conditions in Banking Industry: An Empirical Analysis of the Consolidation, Competition And Concentration in the Indonesia Banking Industry between 2001 and 2009*,

[http://ace2011.org.au/ACE2011/Documents/Abstract\\_Tri\\_Mulyaningsih.pdf](http://ace2011.org.au/ACE2011/Documents/Abstract_Tri_Mulyaningsih.pdf),

Erişim Tarihi: 08.10.2011, p.2.

<sup>55</sup> Goddard and Wilson 2008, p.2.

The fundamental facts for using the Panzar-Rosse methodology in this study is that first of all; Panzar-Rosse method seems well designed to compare competition across banking markets. Data requirements are quite low, and the necessary data can be obtained in many countries.<sup>56</sup> Another contributing fact is that; unlike the empirical literature on SCP, which was primarily based on cross-section studies, the New Empirical Industrial Organization (NEIO) focuses on econometric testing of particular aspects conduct in single industries with the objective of detecting market power or changes in the collusive-competition behavior of firms.<sup>57</sup>

Panzar-Rosse (1987) method is defined a statistic H as the sum of elasticities of revenue R to n factor prices  $w_i$ . Explicitly, the effect on revenue depends on the slope of the demand curve.

Profit for the ( $i^{\text{th}}$ ) bank is given by revenue minus costs:

$$\Pi = R_i(q_{i,j}, n, z_{i,s}) - C_i(q_{i,j}, w_{i,h}, x_{i,s}), \quad i = 1, 2, K, n \quad (1.2)$$

Where  $R_i$  and  $C_i$  represent the revenue and costs of the  $i^{\text{th}}$  bank,  $q_{i,j}$  denotes a vector ( $m$ ) of the outputs of that bank,  $n$  refers to the number of banks in the industry,  $z_{i,s}$  is a vector of exogenous variables that influence demand for the bank's output,  $x_{i,s}$  is a vector of control variables that affect the supply of the bank's output and  $w_{i,h}$  is a vector of ( $k$ ) input prices. Generally, banks maximize profits ( $\pi$ ) where marginal revenue equals marginal cost, so that;

$$\frac{\partial R_i}{\partial q_i}(q_i, n, z_i) - \frac{\partial C_i}{\partial q_i}(q_i, w_i, x_i) = 0, \quad i = 1, 2, k, n \quad (1.3)$$

At the market level, in equilibrium, the zero profit condition implies that;

$$R_i^*(q^*, n^*, z) - C_i^*(q^*, w, x) = 0 \quad (1.4)$$

Where (\*) denotes equilibrium values for the industry as a whole. Market power is measured by the extent to which the revenue of the bank is affected by a change in factor prices. The Panzar-Rosse method defines the sum of the input price elasticities (H) as the measure of competition<sup>58</sup>:

$$H = \sum_{h=1}^k \frac{\partial R_i^*}{\partial w_{i,h}} \frac{w_{i,h}}{R_i^*} \quad (1.5)$$

<sup>56</sup> Degryse et al 2009, p.36.

<sup>57</sup> Lee 2007, p.12.

<sup>58</sup> Matthews and Thompson 2005, p.176-177.

The statistics of H which refer to different values which represent the competition structure in the market are outlined below.

**Table - 1**  
**Discriminatory Power of H-Statistic**

Values of H	Competitive Environment Test
$H < 0$	<ul style="list-style-type: none"> <li>• Monopoly equilibrium: each bank, operates independently as monopoly profit maximization conditions (H is a decreasing function of the perceived demand elasticity).</li> <li>• Perfectly colluding oligopoly</li> <li>• Conjectural variation short-run oligopoly: The number of firms in the industry is fixed and each firm makes decisions based on assumptions about what the other firms' reactions will be to its own actions.</li> </ul>
$0 < H < 1$	<ul style="list-style-type: none"> <li>• Monopolistic competition: free entry equilibrium (H is an increasing function of the perceived demand elasticity). Individual firms face an inelastic demand curve and therefore revenues increase less than proportionately to the changes in factor input prices.</li> </ul>
$H = 1$	<ul style="list-style-type: none"> <li>• Perfect competition. Free entry equilibrium with full efficient capacity utilization.</li> <li>• Natural Monopoly in a perfectly contestable market.</li> </ul>

**Source:** Panzar and Rosse, 1987; Shaffer, 1994, Mathhews and Thompson, 2008

The cost studies that estimate firm's input-output cost relationship are known as Bresnahan and Panzar-Rosse models. Most studies which use individual firm data apply an alternative test for competitive market conditions based on the reduced form revenue equation of the firms.<sup>59</sup> Bresnahan's method uses historical data to estimate a market demand and use macroeconomic data, which limits its possibilities, as these data can be obtained on an annual basis only.<sup>60</sup> Despite the restrictions of Bresnahan model the advantage of the Panzar-Rosse model is that it uses bank level data and allows for bank-specific differences in production function. It also allows one to study differences between types of banks (e.g., larges versus small, foreign versus domestic). Its

<sup>59</sup> HEMPELL, H.S (2002), *Testing for Competition Among German Banks*, Discussion paper 04/02, Deutsche Bundesbank, January, p.5.

<sup>60</sup> MKRTCHYAN, A. (2005), "The Evolution of Competition In Banking in A Transition Economy: an Application of The Panzar Rosse Model To Armenia", *The European Journal of Comparative Economics*, No: 1(2), p.70.

drawback is that it assumes that the banking industry is in long-run equilibrium.<sup>61</sup>

However, a separate test exists to determine whether this condition is satisfied.<sup>62</sup> The factors summarized above do not guarantee that the Bresnahan and Panzar-Rosse tests are without problems of their own. If the market is in a transition phase, these tests inevitably may give misleading results.<sup>63</sup> Furthermore, the econometric problems such as estimation uncertainty, model misspecification, and measurement errors might cause spurious estimates of  $H > 1$ .<sup>64</sup>

- *The Boone (2008) Competition Indicator*: Boone (2008) introduces a new way to measure competition. He starts from the notion that in a more competitive market firms are punished more harshly in terms of their profits for being inefficient. Boone assumes that competition in a market can be intensified in several ways. One way is a fall in entry barriers. The lower the entry barriers, the more firms should enter and the more competitive the industry should be. This intuition requires the usage of concentration indices like the HHI.

- *Conjectural-Variations Method*: Another methodology to infer the level of competition was introduced by Iwata (1974) and Bresnahan (1982). This methodology is often referred to as the conjectural-variations method. It is based on the idea that a bank when choosing its output takes into account the "reaction" of rival banks.<sup>65</sup>

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<sup>61</sup> As the interpretation of the H- statistics is derived for the market equilibrium, the fact that we do observe market entry and exit might question the existence of an overall equilibrium in the market over the investigated time span and, therefore, imposes further limits on the interpretation of such analyses. Nevertheless, Panzar and Rosse (1987) stress that to only test the 'monopoly' hypothesis the long-run equilibrium is not a prerequisite. However, to test for the alternative models, i.e. monopolistic or perfect competition, it is necessary for the observations to be generated in long-run equilibrium. For details, see Hempell (2002).

