

**BANK COMPETITION AND BANKING SYSTEM STABILITY:  
EVIDENCE FROM TURKEY**

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# **ABSTRACT**

## **BANK COMPETITON AND BANKING SYSTEM STABILITY: EVIDENCE FROM TURKEY**

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This study empirically investigates the validity of the competition and stability trade-off hypothesis for the Turkish banking system. To this end, we consider annual bank level accounting data for the 1990-2008 period and compute the most commonly used measures of banking stability and competition. The effects of macroeconomic factors and bank specific indicators including the ownership structure are also taken into account. The fixed effects panel estimation results suggest that the relation between competition and stability is not invariant to the use of alternative indicators. The results based on the Z-Index as a measure of bank stability support the competition-stability and competition-fragility views when concentration ratios and the H-Statistics are used as the alternative competition indicators, respectively. However, when nonperforming loan ratio, a proxy for loan portfolio risk, is used as a stability measure, exactly the opposite outcome is obtained. The results also change when the ownership structure of banks is considered. Consequently, in line with the literature stating that there is no clear-cut relation between competition and stability, the direction of this relation for the Turkish banking system changes with different model specifications.

**Keywords:** Bank competition, concentration, banking system stability, Turkey.

# ÖZ

## BANKA REKABETİ VE BANKACILIK SİSTEMİ İSTİKRARI: TÜRKİYE ÖRNEĞİ

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Bu çalışma, rekabet ve istikrar ikilemi hipotezinin Türk bankacılık sistemi için geçerli olup olmadığını araştırmaktadır. Bu amaçla, 1990-2008 dönemi için banka düzeyinde yıllık muhasebe verileri kullanılmış ve yaygın olarak kullanılan rekabet ve istikrar ölçüleri hesaplanmıştır. Makroekonomik faktörlerin ve bankaların mülkiyet yapısını da içeren bankalara özgü göstergelerin etkisi de dikkate alınmıştır. Sabitlenmiş etki panel tahmin sonuçları rekabet ve istikrar arasındaki ilişkinin kullanılan alternatif göstergelere göre değişiklik gösterdiğini öne sürmektedir. Banka istikrarı ölçütü olarak Z-İndeksi kullanıldığında elde edilen sonuçlar, konsantrasyon oranları ve H-İstatistiği alternatif rekabet ölçütleri için sırasıyla rekabet-istikrar ve rekabet-kırılganlık görüşlerini desteklemektedir. Ancak, istikrar ölçütü olarak kredi portföy riskinin bir göstergesi olan geri dönmeyen krediler oranı kullanıldığında tam tersi sonuç elde edilmektedir. Sonuçlar bankaların mülkiyet yapıları dikkate alındığında da değişmektedir. Sonuç olarak, rekabet ve istikrar arasında kesin bir ilişkin olmadığını belirten literatür ile uyumlu olarak, Türk bankacılık sistemi için söz konusu ilişkinin yönü modelin özelliklerine göre değişiklik göstermektedir.

Anahtar kelimeler: Banka rekabeti, yoğunlaşma, bankacılık sistemi istikrarı, Türkiye.

To My Parents

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# **CHAPTER 1**

## **INTRODUCTION**

Competition is desirable for maximization of social welfare and existence of Pareto efficiency. In other words, in a competitive market setting, there is allocative and productive efficiency as well as dynamic efficiency. As in other industries, competition in banking system is also needed for efficiency and maximization of social welfare. However, banking sector has specific features that make it of particular importance to an economy and properties that may distinguish it from other industries. Banks contribute greatly to economic growth by playing an intermediating role between borrowers and lenders and providing financial resources to other industries and hence facilitating production. Banking system is also important since any instability in the banking system has the potential to lead to a financial instability and economic crisis. Hence, a well functioning banking system is regarded as a cornerstone of a market economy. Policymakers try to ensure that banking system is stable besides ensuring that it is competitive and efficient.

However, there has been a conventional wisdom among policymakers and academicians that more competition in banking system is associated with greater instability, hence there exists a trade-off between competition and banking system stability. This so called “competition-fragility” or “concentration-stability” view is supported theoretically by a great many of studies. There are different mechanisms proposed in the literature by which competition enhances the riskiness of banking system. The first one is the “franchise value hypothesis”, a dominant perception in the literature, which states that franchise value plays a key role in limiting the riskiness of banks. Franchise values reduce banks’ incentive to take excessive risk and make them relatively conservative in order to protect their franchise values which in turn contribute to the stability of the whole banking system. Higher

competition, instead, erodes profit margins causing banks' franchise value to drop, thus reducing incentives for prudent behavior and leading to more aggressive risk taking in an attempt to earn higher profits. Therefore, less concentrated banking systems are more prone to experience crises. Other mechanism proposed in the literature are mainly based on the effects of competition on the supervision and regulation of banks, the interbank market and payment systems, portfolio diversification and informational rents that banks gain from monitoring borrowers.

Recently, there is a counter-argument in the literature that greater competition among banks contributes to banking system stability and hence there exists no trade-off between competition and stability in the banking system. This so-called "competition-stability" or "concentration-fragility" view is mainly built on the "risk shifting paradigm" which states that increase in market power and the resulting higher loan rates have the potential to negatively affect the stability of banks due to moral hazard and adverse selection problems on the part of borrowers. Another argument supporting the competition-stability view is mainly based on the positive impact of competition on regulation and supervision of banks. The final argument is about the effect of "too-big-to-fail or to-important-to-fail policies" in concentrated banking systems on risk taking incentives of banks and borrowers and hence on the stability of banking system.

Not all the theoretical studies propose a clear positive or negative link between competition and stability. Hence, besides the competition-fragility and competition-stability views, there is a view stating that the relation between market structure and stability of banking sector is not straightforward. They argue that this relation is complex and has important interactions with macroeconomic, regulatory and institutional framework of countries and changes with different model specifications.

There is a large empirical literature which aims to examine the impact of banking system structure on its stability and hence shed light on the conflicting theoretical predictions and policy debates on this issue. However, similar to the theoretical literature, empirical studies produce mixed findings and do not offer concrete single evidence on the validity of either the competition-stability or the competition-

fragility views. Empirical studies differ in many aspects. Some studies examine the existence of the trade-off for one country while others conduct a cross-country examination. Furthermore, they also differ in the measurement of both competition and stability. While some studies focus on individual bank stability others base their studies on systemic bank distress. Moreover, while earlier studies measure competition by structural measures such as concentration ratios, relatively recent studies use non-structural measures which are based on bank level data and which measure the actual conduct of banks.

The objective of this study is to survey the theoretical and empirical literature on the relation between competition and stability in banking system and analyze this relation for the Turkish banking system for the period between 1990 and 2008. In the empirical study, all the banks operating at least one year in this period are included. The empirical investigation is based on individual bank stability measures which are Z-Index and nonperforming loan ratio. As a proxy for competition, both structural ( $CR_3$ ,  $CR_5$  and Herfindahl Hirschman Index) and non-structural measures (Panzar and Rosse H-Statistics) of competition are used. All these measures are calculated using bank level accounting data obtained from financial statements published by The Banks Association of Turkey. Therefore, the empirical study draws on a panel data set which has both bank and time dimension. Furthermore, macroeconomic and some bank specific factors as well as the ownership of banks that have the potential to impact stability are controlled for in the empirical analysis.

The remainder of the study is structured as follows: Chapter 2 presents a brief introduction to the trade-off between competition and stability in the banking system by focusing on the benefits of competition and specific features of banking system in terms of competition and stability. Chapter 3 and Chapter 4 provide a review of the theoretical and empirical literature on the relation between bank competition and banking system stability respectively. Chapter 5 presents an analysis of Turkish banking system by focusing on some structural measures of the system. The empirical study on the relation between competition and stability in the Turkish banking system is discussed in Chapter 6. Chapter 7 concludes the study.

## **CHAPTER 2**

### **THE TRADE-OFF BETWEEN COMPETITION AND STABILITY IN BANKING SYSTEM**

#### **2.1. Definition and Benefits of Competition**

Competition is defined as a process of rivalry between firms seeking to win customers' business over time (Whish, 2005). The aim is to increase market share and get higher profits. Firms compete on prices or quality of the products in concern. According to the traditional industrial organization literature, in a perfectly competitive market, there are many producers having small market shares. The concentration in the market is low. Individual producers can not affect the price of the product, so they are price takers. Products are homogenous. Moreover, there are no barriers to enter to or exit from the industry. Finally there is perfect information among producers and consumers.