<sup>62</sup> A subsidiary test is carried out for long-run equilibrium when a reduced- form function, where the dependent variable is the profit (ROA) of the bank, is regressed on the input prices and control variables. The test that the sum of the elasticities of input prices to profit be equal to zero is taken as a test for long-run equilibrium. [For details, see Matthews et al (2007) , Claessens and Laeven, (2004)]

<sup>63</sup> SHAFFER, S. (1994), "Bank Competition in Concentrated Markets", *Business Review*, No:3(4), p.3-4 [see: Mkrtchyan, 2005, p.69-70]

<sup>64</sup> SHAFFER, S. and L. SPIERDIJK (2011) *Cost, Revenue, and Strategic Interaction*, Working Paper, p.2.

[http://www.rug.nl/staff/l.spierdijk/Cost\\_Revenue\\_and\\_Strategic\\_Interaction.pdf](http://www.rug.nl/staff/l.spierdijk/Cost_Revenue_and_Strategic_Interaction.pdf).

Erişim Tarihi: 01.12.2011.

<sup>65</sup> DEGRYSE, H.A., and S. ONGENA (2008), *Competition and Regulation In The Banking Sector: A Review Of The Empirical Evidence on The Sources of Bank Rents*. In A. Thakor & A. Boot (Eds.), *Handbook of Financial Intermediation and Banking*. Amsterdam: Elsevier, p.14-15.

- *Sunk Costs Model*: In this model, it is assumed that the number of “dominant” banks in the market remains approximately the same and that only the number of “fringe” banks will increase in market size.<sup>66</sup>

- *Structural Models of Entry*: A number of recent researches in the literature aim to assess the competitive behavior from observed industry structure that produces insights about unobserved firm profitability. The underlying idea in these so-called “structural models of entry” is that the entry decisions of potential competitors and the continuation decisions of the incumbent firms only occur in case these decisions are actually profitable.

When the models are evaluated; the Boone indicator has some advantages and disadvantages compared to the H-statistic. First, while the H-statistic allows to exclude certain states of competition, an increase cannot be unambiguously interpreted as more competition. This does not hold for Boone's profit elasticity indicator. Second, similar to the distinction that was mentioned for the SCP and NEIO models, both measures of competition have also different data requirements.<sup>67</sup> The studies that used Panzar-Rosse methodology within various researchers are outlined briefly in the proceeding section.

## 1.2. Literature Review

The competition in the financial markets is required to support the wealth and economic development, but should not be also too big to prevent the financial stability and credit access highlights as that may cause the competition losing the optimum level.<sup>68</sup> Therefore, for evaluating the current level by comparing it with the optimum level, it is required to measure the level of competition. It is possible to observe various studies that have applied the Panzar-Rosse method to banking system, for measuring the competitive behavior of banks and have estimated similar levels of H statistics of Panzar-Rosse approach.

Molyneux et al (1996) presented an empirical assessment of competitiveness in the Japanese banking market using the Panzar-Rosse methodology to test for evidence of contestability. The hypothesis that, bank revenues behaved as if earned under monopoly or conjectural variations short-run oligopoly in 1986 but as if under monopolistic competition in 1988, aren't rejected.<sup>69</sup> In the study of Perrakis (1991) the results reject the hypothesis of

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<sup>66</sup> Degryse and Ongena 2008, p.19-21.

<sup>67</sup> Degryse et al 2009, p.36-37.

<sup>68</sup> Bikker et al 2007, p.12-15.

<sup>69</sup> MOLYNEUX, P., J.THORNTON and LLOYD-WILLIAMS, D. M. (1996), "Competition and Market Contestability in Japanese Commercial Banking", *Journal of Economics and Business*, Elsevier, No: 48(1), p.33-45.

monopolistic or oligopolistic behaviour in any of the three industries examined as they tell very little about the level of competition prevailing in Canada's financial industry, apart from excluding the polar cases of monopoly and long-run perfectly competitive equilibrium.<sup>70</sup>

Similarly, Shaffer (1993) concludes in her study that there was no monopoly or collusive-oligopoly market power in Canadian banking from 1965–89.<sup>71</sup> Debandt and Davis (1999), from their study of panel data of banks over the period 1992-1996, provide evidence that European banking markets for large banks in the mid-1990s were still characterised by monopolistic competition, when compared to the United States.<sup>72</sup> Regarding small banks, the level of competition appears to be even lower, especially in France and Germany.

Hondroyannis et al (1999) used the Panzar-Rosse statistic to assess empirically competitive conditions in the Greek banking system over the period 1993-1995. The results indicate that bank revenues were earned as if under conditions of monopolistic competition.<sup>73</sup>

Molyneux et al (1994) used the Panzar- Rosse method to assess competitive conditions in major European Countries banking markets between 1986 and 1989. Their results indicate no change in market conduct of banks between 1986 and 1989 and suggest that banks in Germany, the United Kingdom, France and Spain earned revenues as if under conditions of monopolistic competition in the period. In the case of Italy, they are consistent with banks having earned revenues as if under monopoly or conjectural variations short-run oligopoly conditions.<sup>74</sup>

Hempell (2002), with his study on German banks find that the empirical results require to reject the hypotheses of perfect competition for German banks, with values of the H statistic between zero and one.<sup>75</sup> However, while credit banks (excluding large banks) seem to operate more competitively than cooperative and savings banks (excluding their head institutions), savings banks

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<sup>70</sup> PERRAKIS, S (1991), "Assessing Competition in Canada's Financial System: A Note", *Canadian Journal of Economics*, No: 24(3), p.727-732.

<sup>71</sup> ALLEN, J. and W. ENGERT (2007), "Efficiency and Competition in Canadian Banking", *Bank of Canada Review*, Summer, p. 33-45. [See also, SHAFFER, S. (1993)]

<sup>72</sup> DE BANDT, O. and E.P.DAVIS (1999), A Cross-Country Comparison Of Market Structures In European Banking, ECB Working Paper, No. 7.

<sup>73</sup> HONDROYIANNIS, G., LALOS, S. and E. PAPAPETROU (1999), "Assessing Competitive Conditions in the Greek Banking System", *Journal of International Financial Markets, Institutions and Money*, No:9(4), p.377-391.

<sup>74</sup> MOLYNEUX, P, LLOYD-WILLIAMS, D. M. and J. THORNTON, (1994), "Competitive Conditions in European Banking", *Journal of Banking & Finance, Elsevier*, No: 18(3), p.445-459.

<sup>75</sup> Hempell, H.S (2002).

appear to behave more competitively than cooperative banks. They obtain the highest value for large banks, the group of small banks reaches the lowest H-statistic and medium-sized banks obtain a value in between.

Gelos and Roldos (2002) in their study on European and Latin American countries; find that Argentina and Hungary are near perfect competition whilst others are under monopolistic competition<sup>76</sup>.

Günalp and Çelik (2006) for their study on Turkish banks, indicate that banks are under conditions of monopolistic competition.<sup>77</sup> Again, the study of Aktan and Masood (2010) for the Turkish banking system presents results of monopolistic competition.<sup>78</sup> Rozas (2007), with his study on Spanish banks reveal that in the particular case of large scale the banks are really close to perfect competition. Second, he finds no apparent relationship between competition and market structure in terms of concentration and instability.<sup>79</sup>

Muharrami et al (2006) with their study on Arab GCC banking industry show that banks in Kuwait, Saudi Arabia and the UAE operate under perfect competition; banks in Bahrain and Qatar operate under conditions of monopolistic competition as they are unable to reject monopolistic competition for the banking market in Oman.<sup>80</sup>

Yuan (2006) based on study on Chinese banks reveal that they do not reject perfect competition in many cases. They assert that Chinese banking industry is highly competitive by international standards.<sup>81</sup>

Goddard and Wilson (2008), with their study regarding developed and developing countries find that banking appears to lean more towards the upper (highly competitive) part of the spectrum than has previously been suggested.<sup>82</sup>

<sup>76</sup> The concept of monopolistic competition, first introduced by Chamberlian (1933), has been extensively used in the theory of industrial organization. (See, Frexias and Rochet, 2008, p.81)

<sup>77</sup> GÜNALP B. and T. ÇELİK (2006), "Competition in the Turkish Banking Industry: Evidence from Savings Banks", *Applied Economics*, No: 38, p.1335-1342.

<sup>78</sup> AKTAN, B and O. MASOOD (2010), "The State of Competition of The Turkish Banking Industry: an Application of The Panzar Rosse Model", *Journal of Business Economics and Management*, No: 11 (1), p. 131-145.

<sup>79</sup> ROZAS, L. G. DE (2007), Testing For Competition In The Spanish Banking Industry: The Panzar-Rosse Approach Revisited, Banco de España Working Papers.

<sup>80</sup> MUHARRAMI, S. AL, K. MATTHEWS and Y. KHABARI (2006), "Market Structure and Competitive Conditions in the Arab GCC Banking System", *Journal of Banking & Finance*, No:30(12), p. 3487-3501.

<sup>81</sup> YUAN Y. (2006), "The State of Competition of The Chinese Banking Industry", *Journal of Asian Economics*, No: 17, p.519-534.

<sup>82</sup> GODDARD, J. and J.O.S. WILSON (2008), Measuring Competition in Banking: A Disequilibrium Approach, [www.eief.it/files/2007/10/s\\_20071105.pdf](http://www.eief.it/files/2007/10/s_20071105.pdf), Erişim Tarihi: 20.09.2011.

The study comprises a heterogeneous set of emerging, transition and developing countries.

In the study of Prasad and Ghosh (2005), the results of Indian banks point to monopolistic behavior of banks across time periods and across bank groups, with a more robust H statistic for the second sub-period and for private and foreign banks.<sup>83</sup> Buchs and Mathisen (2005), investigated Ghana banks and find that banks in Ghana appear to behave in a non-competitive manner that could possibly hamper financial intermediation.<sup>84</sup>

Even there are various studies based on the global financial markets, only a limited number of studies (Güenalp and Çelik, 2006; Aktan and Masood, 2010; Kasman, 2001, Çelik and Kaplan, 2010) implemented the Panzar-Rosse approach to measure the competitive conditions in Turkish banking sector. These studies vary widely in the functional form of the estimation equation, the determination of the endogenous and exogenous variables, the estimation method and the data set used. Most studies have had only access to publicly available data and thereby a focus on (large) private banks, investigating the competitive conditions in the time period between the late 1980s and mid-1990s.

Literature presents the findings which often state that Turkish banks are described as monopolistically competitive. Besides the outlined studies that are summarized above, there are several studies (Mkrtchyan, 2005; Matthews and Zhao, 2007; Yeyati and Micco, 2007; Turk- Ariss, 2009; Gelos and Roldos, 2004) which use the Panzar-Rosse method to measure the level of competition in the banking sector post-period 2005. And this paper also uses the Panzar-Rosse model to examine the level of competition in Turkish banking sector.

### **1.3. An Overview of Turkish Banking Sector**

After the November 2000 and February 2001 crises in Turkey, the new macroeconomic environment led to important changes in the banking sector. The rise in the interest rates, depreciation of the Turkish Lira and the contraction of economic activities adversely affected the profitability of the banks. Regarding the financial and operational resurrection attempts in the

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<sup>83</sup> PRASAD, A. and S. GHOSH (2005), Competition in Indian Banking, IMF Working Paper, 2005.

<sup>84</sup> BUCHS, T and J. MATHISEN (2005), Competition and Efficiency in Banking: Behavioral Evidence from Ghana, IMF Working Paper.

scope of the Banking Sector Reconstruction Program, the number of banks, branches, and employees were reduced.<sup>85</sup>

The implementation of "transition to the strong economy program" that started in April 2001 has been revised in the beginning of 2002 including the period of 2002-2004. The program aimed the strengthening of the banking system, increasing the resistance to external shocks of the economy, reducing inflation, reducing public debt, maintaining the financial discipline, and completing the structural reforms.<sup>86</sup> The abundance of liquidity in global financial sector and the global economic growth, the efforts for the adaptation of the membership of European Union as well as the implementation of economic program of 2002-2007 have provided the Turkish banks recover faster and developments in financial structure.<sup>87</sup>

The 2008 crisis causing bankruptcy or insolvency of banks and financial institutions in many countries particularly in the United States, the Turkish banking sector has survived the crisis with little damage. Noteworthy, banks have gained a stronger and a resistant structure. Especially in 2009, banks have made huge profits as a result of the short-term cautions and structural changes when most of the sectors of the economy have been in recession. There have been a growth and an increase in the level of inter-bank competition with the decrease in the interest margin in the first half of the year 2010.<sup>88</sup> Also, due to fast recovery of the macro-economic conditions, strong corporate and individual credit demand, the fall of public sector's debt rollover ratio and the stable outlook of monetary and capital markets the performance of the sector has continued to go better.<sup>89</sup>

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<sup>85</sup> ABBASOĞLU, O., F. AYSAN, A.FARUK and G. ALİ (2007), *Concentration, Competition, Efficiency and Profitability of the Turkish Banking Sector in the Post-Crisis Period*, MPRA Paper No. 5494, p.5.

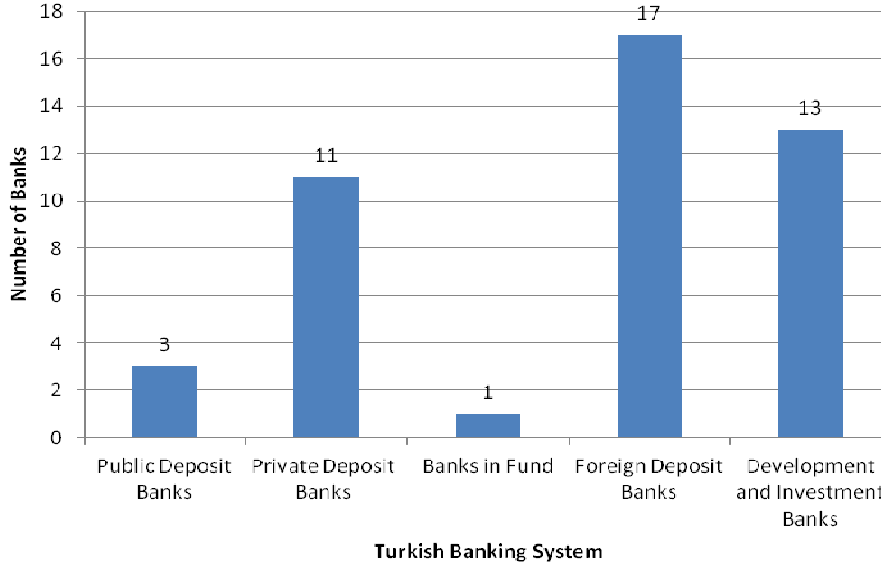
<sup>86</sup> TBB (2008), *50. Yılında Türkiye Bankalar Birliği ve Türkiye'de Bankacılık Sistemi "1958-2007"*, No: 262, p.20.