The benefit of competition is that social welfare increases with the degree of competition in the market. Social welfare is defined as the sum of consumer and producer welfare. It is a static welfare measure. It is given by total surplus that is the sum of the consumer and producer surpluses. Consumer surplus is the difference between consumer's valuation of the good and its market price. It is also defined as the net benefit that a consumer gains by buying the good. Producer surplus is the profit that the producer gets from selling the good that it produces. In perfect competition social welfare is maximized. At the maximum level of social welfare, Pareto efficiency is achieved which is defined as the situation in which it is not possible to make anyone better-off without making someone else worse-off. Efficiency in turn consists of both allocative and productive efficiencies. First of all,

if allocative efficiency is achieved at the equilibrium prices in the market, this means that economic resources are allocated between different goods in such a way that it is not possible to make anyone better-off without making someone else worse-off. Consumer surplus is at the highest value. Goods are allocated between consumers according to the prices that they are prepared to pay and prices are equal to the marginal costs of production. Secondly, productive efficiency means that goods are produced at the lowest cost possible. Under perfect competition, firms produce at the lowest cost and on a more efficient basis in order to earn higher profits (Motta, 2004; Whish, 2005).

Apart from allocative and productive efficiencies, dynamic efficiency is also important. Dynamic efficiency refers to the extent to which a firm introduces new products or processes of production into the market. In perfect competition, it is assumed that producers constantly innovate and develop new products. This is the result of the rivalry between firms to increase market shares. Thus, competition may have the desirable effect of stimulating technological research and development. The competition in the market forces the producers to innovate constantly to produce higher quality products and decrease costs to maintain or increase their market shares and make more profits (Motta, 2004; Whish, 2005).

However, in an imperfectly competitive market, in which concentration is high and competition is low, Pareto efficiency is not achieved and social welfare is not at maximum. As the market power of firms increases, they charge higher prices to consumers and they have less incentive to decrease their costs. Therefore, neither allocative nor productive efficiency is present in the market. At the extreme case of monopolistic market structure, monopoly firm produces below the competitive and hence the optimum level of production and charges the highest prices leading to decline in consumer surplus and hence allocative inefficiency. Moreover, it has no competition constraint from other firms. As a result, it has less incentive to decrease costs and produce at the most efficient way by using the most efficient available technology. Hence, a monopoly firm does not have productive efficiency. Finally, in traditional industrial organization literature, it is thought that a monopoly does not



have the incentive to innovate and develop new products and production processes in turn leading to dynamic inefficiency (Motta, 2004; Whish, 2005).

Competition policy is defined as the set of policies which aim to ensure that competition in the marketplace is not restricted. Thus, the aim of the competition policy is the maximization of social welfare by ensuring that markets are competitive and allocative and productive efficiencies as well as dynamic efficiency are achieved. In other words, competition policy aims to create and maintain an efficient market structure (Motta, 2004; Whish, 2005).

## **2.2. Specific Features of Banking System in Terms of Competition and Stability**

As in other industries, competition in banking system also matters for efficiency and maximization of social welfare. From the traditional industrial organization perspective, competition among banks results in allocative, productive and dynamic efficiencies. Hence, as a first-order effect, it is expected that increased competition in banking sector leads to lower costs, lower loan rates and wider supply of loans, greater product innovation and improved quality of services. Even though financial services have some special properties, the channels through which competition affects efficiency are similar to other industries (Northcott, 2004; Claessens, 2009).

With regards to the allocative efficiency, two aspects are important: the quantity of credit supplied and its efficient allocation. In a perfectly competitive banking market, the profit maximizing behaviour of banks results in equilibrium where the greatest quantity of credit is supplied at the lowest price and where it is efficiently allocated. In terms of productive efficiency, if there is no economies of scale in banking services, productive efficiency is obtained in perfect competition since outputs are produced at minimum cost. As for dynamic efficiency, rivalry among banks leads to product innovation, development of new business processes, usage of higher level of technology in providing banking services, constant increase in the quality of financial products, etc. All these efficiencies in turn lead to increase in social welfare

and economic development (Claessens and Laeven, 2004; Northcott, 2004; Claessens, 2009).

However, banking sector has specific features that make it of particular importance to an economy and properties that may distinguish it from other industries. First of all, banks contribute greatly to economic growth by providing financial resources to other industries and hence facilitating production. They play a crucial intermediating role between borrowers and lenders through facilitating the transfer of resources from savers to borrowers. Banks mobilize, allocate and invest much of society's savings, so bank performance has substantive repercussions on capital allocation, firm growth, industrial expansion and economic development. Moreover, banks have an important function in the reduction of information and transaction costs associated with the interaction of borrowers and lenders. Hence, a well functioning banking system is regarded as a cornerstone of a market economy (Carletti and Hartmann, 2002; Berger *et al.*, 2004; Boyd and De Nicolo, 2005; Beck, 2008).

Besides the importance of an existence of efficiently functioning banking system for economic growth, banking system is also important since any instability in the banking system has the potential to lead to a financial instability. Although financial stability covers all the financial institutions, soundness of banks is usually at the center of financial stability concerns and banking sector policy debates. The reason is that any instability in the banking sector can be easily transmitted to other sectors in the economy by disrupting the interbank lending market and payments mechanism and by reducing credit availability to real sector. Any distress in an individual bank has the potential to impact the whole banking and then financial system through the contagion effects. This in turn has high costs for the economy at large. Given the large social costs of banking sector instability, it is natural for policymakers to make the avoidance of banking instability and crisis a high priority (Carletti and Hartmann, 2002; Beck, 2008; Berger *et al.*, 2008).

Therefore stability of the banking system matters for policymakers as well as the efficiency of it. To achieve efficiency, it is certain that policymakers have to maintain a level of competition in the system by supervisory and regulatory policies.

However, the stability is affected by a lot of factors such as macroeconomic and institutional factors, regulatory and supervisory policies as well as international economic conditions. Stability of the banking system may also be affected by the level of competition in the system. At this point the following question arises: Is competitive banking system more prone to instability or in other words, is there a negative relation between competition and stability in the banking sector? There has been a traditional perception among policymakers and economists that more competition in banking industry is associated with higher incentives to engage in more risky activities which ultimately lead to an increase in probability of bank failures. According to this view, there is a trade-off between competition and banking system stability. A certain degree of market power raises the opportunity cost of bankruptcy, thus moderates risk taking incentives of banks and fosters the stability of the system. The argument that a more competitive banking sector might endanger the stability of the financial system has for so long been the key rationale for the restriction of competition in banking markets by regulators. They think that market power is beneficial for social welfare by reducing the probability of excessive risk taking and consequently by increasing systemic stability. However, recently there is a counter argument that the competition in the banking sector may enhance the stability of banks. According to this opposite view, increase in market power has the potential to negatively affect the stability of banks due to moral hazard and adverse selection problems on the part of borrowers and hence increase instability. Therefore, there exists no trade-off between competition and stability for banking sector (Boyd and De Nicolo, 2005; Schaeck *et al.*, 2006; Beck, 2008; Berger *et al.*, 2008).

To sum up, in banking system, unlike other sectors of the economy, competition policy must take account of the interaction between competition and stability. The view that competition is unambiguously good in banking is more naive than in other industries. The special nature of banking sector in terms of stability means that competition policy is more complicated in the banking system than other sectors.

## CHAPTER 3

### COMPETITION AND STABILITY IN BANKING SYSTEM: THEORY

In this part of the thesis, theoretical literature on the impact of concentration and competition on banking system stability is reviewed. The review of the existing theoretical studies allows identifying an economic rationale for stability concerns of policymakers. This is because the theoretical research on this topic has a profound influence on academicians and policymakers as well as international institutions. However, it should be noted at beginning that these studies do not identify a clear direction on the relation between competition and stability in banking system. They provide contrasting predictions and have not yet agreed on either a positive or a negative impact.

There are mainly three arguments arising from the theoretical studies. Relatively earlier studies support the “*competition-fragility*” or “*concentration-stability*” view which states that as banking system becomes more competitive and less concentrated, it becomes more fragile and less stable. They argue that increase in market power is beneficial for stability. The second view in the literature is the so-called “*competition-stability*” or “*concentration-fragility*” paradigm which proposes that as banking system becomes more competitive, it is less prone to risk of bank failures which in turn enhances financial system stability. The third kind of view states that the relationship between market structure of banks and stability is complex and multifaceted; hence it is not easy to determine a positive or negative relation between the two. They demonstrate that the relationship between banking sector structure and stability has important interactions with macroeconomic, regulatory and institutional framework of countries.

In the first part of this section, the studies supporting the competition-fragility or concentration-stability view are reviewed. Secondly, a relatively recent theoretical research which proposes that competition-stability or concentration-fragility hypothesis is surveyed. Finally, the studies which reject these extreme cases and conclude that there exists no clear-cut relationship between market structure and stability are summarized.

### **3.1. Competition-Fragility or Concentration-Stability View**

The conventional wisdom in the banking literature is that there is a trade-off between competition and stability in the banking sector. This so-called competition-fragility or concentration-stability view states that competition has a detrimental impact on the stability of banks leading to undesirable outcomes in the form of bank failures. In contrast, concentration and hence market power enhances stability by probability of bank failures. This trade-off has long been dominant in the theoretical literature as well as in the actual supervision and regulation of banks. In banking supervision and regulation, excessive competition among banks is perceived to threaten the solvency of banks and at an aggregate level hamper the stability of the entire banking system through resulting in crises. In order to preserve the stability of the financial system, competition has to be restrained (Carletti and Hartmann, 2002; Beck, 2008).

The traditional competition-fragility view has been supported by many theoretical studies. These theoretical studies differ in the mechanism by which concentration or competition affects the riskiness of banking system. The first set of studies supports the famous “*franchise value hypothesis*” which is the dominant perception in this literature. Other studies analyze the effect of concentration and competition on the supervision and regulation of banks, the interbank market and payment systems, portfolio diversification and informational rents that banks gain from monitoring borrowers. In the following part, after the franchise value hypothesis is explained, academic studies supporting this paradigm are reviewed. Then the theoretical studies which analyze the impact of market structure on supervision and regulation of banks, interbank market and payment system, diversification and informational rents are surveyed briefly.

### **3.1.1. Franchise Value Hypothesis**

The franchise value hypothesis constitutes the cornerstone of the traditional competition-fragility strand of the literature. The essence of this paradigm is the analysis of the relationship between market structure and excessive risk taking by banks. Generally speaking, this view states that competition increases banking system fragility since it negatively affects the franchise value of banks.

Before explaining the hypothesis in detail, it may be helpful to make the definition of franchise value. In accounting terms, franchise value is defined as an intangible asset. It is the market value of a bank's equity exceeding its book value and reflected in the market price of shares (Carletti *et al.*, 2007). It can also be defined as the benefit that accrues to a bank's owners from its future operations or the present value of the expected future stream of profits. Hence, it represents the opportunity cost of going bankrupt (Northcott, 2004). This latter definition means that franchise value exists only if the bank remains in business and it is lost in the case of bankruptcy (Micco and Panizza, 2005). The underlying source of franchise value is assumed to be the profits that result from market power present in concentrated banking systems. For banks, these profits provide a buffer against adverse shocks and so increase the market value of the bank since investors value more the banks earning higher profits and more powerful against shocks. The rise in market price of shares beyond the book value creates in turn franchise value (Keeley, 1990; Jimenez *et al.*, 2007; Levy Yeyati and Micco 2007). Besides market power, bank size, efficiency, reputation and the relationship between banks and its clients are also seen as important determinants of franchise value (Furlong and Kwan, 2006).

In the literature and in the actual supervision of banks worldwide, the dominant view is that franchise value plays a key role in limiting the riskiness of individual banks and hence of banking systems more broadly. The reason is that since franchise value exists only when banks remain in business, banks try to avoid bankruptcy not to lose it. Therefore higher franchise values reduce incentive for banks to take excessive risk. They limit or reduce their risk-taking and become relatively conservative in order to protect their franchise values. They tend to behave more prudently by

holding more equity capital or less risky portfolios which in turn contribute to the stability of the whole banking system (Keeley, 1990; Schaeck *et al.*, 2006; Jimenez *et al.*, 2007; Levy Yeyati and Micco, 2007; Beck, 2008).

Higher competition, instead, have a deleterious impact on stability. It erodes market power and profit margins causing banks' franchise value to drop, thus reducing the incentives for prudent behavior. It leads to more aggressive risk taking in an attempt to earn higher profits. Examples of riskier policies that banks may follow are choosing more risky and lower quality portfolios, taking on more credit risk, lowering capital levels, etc. These riskier policies increase the probability of higher non-performing loan ratios and more bank bankruptcies resulting in greater fragility and financial instability. Therefore, less concentrated banking systems are more prone to experience crises. (Keeley 1990; Carletti and Hartmann, 2002; Jimenez *et al.*, 2007; Beck 2008; Berger *et al.*, 2008).

The franchise value paradigm has been supported over time in the banking literature. Before moving to the review of theoretical research on franchise value paradigm, it is beneficial to point out some of the assumptions made by these studies. First of all, they focus on the risk incentive of banks and analyze the effects of competition on banks' risk taking behavior. They see banks as choosing the risk of their asset portfolio and invest in assets with exogenous distributions of returns. Moreover, they allow competition to exist in the deposit market but suppress it in the loan market. Therefore, they take into account the liability side of the balance sheet of banks to analyze the incentive effects of high franchise values for bank risk taking (Carletti and Hartmann, 2002; Boyd and De Nicolo, 2005; Boyd *et al.*, 2006; Martinez-Miera and Repullo, 2008).

The academic research on the topic of the relation between market structure and banking system performance starts in 1980s. Previous work mostly focuses on the United States (US) banking market. Marcus (1984) uses a one period model and shows that as market power and franchise value declines, banks engage in riskier policies (Beck, 2008). Dermine (1986) finds a negative relationship between the level of bank credit risk and market power in deposits in a model in which

bankruptcy risk and deposit insurance is incorporated (Carletti and Hartmann, 2002). Chan, Greenbaum and Thakor (1986) show that increased competition reduces the profits that banks earn by identifying high quality borrowers. The resulting decline in franchise value in turn leads banks to reduce their incentive to screen borrowers. Therefore, credit quality declines and risk of banks increases (Beck, 2008).

The research interest in the relationship between concentration, competition and stability in banking is triggered after the study by Keeley (1990) who provides theoretical framework and empirical evidence for the franchise value view for the US banking system in 1980s. He argues that deregulation of the banking sector following relaxation of state branching restrictions in the US in the 1970s and 1980s increases competition and leads to a reduction in market power and hence franchise values. In his model, he measures market power by the ratio of banks' market value of assets to their book value which is called Tobin's  $q$ . He demonstrates that the decline in market power leads to a higher risk premium that banks have to pay on certificates of deposits and results in lower capital-to-asset ratios. The reduced profits and franchise values resulting from competition also increase the value of bank owners' and managers' put option on deposit insurance funds and magnify the agency problem between bank owners and the government. Banks have an increased incentive to take on extra risk, given the guaranteed funds available to them from deposit insurance. The overall increase in risk-taking causes a dramatic surge in bank failures during the 1980s (Keeley, 1990; Berger *et al.*, 2004; Boyd and De Nicolo, 2005; Beck, 2008; Berger *et al.*, 2008).

Suarez (1994), using a dynamic optimization model with an infinite horizon, demonstrates that there is a trade-off between market power and solvency. If the market power and franchise value of banks decrease, the incentive to engage in riskier policies increases significantly. Since the franchise value of the bank is a component of bankruptcy costs, it encourages the bank to carry out prudent policies that increase the stability and solvency. Edwards and Mishkin (1995) argue that the excessive risk-taking observed in the 1980s in the US is banks' response to the erosion of profits due to competition from financial markets. This competition



decreases their cost advantages in the acquisition of funds and undermines their position in the loan market (Carletti and Hartman, 2002).