<sup>87</sup> TBB (2008), p. IX.

<sup>88</sup> BDDK (2010), *Türk Bankacılık Sektörü Genel Görünümü-Haziran*, No:2010, p.1-4.

<sup>89</sup> TBB (2011), p. 13-15.

**Figure - 1**  
**Turkish Banking Sector in 2010**



**Source:** BAT, Statistical Reports, Bank, Branch and Staff Information, June 2011, p.i.

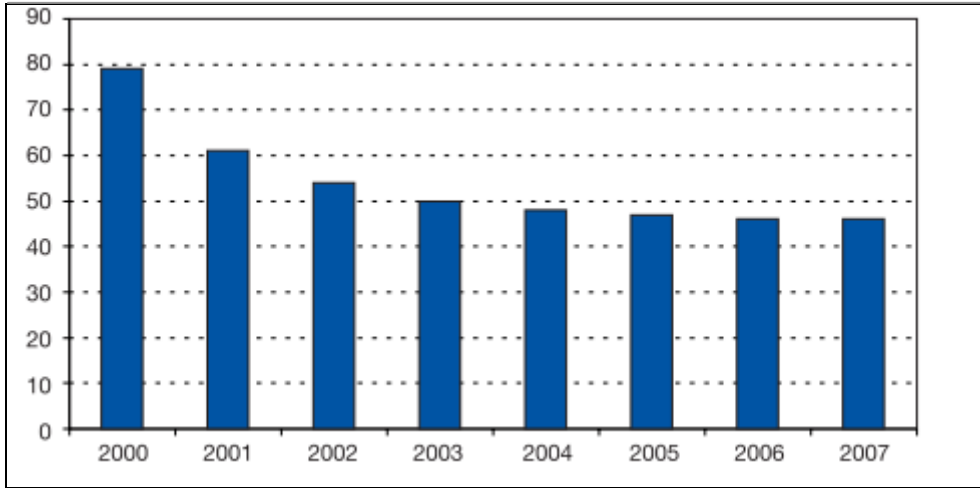
As observed in Figure 1, the numbers of development and investment banks are 13. In the sector 31 of the banks are deposit banks, 3 of the deposit banks are state-owned, and 11 of them are privately-owned banks. The number of the foreign-owned deposit banks is currently 17. There is 1 bank in the body of Saving Deposits Insurance Fund (SDIF).

In recent years, Turkish banks have started to operate under intense competition pressure which has been coming from the non-sector financial institutions and financial markets. As a result of the increasing competition, the banks in the sector have started to tend towards the operations such as non-interest insurance, private banking and asset management. The intense competition among banks forces them to increase their number of products as this reveals the rising importance of the cost of fund resource and fund structure.<sup>90</sup> Thereby, the discrimination of financial products created by banks provides them to benefit from the scope economies. Besides, the growing banks have

<sup>90</sup> YAKICI, T.A. and F. ÇANKAYA (2002), "Türk Bankacılık Sisteminin Ölçek Ekonomileri Açısından Değerlendirilmesi", *Bankacılar Dergisi*, No: 43, p. 33.

started to recognize the economies of scale and scope.<sup>91</sup> This made them to eliminate the operational inefficiency by decreasing the labor force and other variable costs.

**Figure - 2**  
**Number of Banks in Turkey**



**Source:** TBB (2008), 50. Yılında Türkiye Bankalar Birliği ve Türkiye'de Bankacılık Sistemi "1958-2007", No: 262, p. 55.

Despite the increase in the number of branches and staff in the period 2002-2007, balance sheet of the banking sector continued to shrink because of bank mergers and acquisitions. The number of banks decreased by 8 points compared to 2002, decreased to 46 at the end of the year 2007.<sup>92</sup>

As the return on assets of the sector declined in the period of 2002-2007, in which the inflation has fallen sharply and competition has become more powerful, the difference between the banking groups have been closed. State-owned banks have increased their profitability of return on assets contrary to private and foreign banks in the period 2002-2007. The result of this situation is the payment of banks' receivables which have arisen as government debt securities.<sup>93</sup>

<sup>91</sup> ARICAN, E., B.T. YÜCEMEMİŞ, M.E., KARABAY and G. IŞIL (2011), *Türk Bankacılık Sektöründe Ölçek Ekonomileri, Pazar Hakimiyeti ve Rekabet Gücü, Maliyet Etkinliği ve Ölçek Ekonomilerine İlişkin Ekonometrik Bir Uygulama*, TBB, No: 278, p. 25.

<sup>92</sup> TBB 2008, p.55.

<sup>93</sup> TBB 2008, p.94.

When the degree of concentration is concerned, the sector has observed a regular decrease between the periods of 1980-2000. The factors behind this can be summarized as the acceleration of entrance to the sector, high inflation, high public debt and the increasing borrowing options even in the short-term.<sup>94</sup>

When the structure of interest revenue and interest expense of foreign deposit banks is considered, it is interesting that the average share of foreign-owned banks is higher than sector. The underlying reason is that, banks are able to lend the deposits low by keeping the interest margin high, while they concurrently can loan much higher in terms of interest. (See Appendix, 7)

## **2. APPLICATION OF PANZAR-ROSSE METHODOLOGY TO THE TURKISH DEPOSIT BANKS**

### **2.1. Data**

As observed from the studies in the given literature, researchers used panel data in order to measure the level of competition for banks. Panel data models have important superiorities over ordinary time series and/or cross-sectional models. In these models, number of observations is more than that of in cross-section and time series models, thus the parameters are more reliable. In addition, estimated models depend on less restrictive assumptions.<sup>95</sup> In this study, we used panel data regression as econometric analysis method. The data covers 31 banks privately held and domestically owned that are fully licensed as deposit banks. The sample period covers annual data of 2002-2010 where the final sample consists of 279 bank-year observations. Data are obtained from the annual reports of Banks Association of Turkey database.

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<sup>94</sup> TBB 2008, p.102.

<sup>95</sup> Tunay 2009, p.42.

**Table - 2**  
**Summary of Data Sample in Different Classification and Sizes**

Scale	Number of banks	Public Deposit Banks	Private Deposit Banks	Foreign Deposit Banks	Total Assets (1000 TL)	Total Interest Revenue (1000 TL)	Total Interest Revenue / Total Assets (%)
<b>Small Banks</b>	17	-	8	9	35,057,120	2,541,605	7.2
<b>Medium Banks</b>	7	-	3	4	143,316,932	13,371,997	9.3
<b>Large Banks</b>	7	3	4	-	751,782,466	58,380,189	7.7

**Source:** The data are calculated based on the annual data obtained from BAT, Statistical Reports, June 2011.

When the analyzed period is concerned, the number of banks in Turkey has been decreasing due to the merger and acquisition activities and/or liquidation of some insolvent banks. As the number of state-owned banks did not change throughout the period, the decline in the number of banks in the sector is attributed to the decline in the number of privately-owned banks, particularly the commercial ones.