Hellmann *et al.* (2000) analyze the relation between competition for deposits and excessive risk taking in a dynamic model of moral hazard in which banks choose their asset risk and compete for deposits. They argue that financial liberalization which removed barriers to entry and branching restrictions and deregulated interest rate ceiling in deposits in US in 1970s and 1980s stimulates excessive risk taking and has a negative impact on prudent bank behavior. Removal of interest ceilings results in increased competition for deposits which in turn lowers bank profitability and franchise value. This encourages moral hazard behavior by banks of inducing them to take excessive risk because of the government deposit insurance. They have option to put their assets to the deposit insurer if they take risks and lose all their capital.

Matutes and Vives (2000) investigate the link between imperfect competition in the deposit market, risk taking incentives and deposit insurance. Their conclusion is in favor of a positive impact of competition on the risk of bank failures, depending on the deposit insurance scheme. There are three circumstances. The first one is that when there is no deposit insurance but intense competition exists, the failure costs are high, deposit rates are excessive and so bank asset risk is high. A second result is that when deposits are insured through a flat rate scheme, competition leads to excessive deposit rates even without failure costs and banks take the maximum asset risk. Both deposit regulation (deposit limits or rate ceilings) and investment restrictions are needed to remove the negative effect of competition. Finally, when deposit insurance premiums are risk adjusted, deposit rates and bank asset risk are lower than in an economy without deposit insurance.

Repullo (2004) uses a dynamic model of imperfect competition in banking and showed that in the absence of regulation in the banking sector, more competition and lower bank margins lead to more risk and decreases banks' soundness. This is because bank managers have an incentive to take excessive risks so as to benefit shareholders at the expense of depositors (Jimenez *et al.*, 2007).

Bolt and Tieman (2004) investigate the consequences of loan competition among banks for risk taking behaviour and probability of default in a model in which banks compete by setting acceptance criteria for granting loans. They find that increased competition results in more risk taking by banks. This is due to the fact that a bank with looser acceptance criteria attracts more demand and makes higher per period profits, however the quality of the bank's loan portfolio deteriorates which in turn causes higher default probabilities and risk of failure. Therefore increased competition leads to lower profits overall and lower cost of bankruptcy, thus makes banks more prone to risk seeking in order to increase demand.

Micco and Panizza (2005) analyze several channels through which concentration affects how bank credit reacts to external shocks. They find that higher concentration may play a role in smoothing external shocks. They show that if a higher level of concentration is associated with higher profitability, banks with some monopoly power are able to build a buffer that allows them to take more risk and to reduce margins during economic downturns.

### **3.1.2. Effect of Competition on Regulation and Supervision of Banks**

The second argument supporting the competition-fragility view refers to the number of banks to be regulated and supervised by the authorities. Some researchers state that more concentrated banking systems which have a relatively small number of larger banks is substantially easier for supervisors to monitor efficiently than competitive banking system with lots of banks. Since the quality of regulation and supervision is better, concentrated banking systems suffer fewer banking crises and thus overall banking system stability is enhanced. According to Allen and Gale (2000, 2003), the US, which has large number of banks, supports this view since it has a history of much greater financial instability than the United Kingdom or Canada, where the banking sector is dominated by few larger banks (Beck *et al.*, 2006b; Beck, 2008).

### **3.1.3. Effect of Competition on Interbank Market and Payment System**

Another channel stated in the literature through which competition can impact stability is the interbank market and payment system. Allen and Gale (2000) show that perfect competition can prevent banks to provide liquidity to a bank hit by a temporary liquidity shortage. No bank has incentive to provide liquidity to the troubled bank, causing this bank to eventually fail with negative repercussions for the whole sector (Allen and Gale, 2004; Beck, 2008). Saez and Shi (2004) argue that if banks are limited in number, they may have an incentive to act strategically and cooperate to provide liquidity to the bank that has the temporary liquidity shortage. This prevents contagion and makes the banks that provide funds in this way better-off (Allen and Gale, 2004; Beck, 2008). Micco and Panizza (2005) find that banks with a larger market share can internalize the positive counter-cyclical effects of expanding credit during recessions and have incentives to reduce financial contagion.

Allen and Gale (2004) analyze the relationship between contagion, financial fragility and competition. They define contagion as an important source of financial instability which occurs when a small shock to an individual bank spreads from bank to bank throughout the rest of the financial system and causes a systemic problem affecting the entire economy. Allen and Gale (2000b) develop a model of contagion through the interbank market with a perfectly competitive banking system. It is shown that a shock in liquidity in a particular region that is small relative to the economy could spread through the interbank market and lead to systemic risk so that all the banks in the financial system to go bankrupt (Allen and Gale, 2004). Allen and Gale (2004) extend this model of contagion to allow for imperfect competition in the banking sector. They show that imperfectly competitive banking market may be more stable than perfectly competitive one, so there is a trade-off between competition and financial stability. The reason is that each oligopolistic bank realizes that its actions affect the price of liquidity. By providing sufficient liquidity to the market they ensure that contagion and their own bankruptcy are avoided.

#### **3.1.4. Effects of Competition on Portfolio Diversification and Informational Rents**

The implications of the impact of concentration on banks' portfolio diversification are also analyzed in the context of the relation between concentration, competition and stability. The related studies assume that the consolidation and concentration across activities in the banking industry leads to larger banks and larger banks usually have more diversified portfolios. Increased diversification of activities lowers the riskiness of profits and makes banks less prone to failure. This in turn leads to more stability (Mishkin, 1999; Beck *et al.*, 2006b; Beck, 2008). For example, if a financial institution is engaged in both banking and insurance, when it faces an unusual amount of insurance claims, it can more easily meet this claim than an institution engaged in insurance only (Mishkin, 1999). Micco and Panizza (2005) find that a higher degree of concentration can be associated with larger and more diversified banks which in turn allow banks to take more risk and hence continue lending during recessions.

Besanko and Thakor (1993) state that in the course of the relationship with their borrowers, banks need some private information of them. Acquiring this information is a costly process; however it provides informational rents to banks. As long as banks appropriate at least part of these rents, they have an incentive to monitor borrowers so as to enjoy the value of the relationship which in turn limit their risk exposure. In more competitive environment, relationship banking decreases in value; banks earn fewer informational rents from their relationship with borrowers, reducing their incentives to properly screen them. So in a framework of relationship banking, increased competition induces banks to choose riskier portfolio strategies. This increases the risk of fragility. Boot and Greenbaum (1993) obtain similar results in a two-period model in which banks can acquire funding-related reputational benefits and improve their rents through costly monitoring. As competition increases they give up monitoring their loan customers which is a costly activity. They are not selective while granting loans in turn increasing the risk profile of banks (Carletti and Hartmann, 2002).

### **3.2. Competition-Stability or Concentration-Fragility View**

The traditional competition-fragility view is challenged by the relatively recent competition-stability strand of the literature which argues that greater competition contributes to bank stability or in other words financial instability increases as the degree of competitiveness is lessened. It should be noted that in contrast to the competition-fragility literature, the studies that conclude a positive relation between competition and stability are relatively recent and small in number. Moreover, as in the competition-fragility literature, the theoretical studies supporting competition-stability view differ in the ways by which competition or concentration affects banking system soundness. The dominant view is the “*risk-shifting paradigm*” which has a great impact on the banking literature. This paradigm examines the impact of competition in the loan and deposit markets on the moral hazard and adverse selection incentives of borrowers. Another argument mainly refers to the impact of market structure on regulation and supervision of banks which reverses the positive impact of concentration on the supervision of banks as stated in the competition-fragility literature. The final argument is the called “*too-big-to-fail*” or “*too-important-to fail*” view which is related to the effect of market structure on regulatory policies in the banking system. All these arguments are reviewed below.

#### **3.2.1. Risk Shifting Paradigm**

Competition-stability view is mainly built on the risk shifting paradigm. The studies supporting this paradigm basically focus on the moral hazard and adverse selection problems in the banking sector and analyze the effects of competition on moral hazard and adverse selection incentives of borrowers. Moreover researchers allow competition to exist in both the deposit and loan markets. However, they mainly take into account the loan market and hence the asset side of the balance sheet.