## 2.2. Estimation Equation and the Explanatory Variables

The revenue equation in the Panzar-Rosse model is interpreted as a reduced form rather than a structural equation: The following econometric revenue equation is estimated using two alternative specifications of dependent variable: total interest revenue to total assets or total revenue to total assets.

In most studies concerning the competition, three different input prices are considered as independent variables: (1) the deposit rate, measured by the ratio of annual interest expenses to total assets; (2) wages, measured by the ratio of personnel expenses to total assets; and (3) price of equipment or fixed capital, measured by the ratio of capital expenditures and other expenses to total assets.<sup>96</sup>

<sup>96</sup> Degryse and Ongena 2008, p.13.

The variables which we added to our econometric model are defined as follows:

*ORTA*, ratio of total revenues to total assets;

*IEF*, ratio of annual interest expenses to own funds (unit price of funds);

*OE*, ratio of operating expenses to total assets;

*PL*, ratio of personnel expenses to number of employees (unit price of labor);

*ASS*, ratio of bank's share in total banking assets

*PRVA*, ratio of provisions to total assets

*LN*, natural logarithm.

In order to estimate the H statistic, we used total revenues to total assets ratio as the dependent variable (*ORTA*) to take into account of both of interest and non-interest income. The dependent variable is expressed as a ratio to total assets in order to eliminate size effects. As already mentioned, the H-statistic is sum of the elasticity of revenue with respect to factor prices. We use following factor prices; ratio of annual interest expenses to own funds as a unit price of funds, ratio of personnel expenses to number of employees as a unit price of labor and ratio of operating expenses to total assets. In addition to the factor prices, ratios of bank's share in total banking assets and the proportion of provisions to total assets are included in the estimation equation for economic reasons. First variable added for scale effects and the second variable added might influence the dependent variable, because the higher proportion of risky loans in the banking portfolio, the higher interest revenues. The model for obtaining the measures of the competitive banking environment in Turkey is of the below logarithmic form and the following estimation equation is applied to the data set:

$$\ln \text{orta}_{it} = b_0 + b_1 \ln \text{ief}_{it} + b_2 \ln \text{oe}_{it} + b_3 \Delta \ln \text{pl}_{it}^r + b_4 \ln \text{ass}_{it} + b_5 \ln \text{prva}_{it} + u_{it} \quad (2.1.)$$

Subscripts *i* and *t* refer to bank *i* at time *t*, superscript *r* indicates real values (i.e. nominal values deflated by the GDP deflator). All variables are defined as described above,  $b_0$  is a constant and  $u_{it}$  stands for the stochastic error term. The estimation equation given above appears to us as a natural choice, consistent with the concept of Panzar-Rosse. The H-statistic of the model is measured as the sum of  $b_1$ ,  $b_2$  and  $b_3$ . A different specification using the ratio of revenues to total assets as dependent variable is often used in the literature. To account for firm specific risk we use the provisions to assets ratio (*PRVA*).

We expect the *PRVA* to be positively correlated to the dependent variable, since higher provisions should lead to higher bank revenue. The *ASS*

variable is included in our analysis to account for possible scale economies, given the wide range of bank asset sizes in the Turkish banking system.

### **2.3. Empirical Results and Interpretation**

First, we investigate the stationary properties of the variables. A stationary series fluctuates around a constant long-run mean and, this implies that the series has a finite variance which does not depend on time. On the other hand, non-stationary series have no tendency to return to a long-run deterministic path and the variances of the series are time-dependent. If the unit root tests find that a series contain one unit root, the appropriate route in this case is to transform the data by differencing the variables prior to their inclusion in the regression model. In our estimation, except LNPL variable (see, Appendix 8.) all of the other variables are stationary. For this reason we calculated first difference of LNPL variable, then we investigated again stationary of the first difference of the LNPL variable series (DLNPL)  $\Delta \text{LNPL}_{it} = \text{LNPL}_{it} - \text{LNPL}_{it-1}$ . In conclusion, since the Augmented Dickey-Fuller test p-value is less than our 5% significance level, it allowed us to reject the null hypothesis of a unit root in the first difference of LNPL variable (DLNPL).

We estimate a model with a cross section fixed effect. All regression coefficients are restricted to be the same across all cross sections, so this is equivalent to estimating a model on the stacked data, using the cross sectional identifiers only for the fixed effect. In order to detection of autocorrelation, we need a more sophisticated technique than visual inspection to discern the presence of autocorrelation. The Durbin - Watson (d) statistic is functionally related to the autocorrelation coefficient  $\rho$  as follows:  $d = 2(1-\rho)$ . When  $d \approx 2$ ,  $\rho \approx 0$ , that is, there is no evidence of autocorrelation in the model. The OLS estimates may be obtained by simply appending the term AR (1) to the equation, which stands for autoregressive first-order. Without AR(1) term our Durbin - Watson statistic (d) was equal to 1.56; also we had appended the term AR(1) to our equation and now our Durbin - Watson statistic (d) is equal to 2.16; that is, there is no evidence of autocorrelation in the model. We add an AR (1) term to the specification, and compute estimates using Ordinary methods. Note in particular the description of the sample adjustment where we show that the estimation drops one observation for each cross-section when performing the AR differencing. Ordinary least squares method is the simplest and most common estimation procedure employed in the Panzar-Rosse literature. In the Panzar-Rosse approach, banks should be observed from a long-run equilibrium perspective. To draw general outcome from the current study, we would ideally like to analyze the deposit banks in equilibrium. As seen in Table 3, it can be stated that the industry reached equilibrium in the period of 2002-2010. The

equilibrium statistic E is calculated as the sum of the input price elasticities, and the hypothesis that its value is 0 is tested, here we fail to reject the hypothesis that banks are in a long-run equilibrium.

**Table - 3**  
**Equilibrium Test Results for Deposit Banks for 2002-2010**  
**(Dependent Variable - LNROA)**

Dependent Variable: LNROA				
Method: Panel Least Squares				
Sample (adjusted): 2003 2010				
Cross-sections included: 31				
Total panel (unbalanced) observations: 225				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.599570	0.674554	2.371299	0.0187**
DLNPL	0.238746	0.131644	1.813577	0.0713***
LNIEF	-0.135340	0.091047	-1.486481	0.1388
LNOE	-0.051117	0.201184	-0.254079	0.7997
LNPRVA	0.345265	0.102925	3.354527	0.0010***
LNASS	-0.469619	0.198823	-2.361993	0.0192**
<b>E</b>	<b>0.05</b>			
R-squared	0.588275	Mean dependent var		0.503178
Adjusted R-squared	0.512030	S.D. dependent var		0.909717
S.E. of regression	0.635482	Akaike info criterion		2.076780
Sum squared resid	76.32521	Schwarz criterion		2.623356
Log likelihood	-197.6377	F-statistic		7.715557
Durbin-Watson stat	1.973372	Prob(F-statistic)		0.0000***

\*, \*\* and \*\*\* indicate statistical significance at 10, 5, and 1%, respectively.