Before reviewing the studies which produce competition-stability prediction resulting from the risk shifting incentives in the banking sector, it is appropriate to make the definition of moral hazard and adverse selection. Moral hazard arises when a party insulated from risk behaves differently from the way it would behave if it

were fully exposed to the risk. The party does not take the full consequences and responsibilities of its activities. Therefore, it has a tendency to act less carefully than it otherwise would and make another party to hold responsibility for the consequences of its actions. In banking, moral hazard problems enhance default risk of borrowers. Adverse selection refers to a market process in which bad results occur when buyers and sellers have asymmetric information. For example, in adverse selection problem, a bank that sets one price for all its customers runs the risk of being adversely selected by least profitable customers. In banking, adverse selection means there may be loan customers with riskier projects than the banks know.

Stiglitz and Weiss (1981) provide theoretical foundations to the risk shifting paradigm. They show that higher loan interest rates which result from lower competition may increase the riskiness of loan portfolios due to moral hazard and adverse selection problems. While increased funding costs discourage safer loan customers from borrowing, other borrowers are induced to choose riskier projects and hence are likely to face a higher probability of default. This situation leads to an increase in the volume of nonperforming loans, adding to the bank's risk exposure and undermines financial stability (Berger *et al.*, 2008).

Koskela and Stenbacka (2000) analyze the relationship between market structure in banking and risk taking in credit markets by introducing competition into lending markets. They show that introduction of lending rate competition into the credit markets reduces lending rates and generate higher investments without increasing bankruptcy risks in equilibrium. Hence, there is no trade-off between competition and stability. They are the first to show that allowing for competition in lending markets reverses the findings of the studies concluding that there is a trade-off between competition and stability. This finding is subsequently confirmed by Boyd and De Nicolo (2005).

Recently, Boyd and De Nicolo (2005) challenge the traditional competition-fragility view through the risk-shifting paradigm. They propose that market power may destabilize the banking system and be detrimental for financial stability. In their study, they criticize the traditional franchise value paradigm on several aspects. First

of all, the studies that support franchise value paradigm focus only on deposit market and do not take into account loan market. They allow competition to exist in deposit markets, but it is suppressed in loan markets. Furthermore they ignore the fact that banks invest in loans besides other assets. Hence, they assume that when making asset allocation decisions banks only solve the portfolio problem. However, since banks also invest in loans, they are also confronted with an optimal contracting problem. Moreover, since loan market is ignored, the studies focus only on risk-taking by banks. They assume that banks choose the riskiness of their assets and may consequently increase or decrease it depending on the degree of competition. They conclude that when confronted with increased competition, banks intentionally take on more risky portfolios resulting in fragility. Boyd and De Nicolo (2005) point out that besides banks, borrowers also choose the riskiness of their investment financed by bank loans. Nevertheless, the traditional studies ignore the impact of competition or concentration in the banking sector on borrowing firms' behavior.

Boyd and De Nicolo (2005) introduce a model where loan markets exist besides deposit markets and competition is allowed in both. Furthermore, they incorporate moral hazard and adverse selection problems in their models. They take into account the fact that banks also invest in loans, therefore when making optimal asset allocation decisions they are faced with both a portfolio decision and an optimal contracting problem. In a portfolio problem, asset prices and return distributions are given and there is no private information for banks. By solving this problem banks allocate their capital to a set of financial claims such as bonds and other traded securities. When there is a loan market, banks also have to solve an optimal contracting problem with their borrowers. In this problem, the actions of borrowers are unobservable or observable at cost. There is private information and borrowers' actions depend on loan rates and other terms of the loan contract. The risk of these loans is increasing in the loan interest rate. Borrowers entirely determine project risk, conditional on the loan rate set by banks. Moreover, loan defaults are perfectly correlated so that the loans' probability of default coincides with the banks' probability of failure. Banks make many different kinds of loans in imperfectly competitive markets with private information. Realistically banks are generally involved in both kinds of activity simultaneously.

As deposit markets become more concentrated, banks become less eager to seek low probability, high return outcomes in turn decreasing their risk profile. Increase in concentration or decrease in competition among banks in the loan markets however, translates into higher interest rates charged on business loans. Therefore, as competition declines banks earn more rents in their loan markets by charging higher loan rates. Higher interest rates increase the expected rate of return on bank assets; on the other hand it also increases the standard deviation of those returns in a moral hazard and adverse selection environment. This is because when confronted with increased interest rates on their loan, borrowers optimally choose higher risk projects and increase their own risk of bankruptcy. The higher interest rates charged to loan customers make it harder to repay loans and create moral hazard incentives for borrowers to shift into riskier projects to compensate for the high loan rates. This practice results in an increase in firm default risk and so in a higher probability that loans turn non-performing and a higher bankruptcy risk for banks and greater bank instability. Also the higher rates may also result in a riskier set of borrowers due to adverse selection problems. This is because a bank that sets higher price for all its customers runs the risk of being adversely selected by least profitable customers. Bank competition via reducing loan rates, makes it easier for borrowers to repay loans and then reduces moral hazard incentives to shift into riskier projects. Therefore, greater competition reduces default risk of borrowers and hence banks losses and so risk of failure unambiguously declines

To conclude, Boyd and De Nicolo (2005) arrive at a conclusion that a positive relationship between concentration and bank fragility exists. This result is based on the effect of competition on borrower's behavior. This mechanism exists on the asset side of the balance sheet and related with the loan market competition which is not taken into account by studies that focus on deposit market competition. In franchise value hypothesis, less competition in deposit markets results in higher profits due to lower deposit rates and banks intentionally seek less risk. The economic rents that banks earn from depositors provide incentives to carry out conservative asset side policies. This is called in the literature as the deposit market channel. However, at the same time, less competition in banking specifically in loan market means loan rates are high, hence borrower profits go down and they intentionally seek more risk. This



is named as the loan market channel. If competition is low and banks have high market power in both deposit and loan markets, the net effect of deposit and loan market channels determine the risk level of banks. If there is moral hazard and adverse selection problems on the part of borrowers, the loan market effect dominates and increasing concentration results in higher bank risk. Hence loan market channel can eliminate the trade-off between competition and financial stability implied by the deposit market channel of the franchise value paradigm. Boyd and De Nicolo (2005)'s risk-shifting paradigm argues that more competition across the loan and deposit markets could decrease borrower credit risk and enhance financial stability (Boyd and De Nicolo, 2005).

Martinez-Miera and Repullo (2008) criticize Boyd and De Nicolo (2005)'s assumption that loan defaults are perfectly correlated so that loans' probability of default coincides with banks' probability of failure. They say that the result of Boyd and De Nicolo (2005) model (BDN model) does not necessarily hold in the case of imperfect correlation of loan defaults. They extend BDN model by assuming imperfect correlation across individual firms' loan default probabilities. Furthermore, they also criticize BDN model on ignoring the fact that lower loan rates also reduce banks' revenues from non-defaulting loans. They propose the "*margin effect hypothesis*" based on the assumption that greater bank competition reduces interest payments from non-defaulting loans of firms that are able to repay even at higher interest rates, which provide a buffer to cover loan losses. According to this hypothesis, more competition leads to lower loan rates and consequently lower revenues from non-defaulting borrowers, which in turn decreases profits and increase risk taking by banks. Thus, in addition to the risk-shifting effect identified by Boyd and De Nicolo (2005), there is a margin effect that goes in the opposite direction. So the final effect on the risk of bank failure is ambiguous. They state that when interest rates increase, there are more defaults due to a risk-shifting effect but at the same time, there is a margin effect that generates more revenue for the bank coming from non-defaulted borrowers that pay a higher interest rate. In that framework, their conclusion is that there is a U-shaped relationship between competition and the risk of bank failure instead of a monotonic one as in BDN model. As the number of banks increases, the probability of bank default first declines but increases beyond a certain

point. Depending on the degree of default correlation across firms and the intensity of the risk-shifting effect, it is possible to find an initial decline in risk as the number of banks so competition increases, but an eventual increase in risk as the number of banks operating in a market keeps growing. Specifically, in very concentrated markets, the risk-shifting effect dominates, so entry reduces the probability of bank failure, whereas in very competitive markets the margin effect dominates, so further entry increases the probability of failure. Hence there is a U-shaped relationship between competition and the risk of bank failure.