The results of estimating equation (1) are shown in Table 4. The empirical results of Panzar-Rosse are consistent with monopolistic competition; the cases of monopoly and perfect competition are strongly rejected. Most of the

estimated coefficients are statistically significant, as there is no evidence of multicollinearity among the independent variables.<sup>97</sup>

The estimated coefficients have the expected signs and are all statistically significant since there is no evidence of multicollinearity among the independent variables. The coefficient of the LNASS variable is negative and statistically significant for all the years. This suggests that size-induced differences between banks, in terms of assets, may lead to lower total revenue per unit of asset implying that larger banks seem to be less efficient compared to smaller banks.

The sign of the coefficient of the LNPRVA variable is positive and statistically significant, indicating that banks with higher provisions to assets in their balance sheet generate higher revenues per unit of assets. This suggests that the higher the risks that the banks have to undertake the higher revenue the banks will obtain. The coefficient of the LNIEF variable and the coefficient of the LNOE variable are statistically significant for all the years. The coefficient of the LNOE variable is one of the most critical expenses that influence the banks' overall revenue as the results confirm the importance. The *F*-statistic for testing the hypothesis indicates that we can reject the null hypothesis at 0.01% level of significance for all the estimated years. The above results, in accordance with the actual estimated value of *H* from the estimated regression equations, suggest that the *H*-statistic value is positive and different from unity; it is between zero and 1.

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<sup>97</sup> The covariance between the estimated parameters is small in absolute values indicating that multicollinearity is not associated with the independent variables used in the regression equation. One of the most frequent is the problem that two or more of the independent variables are highly correlated to one another. This is called multicollinearity. If a correlation coefficient matrix with all the independent variables indicates correlations of 0,75 or higher, then there may be a problem with multicollinearity. It is seen from the tables that we have not any multicollinearity problem.

**Table - 4**  
**Regression Results of Competitive Conditions for Turkish Banks:**  
**Covering The Period 2002-2010**

Dependent Variable: LNORTA				
Method: Panel Least Squares				
Sample (adjusted): 2004 2010				
Cross-sections included: 31				
Total panel (unbalanced) observations: 210				
Convergence achieved after 8 iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.193426	0.195854	11.19930	0.0000***
DLNPL	0.142875	0.033741	4.234416	0.0000***
LNIEF	0.065519	0.027910	2.347535	0.0200**
LNOE	0.406214	0.052093	7.797786	0.0000***
LNASS	-0.186093	0.054838	-3.393513	0.0009***
LNPRVA	0.146565	0.034615	4.234111	0.0000***
AR(1)	0.128044	0.074239	1.724749	0.0864*
<b>H</b>	<b>0.61</b>			
Cross-section fixed (dummy variables)				
R-squared	0.854749	Mean dependent var		2.000220
Adjusted R-squared	0.824523	S.D. dependent var		0.414548
S.E. of regression	0.173654	Akaike info criterion		-0.504938
Sum squared resid	5.216943	Schwarz criterion		0.084790
Log likelihood	90.01849	F-statistic		28.27889
Durbin-Watson stat	2.166665	Prob(F-statistic)		0.0000***
Inverted AR Roots	.13			

\*, \*\* and \*\*\* indicate statistical significance at 10, 5, and 1%, respectively

As can be seen in Table 5, all of the variables were found to be statistically significant at 1% level. It also indicates that these variables have strong explanatory power in operating revenues to total assets ratio. The sign of the coefficient of the LNPRVA variable is positive and statistically significant,

indicating that banks with higher provisions to assets in their balance sheet generate higher revenues per unit of assets.

**Table - 5**  
**Regression Results of Competitive Conditions**  
**for Private Deposit Banks**

Dependent Variable: LNORTA				
Method: Panel EGLS (Cross-section weights)				
Sample (adjusted): 2003 2010				
Cross-sections included: 11				
Total panel (unbalanced) observations: 86				
Linear estimation after one-step weighting matrix				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.787594	0.176646	15.78069	0.0000***
DLNPL	0.128310	0.028989	4.426224	0.0000***
LNOE	0.303966	0.040777	7.454289	0.0000***
LNIEF	0.090204	0.029393	3.068865	0.0031***
LNASS	-0.223782	0.055898	-4.003435	0.0002***
LNPRVA	0.207605	0.031093	6.676813	0.0000***
<b>H</b>	<b>0.52</b>			
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.990149	Mean dependent var		2.379964
Adjusted R-squared	0.988038	S.D. dependent var		1.103990
S.E. of regression	0.120746	Sum squared resid		1.020568
F-statistic	469.0451	Durbin-Watson stat		1.986035
Prob(F-statistic)	0.0000***			
Unweighted Statistics				
R-squared	0.885015	Mean dependent var		1.978472
Sum squared resid	1.061603	Durbin-Watson stat		2.162679

\*, \*\* and \*\*\* indicate statistical significance at 10, 5, and 1%, respectively.

As figured out in Table 5, the coefficient of the LNASS variable is negative (-0.22) and statistically significant. This indicates that one point percentage increase in LNASS leads to 22 percent decrease in LNORTA. This suggests that size-induced differences between banks may lead to lower total revenue per unit of assets.

**Table - 6**  
**Regression Results of Competitive Conditions**  
**for Foreign Deposit Banks**

Dependent Variable: LNORTA				
Method: Panel Least Squares				
Sample (adjusted): 2004 2010				
Cross-sections included: 17				
Total panel (unbalanced) observations: 114				
Convergence achieved after 10 iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.770628	0.322052	5.497958	0.0000***
DLNPL	0.223440	0.056365	3.964202	0.0001***
LNIEF	0.036781	0.036894	0.996936	0.3214
LNOE	0.510738	0.080129	6.373967	0.0000***
LNASS	-0.161014	0.072786	-2.212145	0.0295**
LNPRVA	0.134739	0.054756	2.460717	0.0158**
AR(1)	0.158038	0.103270	1.530330	0.1294
<b>H</b>	<b>0.76</b>			
Cross-section fixed (dummy variables)				
R-squared	0.856505	Mean dependent var		2.062894
Adjusted R-squared	0.821813	S.D. dependent var		0.478428
S.E. of regression	0.201955	Akaike info criterion		-0.183377
Sum squared resid	3.711498	Schwarz criterion		0.368663
Log likelihood	33.45248	F-statistic		24.68940
Durbin-Watson stat	2.135095	Prob(F-statistic)		0.0000***
Inverted AR Roots	.16			

\*, \*\* and \*\*\* indicate statistical significance at 10, 5, and 1%, respectively.

In Table 6, when we look at the results of the analysis of the foreign-owned banks, the explanatory power of LNIEF variable (p- value; 0,32) is not statistically significant. This suggests that the explanatory power of variable LNIEF for foreign-owned banks is weaker compared to that of private deposits banks. One of the main reasons of this situation is the sharp differences in the ratio of interest expenses to total funds among foreign-owned banks.

The other is the foreign-owned banks' ability to provide funds more easily from abroad. While the coefficient of the LNIEF is not significant, the coefficient of the LNASS is also found to be negative (-0,16) and significant at 5% level. This indicates that one point percentage increase in LNASS variable leads to 16 percent decrease in LNORTA variable. When H values are analyzed according to the structure of capital, market condition is observed monopolistic competition in each of the three regression equation (see Table 1). H statistics for foreign-owned banks is found to be higher compared to private deposits banks (0,76 > 0,59). This indicates that there is more intense competition among foreign-owned banks.

### **3. CONCLUDING REMARKS**

The consensus in the field of research is that banking markets exhibit monopolistic competition. The study estimates competitive level for deposit banks in Turkey with an application of an empirical method developed by Panzar-Rosse. By estimating the banks' reduced form revenue functions, the sums of their estimated factor price elasticities which constitute the so called H-statistics provide information about banks' competitive behavior. Therefore we used the Panzar-Rosse methodology to assess competitive conditions in the Turkish banking system for deposit banks over the period 2002-2010. Despite the fact that the time period considered concerns the signs of aftermath financial crisis for the banking system we believe that it has been helpful to exclude the period before 2002. We estimated reduced form bank revenue equations following recent research into competitive conditions in banking markets. We employed two different estimating methods since the data is cross-section and time-series.

The results indicate that for the period under consideration, Turkish deposit banks earned revenues as if they were under conditions of monopolistic competition. Consistent with previous NEIO studies, this study robustly reject the hypothesis of pure monopoly pricing or conjectural variations oligopoly pricing, as well as the hypothesis of perfectly contestable or long-run competitive pricing, and are consistent with monopolistic competition. This result seems to be consistent with the findings of previous studies investigating the level of competition of deposit banks in the Turkish banking system as well

as the findings of most studies performed for the EU banks. When comparing the level of competition in banks concerning the capital, the estimation results in a decrease of the H-statistics by bank size. We find the highest value for (0,78) foreign deposit banks, the group of private deposit banks reaches the lowest H statistics (0,59). These findings support the results of earlier studies which also found higher H statistics for foreign deposit banks is larger than that of private deposit banks. Therefore, the competition among foreign banks seems to be more severe in the sector.

As the recovery conditions of the banking sector in Turkey still remain, with the liberalization and deregulation of the banking system, there have been clear indications of increase in competition. We believe that our study, gives further information about the sector as the empirical analysis provide an additional comparative evidence of competitive power in terms of capital structure of deposit banks. Finally, the results may have broader application to other banking systems in developing countries whose financial system undergoes similar structural changes. This paper makes several contributions to the literature. To best of our knowledge, it is one of the critical papers that analyses the firm behavior of banks and the level of competition by Panzar-Rosse method in Turkish banking sector within a wider perspective.

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## APPENDIX

**Appendix - 1**  
**Market Shares of Turkish Deposit Banks**

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	17,7	18,7	18,6	16,4	14,8	14,4	14,8	15,6	15,7
Türkiye Halk Bankası A.Ş.	8,2	7,8	8,4	6,8	7,1	7,2	7,2	7,6	7,6
Türkiye Vakıflar Bankası T.A.O.	6,0	6,9	7,9	8,2	7,6	7,6	7,4	8,1	7,7
Adabank A.Ş.	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Akbank T.A.Ş.	11,5	11,8	11,4	13,2	11,8	12,2	12,1	11,9	11,8
Alternatif Bank A.Ş.	0,6	0,5	0,4	0,4	0,4	0,5	0,5	0,5	0,4
Anadolubank A.Ş.	0,5	0,6	0,6	0,5	0,6	0,5	0,5	0,5	0,5
Şekerbank T.A.Ş.	1,0	1,0	1,0	0,8	0,8	1,1	1,1	1,1	1,2
Tekstil Bankası A.Ş.	0,5	0,5	0,4	0,5	0,6	0,5	0,4	0,3	0,3
Turkish Bank A.Ş.	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Türk Ekonomi Bankası A.Ş.	1,1	1,1	1,2	1,4	1,7	2,1	2,1	1,9	2,0
Türkiye Garanti Bankası A.Ş.	9,2	9,0	8,6	9,2	10,4	12,0	12,6	13,2	12,9
Türkiye İş Bankası A.Ş.	11,2	12,4	12,6	16,0	15,5	14,3	13,8	14,2	13,7
Yapı ve Kredi Bankası A.Ş.	8,9	8,4	8,0	6,0	10,1	9,0	9,0	8,1	8,8
Arap Türk Bankası A.Ş.	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Citibank A.Ş.	0,7	0,5	0,6	0,6	1,3	0,7	0,8	0,6	0,7
Denizbank A.Ş.	1,6	1,9	2,2	2,4	2,4	2,7	2,7	2,7	2,9
Deutsche Bank A.Ş.	0,1	0,1	0,1	0,1	0,2	0,1	0,1	0,2	0,3
Eurobank Tefen A.Ş.	0,3	0,2	0,2	0,2	0,2	0,5	0,5	0,5	0,4
Finans Bank A.Ş.	2,3	2,3	2,8	3,1	3,7	3,7	3,8	3,7	4,0

Fortis Bank A.Ş.	1,8	2,1	2,3	1,7	1,8	1,8	1,7	1,4	1,3
HSBC Bank A.Ş.	1,5	1,4	1,7	2,0	2,1	2,4	2,1	1,7	1,8
ING Bank A.Ş.	1,7	1,8	2,0	2,1	2,4	2,2	2,3	1,9	1,8
Millennium Bank A.Ş.	0,0	0,0	0,1	0,2	0,2	0,2	0,2	0,1	0,1
Turkland Bank A.Ş.	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,2
Bank Mellat	0,1	0,0	0,1	0,0	0,0	0,0	0,0	0,0	0,2
Habib Bank Limited	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
JPMorgan Chase Bank N.A.	0,0	0,0	0,1	0,1	0,0	0,0	0,0	0,0	0,1
Société Générale (SA)	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,0	0,1
The Royal Bank of Scotland N.V.	0,1	0,2	0,1	0,2	0,1	0,2	0,2	0,2	0,1
West LB AG	0,1	0,1	0,1	0,1	0,1	0,2	0,1	0,1	0,1
<b>HHI</b>	<b>856,62</b>	<b>922,92</b>	<b>933,26</b>	<b>964</b>	<b>957,1</b>	<b>936,03</b>	<b>945,95</b>	<b>985,28</b>	<b>972,39</b>

**Notes:** (the HHI values are calculated by authors based on the data obtained from BAT, Statistical Reports, June 2011)

### Appendix - 2 Descriptive Statistics of Turkish Private Deposit Banks

	LNPRVA	LNIEF	LNOE	LNORTA	LNASS	LNPL
Mean	-4.597575	-2.521515	1.346292	1.961962	0.401744	3.350302
Median	-4.652691	-2.545874	1.322630	1.946055	0.148997	3.337953
Maximum	-3.320215	-1.536772	2.139484	2.701445	2.808639	4.112506
Minimum	-6.263962	-3.617944	0.758622	0.913768	-4.923224	2.496617
Std. Dev.	0.679922	0.409520	0.326486	0.330633	1.871548	0.357327
Skewness	-0.161817	0.131208	0.537149	-0.318172	-0.480422	-0.009684
Kurtosis	2.881142	2.933572	2.857645	4.189418	2.886890	2.845067
Jarque-Bera	0.450702	0.277835	4.452859	6.899506	3.549059	0.092438
Probability*	0.798236	0.870300	0.107913	0.031753	0.169563	0.954833
Sum	-418.3793	-229.4578	122.5125	178.5386	36.55866	304.8775
Sum Sq. Dev.	41.60648	15.09360	9.593384	9.838608	315.2422	11.49145

\*p-value < 0,05 reject  $H_0$ , observations are normally distributed.