### **3.2.2. Too-Big or Too-Important-to-Fail Policies**

Advocates of the competition-stability view argue that policymakers are more concerned about bank failures in concentrated banking systems with fewer and larger banks relative to competitive banking systems with many small banks. The reason is that presence of larger banks constitutes a potential threat to the safety and soundness of the financial system because; a failure of a large bank exposes the financial system to systemic risk. Concerns about contagion and financial crisis resulting from the failure of large banks make regulators reluctant to let large institutions fail in the event of solvency problems. Therefore, governments give the implication that they will guarantee the survival of these banks to avoid country-wide crisis. Hence, many countries with concentrated banking systems have implicit “*too-important-to-fail*” or “*too-big-to-fail*” policies that protect large banks by giving them larger insurance subsidies more than small banks. However these implicit policies in turn pose problems for the safety and stability of the banking market. These problems originate from the fact that unwillingness of the regulator to let the bank fail intensifies risk-taking incentives of it. The institutions believe that they are too big to fail and are likely to be explicitly or implicitly protected by the government safety net. From this perspective, concentrated banking systems may lead to more risk taking and tend to be more fragile than diffuse banking system with many small banks (Mishkin, 1999; Beck *et al.*, 2006b; Schaeck *et al.*, 2006; Levy Yeyati, and Micco, 2007; Beck , 2008).

Moreover, too-big-to-fail policies also create moral hazard problem on the part of depositors. Depositors of large financial institutions know that they are likely to be completely protected by government insurance if the institution fails. This enhances moral hazard problem because, depositors have little incentive to monitor the bank and withdraw their funds if the bank is taking on too much risk. Because of this lack of monitoring, large institutions in turn take on even greater risks, thereby making failures of these institutions more likely. To sum up, financial bail-outs of banks by governments can therefore encourage risky lending in the future, if those that take the risks believe that they will not have to carry the full burden of losses. Lending institutions make risky loans that will return to the bank if the investment turns out well but will be bailed out by the taxpayer if the investment turns out badly (Beck *et al.*, 2006b; Levy Yeyati, and Micco, 2007; Beck, 2008).

### **3.2.3. Effect of Competition on Supervision of Banks**

Proponents of the competition-stability view disagree with the proposition that concentrated banking system with a few banks is easier to monitor than a less concentrated banking system with many banks. Their argument is that as bank size increases with the increased concentration and consolidation across activities, banks become more complex and harder to regulate and supervise by authorities. Thus, this argument predicts a positive relationship between concentration and fragility (Beck *et al.*, 2006b; Beck, 2008).

### **3.3. No Clear Relation between Competition and Stability**

Not all studies in the literature find a clear positive or negative link between competition and stability. Some authors argue that the relation between market structure and riskiness of banking system is not straightforward. The direction of the relation depends on many issues and changes with different model specifications. Below, some of the cited studies in the literature supporting this view are surveyed.

Matutes and Vives (1996) propose that competition per se does not need to create instability. They argue that bank vulnerability to runs can emerge independently of

competition in any market structure. This is because the probability of bank failure is endogenously determined by self-fulfilling expectations of depositors and this implies multiple equilibriums. These equilibriums include corner solutions where only one bank is active or none of the banks is active due to systemic banking crisis. Another reason of the crisis is the existence of a coordination problem among depositors irrespective of the degree of competition in the deposit market (Carletti and Hartman, 2002; Beck *et al.*, 2006b; Beck, 2008).

Caminal and Matutes (2002) present a model where competition influences bank solvency through the incentives to invest in technologies reducing information asymmetries and moral hazard problems of borrowers. Banks compete for loans and use costly monitoring or credit rationing to deal with moral hazard problem. They find an ambiguous impact of market power on bank failures, resulting from the existence of two countervailing forces. On the one hand, more market power leads to greater loan rates which enhance moral hazard problems. On the other hand, since a monopoly bank faces a higher risk of failure due to moral hazard problems, market power provides more incentives for banks to monitor borrowers. Consequently the relationship depends on the level of monitoring costs for banks. They demonstrate that monopoly banks with intermediate monitoring costs can be more prone to originate risky loans that give rise to a higher probability of failure.

Boyd *et al.*, (2004) examine the effect of nominal interest rates on relative probabilities of banking crises in competitive versus monopolistic banking systems. They use a monetary general equilibrium model in which government chooses a steady-state inflation rate or nominal interest rate and there is no regulatory intervention such as lender-of-last-resort and deposit insurance. They find out that the relative probability of a banking crisis under competition versus monopoly can not be determined independently of the level of nominal interest rate. In particular, if the nominal rate of interest is below a threshold, a monopolistic banking system always results in a higher crisis probability than a competitive banking system. However, if the nominal interest rate is above that threshold, the crisis probability is higher under competition than monopoly. The intuition is that a monopolistic bank can generate higher expected profits by limiting its holdings of cash reserves relative

to a competitive banking system. Nevertheless, this raises the probability of a banking crisis due to unexpected reserve exhaustion. On the other hand, a monopolistic bank also offers depositors relatively lower returns which tend to reduce the probability of reserve exhaustion. The relative probability of crisis under monopoly versus competition depends on the strengths of these two forces.

Allen and Gale (2004) assess a variety of different models of competition and stability in the banking sector to illustrate the potential trade-offs that may exist between competition and financial stability. They highlight that the relationship between competition and financial stability is multifaceted and complex; hence the view that there is a trade-off between competition and financial stability may not hold. Different models can provide different results and there is a very wide range of possibilities.

Boyd *et al.*, (2006) study two models in which banks face an asset allocation decision. The first model reflects the franchise value hypothesis. It allows for competition in deposit, but not in loan markets and there is only portfolio problem and no contracting problem between banks and borrowers. This model predicts a negative relationship between banks' stability and competition. The second model is from Boyd and De Nicolo (2005)'s model which predicts a positive relationship between competition and stability. It allows for competition in both loan and deposit markets and banks solve an optimal contracting problem with their borrowers. They show that the two models yield opposite predictions with respect to banks' risk-taking. The prediction of the franchise value hypothesis model is that risk of failure is strictly increasing in the number of firms. With the Boyd and De Nicolo (2005)'s model, on the other hand, risk of failure is strictly decreasing in the number of firms. They conclude that theoretical arguments do not show that banking stability decreases with the degree of competition. Theoretically, that result depends on a particular model specification.

To sum up, theoretical studies on the relationship between competition, concentration and stability in the banking sector come to different conclusions with regards to the direction of the relationship. Relatively earlier studies on this issue

support the view that competition leads to instability in banking sector and hence there is a trade-off between competition and stability. The widely recognized paradigm supporting this view is the franchise value view stating that market power decreases the risk-taking incentive of banks and probability of bankruptcy. This view has had an influence on academicians and policymakers for so long. Other studies which conclude that competition may have a detrimental impact on the stability of competition take in to account the effects of concentration and competition on regulation and supervision of banks, interbank market and payment systems, portfolio diversification and informational rents.

Relatively recent studies however, propose that competition may enhance the stability of the banking system. The popular view is the risk-shifting paradigm stating that the due to moral hazard and adverse selection problems on the part of borrowers, increase in loan rates due to decrease in competition and the resulting market power may lead to an increase in riskiness of banks. Other studies which support the positive relationship between competition and stability focus on the too-big or too-important-to-fail policies and effect of competition on supervision of banks. Furthermore, some studies conclude that the relationship between competition and stability in banking sector is complex and depend on many other factors and hence there is no clear positive or negative relationship between them.

## **CHAPTER 4**

### **COMPETITION AND STABILITY IN BANKING SYSTEM: EMPIRICAL LITERATURE**

In this chapter, empirical studies on the relation between competition, concentration and stability in the banking system are surveyed. There is a large and growing empirical literature which aims to examine the impact of banking system structure on its stability and hence shed light on the conflicting theoretical predictions and policy debates on this issue. However, similar to the theoretical literature, empirical studies produce mixed findings and contradictory evidence. Therefore they do not offer concrete single evidence on the validity of either the competition-stability or the competition-fragility hypotheses. In this chapter, we first present the most commonly used measures of banking system competition and stability. We then proceed with the survey of the empirical studies on this issue.

#### **4.1. Measuring Stability and Competition**

In order to empirically test the relation between banking system competition and stability, appropriate measures of both are needed. In empirical studies several measures are used to approximate market structure and stability. Below, the measures of stability and competition that are frequently used in empirical studies are explained briefly.

##### **4.1.1. Measuring Banking System Stability**

In the empirical literature, stability in banking system is generally measured as either by identifying the occurrence of systemic banking distress or measuring individual

bank distress (Beck *et al.*, 2006b). Systemic banking distress is measured by taking into account the episodes of banking system crisis. It ignores individual bank level fragility. Individual banking distress, however, is approximated by using bank level accounting data.

### **Systemic Banking Distress:**

Systemic bank distress is broadly defined as periods when the banking system is not capable of fulfilling its intermediation function effectively anymore. Although there is no single and unambiguous definition of a systemic crisis, the definition of Demirguc-Kunt and Detragiache (1998, 2002) is accepted in the literature. In this study, occurrence of banking sector distress is identified and dated by using information on individual bank failures. Then, these are classified as systemic if one of the following cases happens: Non-performing loans of the banking system reach at least 10% of total assets at the peak of the crisis; the fiscal cost of the rescue operations is at least 2% of GDP; authorities use emergency measures, such as bank holidays, deposit freezes, blanket guarantees to depositors or other bank creditors to assist the banking system, or if countries undertake large scale bank nationalizations. They use a dummy variable that equals one if the country is going through a systemic crisis and zero if it is not and then use this dummy variable as proxy for banking system stability (Beck *et al.*, 2003; Beck, *et al.*, 2006b; Beck, 2008).

### **Individual Bank Distress:**

Some empirical studies focus on individual bank distress to measure the stability of banking system. While policymakers are concerned more about the systemic banking crises, individual bank fragility can also be worrying since several systemic banking crises start as crises in individual banks. Especially the failure of large banks can have important repercussions for financial system as a whole leading to country wide crisis. There are two commonly used measures of individual bank fragility; namely Z-Index and non-performing loan ratio. They both measure the probability of occurrence of a banking distress (Beck, 2008).

**Z-Index:** Individual bank fragility is generally measured by Z-Index which is a proxy for the probability of insolvency or entry into bankruptcy. It is an inverse



measure of overall bank risk. Z-Index is defined as the sum of return on assets and capital to asset ratio divided by the standard deviation of return on assets:

$$Z_i = \frac{(ROA_i + E/TA_i)}{\sigma(ROA_i)} \quad (4.1)$$

where, ROA is the return on assets ratio, E/TA is the equity to total assets ratio or capitalization ratio and  $\sigma(ROA)$  is the standard deviation of return on assets over the period under study. In this formula,  $i$  denotes an individual bank. Z-Index is calculated by using accounting data of banks (Beck, 2008; Berger *et al.*, 2008).

Z-Index combines in a single indicator the profitability given by ROA, leverage or capitalization level given by E/TA and return volatility given by  $\sigma(ROA)$ . It indicates the number of standard deviations in return on assets that a bank is away from insolvency and likelihood of failure. In other words, it represents the number of standard deviations below the mean by which profits have to fall so as to just deplete equity capital. Z-Index increases with profitability and leverage or capitalization level and decreases with return volatility or unstable earnings. Thus, a larger value of the Z-Index indicates a smaller risk profile for a bank and a higher bank stability (De Nicolo *et al.*, 2003; Boyd *et al.*, 2006; Beck, 2008; Berger *et al.*, 2008).

***Non-Performing Loan Ratio (NPL):*** In some empirical studies, researchers use non-performing loan ratio as individual bank fragility indicator. It is defined as the ratio of the volume of non-performing loans to total loans of a bank. Unlike Z-Index which indicates overall bank risk, NPL measures the credit or loan portfolio risk (Jimenez *et al.*, 2007; Beck, 2008; Berger *et al.*, 2008).

#### **4.1.2. Measuring Competition**

The approaches for the measurement of competition can be divided into two major streams: the structural approach and the non-structural approach. The structural approach is based on the traditional industrial organization literature and centers on the Structure-Conduct-Performance (SCP) paradigm. The SCP paradigm makes links

between structure and performance of industries. Structure refers to mainly the concentration in the market. Conduct refers to the behavior of firms in various dimensions such as pricing, research and development, advertising, etc. Performance refers to efficiency, mainly defined by extent of market power, with greater market power implying lower efficiency. The paradigm is based on the hypotheses that structure influences conduct (lower concentration leads to more competitive behavior of firms); conduct influences performance (more competitive behavior leads to less market power, less profits and greater efficiency) and structure therefore influences performance (lower concentration leads to lower market power). Hence the causality goes from structure to performance. Generally speaking, the SCP paradigm argues that greater concentration causes less competitive bank conduct and leads to greater market power and profitability of the bank. This in turn drives loan rates up and decreases deposit rates and hence decrease consumer welfare (Bikker and Haaf, 2002; Berger *et al.*, 2004; Carletti *et al.*, 2007, Levy Yeyati, and Micco, 2007; Claessens, 2009). Moreover, SCP paradigm assumes that since market structure is related to competitive conduct, competition can be approximated by the degree of concentration. Hence competition is measured by market structure measures such as number of banks, concentration ratios and Herfindahl-Hirschman Index as inverse indicators of the intensity of competition (Claessens and Laeven, 2004; Claessens, 2009).

SCP paradigm is criticized on the assumption that structure determines performance and it is argued that structure is not necessarily exogenous and market structure itself is affected by conduct and performance. Moreover, the measures of competition based on SCP approach are also criticized since the competitiveness of an industry cannot be measured by market structure indicators alone. They measure the actual market shares without allowing inferences on the competitive behavior of banks. Hence they are indirect proxies (Bikker and Haaf, 2002; Berger *et al.*, 2004; Claessens and Laeven, 2004; Claessens, 2009). Claessens and Laeven (2004) and Claessens (2009) argue that the degree of competition in the banking system should be measured with respect to the actual behavior of banks. The actual behavior is related not only to market structure but also to entry barriers, barriers on foreign ownership and activity restrictions which can limit the degree of competition.

As a response to the theoretical and empirical deficiencies of the structural models, non-structural models of competition are developed. These new industrial organization approaches provide non-structural measures such Lerner Index, Iwata model, Bresnahan and Lau model and Panzar and Rosse model to circumvent the problems of the competition measures based on traditional industrial organization approach. Non-structural measures do not assess the competitive conduct of banks through the analysis of market structure, but rather measure banks' conduct directly. Therefore, the recent literature on competition differentiates between competition and concentration (Bikker and Haaf, 2002; Levy Yeyati and Micco, 2007).

Below, the most frequently used measures of competition in the empirical literature are defined briefly. First of all structural measures of competition namely n-bank concentration ratio and Herfindahl-Hirschman Index are explained. Then Lerner Index and Panzar and Rosse H-Statistics which are non-structural measures of competition are defined.

***n-Bank Concentration Ratio ( $CR_n$ ):*** n-bank concentration ratio is the sum of market shares of n largest banks in the banking system. It is calculated by the following formula:

$$CR_n = \sum_{i=1}^n s_i \quad (4.2)$$

where  $s_i$  is the market share of bank i and n is the number of banks in concern. Total assets are generally used to measure the bank size in calculation of market shares. Concentration ratios give equal emphasis to the n leading banks and neglect the effect of many small banks in the market. There is no general rule determining the optimal value of n. However, in the empirical analysis, n is generally determined to be 3, 4 or 5. The ratio ranges between 0 and 1. It approaches zero if there is an infinite number of very small banks in the system and it equals 1 if there is one monopoly bank. The index provides information only about shifts in market shares between the top n banks and the remaining small banks, but does not capture changes in distribution within these two groups. Moreover, it ignores the structural changes

in the part of the industry which is not included in concentration ratio and also neglects the competitive influence of small banks on the decisions of the large banks in the market (Bikker and Haaf, 2002; Alegria and Schaeck, 2006).