**Appendix - 3  
Correlation Matrix**

	LNASS	LNIEF	LNOE	LNORTA	LNPRVA	DLNPL
LNASS	1.000000	0.037709	-0.290896	-0.115362	0.191941	-0.021136
LNIEF	0.037709	1.000000	0.322315	0.407917	0.332493	0.118910
LNOE	-0.290896	0.322315	1.000000	0.660191	0.261207	0.186751
LNORTA	-0.115362	0.407917	0.660191	1.000000	0.585229	0.231635
LNPRVA	0.191941	0.332493	0.261207	0.585229	1.000000	0.008175
DLNPL	-0.021136	0.118910	0.186751	0.231635	0.008175	1.000000

Source: Authors' calculation.

**Appendix - 4  
Correlation Matrix of Deposit Banks**

	LNASS	LNIEF	LNOE	LNORTA	LNPRVA	DLNPL
LNASS	1.000000	-0.281308	-0.508532	-0.151296	0.436695	-0.017714
LNIEF	-0.281308	1.000000	0.505803	0.414005	-0.162330	0.255840
LNOE	-0.508532	0.505803	1.000000	0.664089	0.005712	0.261622
LNORTA	-0.151296	0.414005	0.664089	1.000000	0.426066	0.231275
LNPRVA	0.436695	-0.162330	0.005712	0.426066	1.000000	-0.084834
DLNPL	-0.017714	0.255840	0.261622	0.231275	-0.084834	1.000000

Source: Authors' calculation

**Appendix - 5  
Correlation Matrix of Foreign-owned Banks**

	LNASS	LNIEF	LNOE	LNORTA	LNPRVA	DLNPL
LNASS	1.000000	0.084249	0.188092	0.062937	0.131071	-0.006409
LNIEF	0.084249	1.000000	0.383679	0.448007	0.539037	0.069509
LNOE	0.188092	0.383679	1.000000	0.658785	0.459195	0.161737
LNORTA	0.062937	0.448007	0.658785	1.000000	0.677882	0.263969
LNPRVA	0.131071	0.539037	0.459195	0.677882	1.000000	0.075507
DLNPL	-0.006409	0.069509	0.161737	0.263969	0.075507	1.000000

Source: Authors' calculation

**Appendix - 6**  
**Net Profit in Turkish Banks via Capital Structure (millionTL)**

	2010	2009	2008	2007	2006	2005	2004	2003	2002
<b>Sector</b>	21.360,25	19.477,32	12.774,07	14.331,48	10.981,40	5.714,74	6.456,08	5.610,28	2.357,00
<i>Public</i>	6.880,14	6.393,25	3.905,77	4.512,83	3.733,23	2.869,06	2.682,32	1.790,36	1.056,11
<i>Private</i>	11.683,22	9.974,95	6.480,78	7.154,75	4.657,44	1.390,52	2.825,40	2.917,04	2.430,85
<i>Foreign</i>	1.952,85	2.066,98	1.384,87	1.696,05	1.460,58	513,10	246,88	186,24	82,05

Source: Authors' calculation is based on the data from BAT.

**Appendix - 7**  
**Interest Revenues/Interest Expenses (%) of Banking Sector in Turkey**

YEARS	2010	2009	2008	2007	2006	2005	2004	2003	2002
<b>Banking System in Turkey</b>	204.2	200.1	157.9	159.2	160.9	176.2	177.8	140.8	140.6
<b>Deposit Banks</b>	201.6	197.5	155.5	157.1	158.5	173.4	174.1	136.9	137.3
<i>Privately-owned Deposit Banks</i>	200.3	198.7	154.7	158.0	156.5	189.1	181.0	134.6	144.4
<i>Foreign-owned Banks</i>	252.5	236.3	182.5	178.0	181.6	192.1	215.2	269.0	233.7
<b>Banks opened a branch office in Turkey</b>	460.6	443.2	263.5	166.0	140.0	141.9	162.0	192.0	162.4

Source: Authors' calculation is based on the data from BAT.

**Appendix - 8**  
**ADF Fisher Unit Root Test on LNPL**

Null Hypothesis: Unit root (individual unit root process)		
Sample: 2002 2010		
Exogenous variables: Individual effects		
User specified lags at: 1		
Total (balanced) observations: 217		
Cross-sections included: 31		
Method	Statistic	Prob.**
ADF - Fisher Chi-square	73.1711	0.1568
ADF - Choi Z-stat	-2.18149	0.0146
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.		

**Source:** Authors' calculation

**Appendix - 9**  
**ADF Test Result for LNASS**

Null Hypothesis: Unit root (individual unit root process)		
Sample: 2002 2010		
Exogenous variables: Individual effects		
User specified lags at: 1		
Total number of observations: 214		
Cross-sections included: 31		
Method	Statistic	Prob.**
ADF - Fisher Chi-square	83.6432	0.0349
ADF - Choi Z-stat	-1.91174	0.0280
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.		

**Source:** Authors' calculation

**Appendix - 10**  
**ADF Test Result for LNIEF**

Null Hypothesis: Unit root (individual unit root process)		
Sample: 2002 2010		
Exogenous variables: Individual effects		
User specified lags at: 1		
Total number of observations: 215		
Cross-sections included: 31		
Method	Statistic	Prob.**
ADF - Fisher Chi-square	87.4258	0.0184
ADF - Choi Z-stat	-1.24939	0.1058
** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.		

Source: Authors' calculation

**Appendix - 11**  
**ADF Test Results LNOE**

Null Hypothesis: Unit root (individual unit root process)		
Sample: 2002 2010		
Exogenous variables: Individual effects		
User specified lags at: 1		
Total (balanced) observations: 217		
Cross-sections included: 31		
Method	Statistic	Prob.**
ADF - Fisher Chi-square	103.740	0.0007
ADF - Choi Z-stat	-3.05347	0.0011
** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.		

Source: Authors' calculation

**Appendix - 12**  
**ADF Test Results LNORTA**

Null Hypothesis: Unit root (individual unit root process)		
Sample: 2002 2010		
Exogenous variables: Individual effects		
User specified lags at: 1		
Total number of observations: 214		
Cross-sections included: 31		
Method	Statistic	Prob.**
ADF - Fisher Chi-square	120.999	0.0000
ADF - Choi Z-stat	-4.01924	0.0000
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.		

**Source:** Authors' calculation

**Appendix - 13**  
**ADF Test Results LNPRVA**

Null Hypothesis: Unit root (individual unit root process)		
Sample: 2002 2010		
Exogenous variables: Individual effects		
User specified lags at: 1		
Total (balanced) observations: 217		
Cross-sections included: 31		
Method	Statistic	Prob.**
ADF - Fisher Chi-square	141.230	0.0000
ADF - Choi Z-stat	-4.33215	0.0000
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.		

**Source:** Authors' calculation

**Appendix - 14**  
**ADF Fisher Unit Root Test on DLNPL**

Null Hypothesis: Unit root (individual unit root process)		
Sample: 2002 2010		
Exogenous variables: Individual effects		
User specified lags at: 1		
Total (balanced) observations: 186		
Cross-sections included: 31		
Method	Statistic	Prob.**
ADF - Fisher Chi-square	84.4218	0.0307
ADF - Choi Z-stat	-3.13552	0.0009
** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.		

**Source:** Authors' calculation