**Herfindahl-Hirschman Index (HHI):** Herfindahl-Hirschman Index is the most widely used measure of concentration and a proxy for competition in theoretical research and empirical analysis. It is the sum of the squares of market shares of all the banks and has the following form:

$$HHI = \sum_{i=1}^n s_i^2 \quad (4.3)$$

where  $s_i$  is the market share of bank  $i$  and  $n$  is the total number of banks in the system. In calculating market shares, total assets are usually taken as a measure of bank size. Contrary to the  $n$ -bank concentration ratios, in the calculation of HHI, all banks in the market are taken into account. HHI stresses the importance of larger banks by giving them a higher weight than smaller banks. If  $n$  is the total number of banks, HHI ranges between  $1/n$  and 1. It reaches its lowest value, the reciprocal of the number of banks, when all banks in a market are of equal size and it reaches unity in the case of monopoly (Bikker and Haaf, 2002; Alegria and Schaeck, 2006).

**Lerner Index:** Lerner Index is a commonly used measure of market power and a non-structural proxy for competition. It is defined as the difference between price and marginal cost divided by price. It captures the degree to which a bank can increase its marginal price beyond its marginal cost. It is regarded as a more accurate measure of market power than the standard concentration measures. It is calculated by using bank level data. However, one drawback of Lerner Index is that computation of it requires a proper estimation of the marginal cost of the product (Jimenez *et al.*, 2007). Lerner Index is equal to zero in perfect competition since price is equal to marginal cost. It increases in less competitive markets as price diverges from marginal cost. In other words, the index decreases as the degree of competitiveness increases (Beck, 2008).

**Panzar and Rosse (PR) Model and H-Statistics:** Panzar and Rosse model is developed by Panzar and Rosse (1982, 1987). The PR model is used to assess the competitiveness of a banking sector and designed to discriminate between competitive, monopolistically competitive and monopolistic markets. The model investigates the extent to which a change in factor input prices is reflected in equilibrium revenues earned by a specific bank. There are some assumptions of the model. First of all, it assumes that equilibrium condition exists in the banking market. Furthermore, it supposes a demand with constant elasticity and a Cobb-Douglas production function and hence a homogenous cost structure. Under these assumptions, in 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 (Claessens and Laeven, 2004; Schaeck and Cihak, 2007).

The PR model provides a measure called “*H-Statistics*” ranging between 0 and 1 which is a competition measure based on the estimated responsiveness of firm revenue to changes in factor input prices. H-Statistics is calculated from reduced-form bank revenue equations and measures the sum of the elasticities of the total revenue of the banks with respect to the bank's input prices. H-Statistics measures market power by the extent to which changes in the factor input prices translate into equilibrium revenues. Hence in calculation of H-Statistics, first of all the following reduced-form revenue equation is estimated:

$$\ln(P_{it}) = \alpha + \beta_1 \ln(W_{1,it}) + \beta_2 \ln(W_{2,it}) + \beta_3 \ln(W_{3,it}) + \gamma_1 \ln(Y_{1,it}) + \gamma_2 \ln(Y_{2,it}) + \gamma_3 \ln(Y_{3,it}) + \delta D + \varepsilon_{it}, \quad (4.4)$$

where  $P_{it}$  is the ratio of gross interest revenue to total assets (proxy for output price of loans),  $W_{1,it}$  is the ratio of interest expenses to total deposits (proxy for input price of deposits),  $W_{2,it}$  is the ratio of personnel expenses to total assets (proxy for input price of labor), and  $W_{3,it}$  is the ratio of other operating and administrative expenses to total assets (proxy for input price of equipment/fixed capital). The subscript  $i$  denotes bank  $i$  and the subscript  $t$  denotes year  $t$ . Moreover, several control variables at the

individual bank level are included in the equation. Specifically,  $Y_{1,it}$  is the ratio of equity to total assets,  $Y_{2,it}$  is the ratio of net loans to total assets, and  $Y_{3,it}$  is the total assets (to control for potential size effects).  $D$  is a vector of year dummies. H-Statistics is equal to  $\beta_1 + \beta_2 + \beta_3$  (Claessens and Laeven, 2004; Schaeck and Cihak, 2007).

Since the PR model is only valid if the market is in equilibrium condition, following equation is estimated to find out whether equilibrium condition exists:

$$\ln(ROA_{it}) = \alpha + \beta_1 \ln(W_{1,it}) + \beta_2 \ln(W_{2,it}) + \beta_3 \ln(W_{3,it}) + \gamma_1 \ln(Y_{1,it}) + \gamma_2 \ln(Y_{2,it}) + \gamma_3 \ln(Y_{3,it}) + \delta D + \varepsilon_{it}, \quad (4.5)$$

where ROA is the return on assets (pre-tax profits to total assets). Market equilibrium condition indicates that the sum of the coefficients on the input prices ( $\beta_1 + \beta_2 + \beta_3$ ) equals zero. In other words, input prices are uncorrelated with returns since a competitive system will equalize risk-adjusted rates of return across banks in equilibrium. The idea behind this test is that in equilibrium, returns on bank assets should not be related to input prices (Claessens and Laeven, 2004; Schaeck and Cihak, 2007).

H-Statistics is interpreted as follows:  $H < 0$  indicates monopoly,  $H = 1$  indicates perfect competition and  $0 < H < 1$  indicates monopolistic competition. Since the cost functions are homogenous of degree one in input prices, a proportional increase in factor prices is mirrored by an increase in revenue under perfect competition. Given that a competitive firm is constrained to zero economic profit at the initial price, it must adjust output prices to pass on the entire cost increase to remain solvent. Thus in equilibrium, a bank's revenue must change by the same percentage as its costs and so by the same percentage as its input prices, so  $H=1$ . Under monopolistic competition, revenues increase less than 1. In the monopoly case, increases in factor input prices are not reflected in revenue or even decrease revenue. Therefore, as H-Statistics increases, it means there is less market power in the banking sector (Claessens and Laeven, 2004; Schaeck and Cihak, 2007).

## 4.2. The Empirical Literature

The evolution of the empirical study on the relation between competition, concentration and banking stability is examined by showing how the state of the literature was in 1990s and how it has evolved since that time. The literature on this issue emerged mainly in early 1990s. In those years, the empirical research mostly tested the traditional SCP paradigm in banking industry and consistent with this paradigm, measures of concentration such as n-bank concentration ratio or HHI were used as an inverse indicator of the intensity of competition. Furthermore, in empirical studies, bank conduct, market power and performance were usually approximated by bank prices and measures of costs and profitability. Moreover, the studies were generally static cross-section or short-run time series. They mostly examined the local US banking markets due to data problems since bank-level data were only available for the main developed countries (Berger *et al.*, 2004; Northcott, 2004; Schaeck and Cihak, 2007).

Recent studies take a broader perspective of competition by distinguishing between concentration and broader measures of competition. They use indicators that allow for the possibility that different sizes and types of banks may affect competitive conditions differently. They include indicators for regulatory restrictions on bank entry and activities and other legal impediments to competition to gauge the competitive environment. As well, a number of studies try to capture different dimensions of competition by examining the competitive effects of ownership of banks. Furthermore, recent research takes into account the broader context of national institutional framework that reflects national policies such as protection of private property rights and the freedom to compete in the economy. Moreover, in recent studies, measures of conduct and performance have expanded beyond price and profit measures and include indicators of efficiency, service quality, and riskiness of banks. Researchers have also broadened the focus from local US markets. The recent studies include analysis of panels of large number of countries as well as cross-country comparisons mainly owing to the recent databases including bank level data of many developed and developing countries (Berger *et al.*, 2004).

#### **4.2.1. Studies Based on One Country or Comparison of Two Countries**

Keeley (1990) tests whether increase in competition after deregulation of the banking industry in the US in 1970s and 1980s leads to a decline in bank franchise values and increase in bank default risk through reductions in capital and increases in asset risk. He uses franchise value which is the ratio of market value of equity to its book value as a proxy for market power. He measures bank risk by using two variables. The first one is the solvency ratio defined as the market value of capital divided by the market value of assets and the second one is the interest rates on certificates of deposit. By controlling for macroeconomic variables and bank characteristics, he shows that deregulation of state branching restrictions in US erodes franchise values and so market power of banks. Then he relates two measures of bank risk to the measure of market power. He finds that the solvency ratio has a positive relationship with market power indicating that more competitive banking systems are associated with reduced capital cushions and higher bank fragility. Also he shows that interest rates on certificates of deposit have a negative relationship with market power which means that reduced market power is associated with higher interest rates on certificate of deposits and higher risk premiums. Therefore he provides evidence that increased competition erodes franchise values and capital cushions; in turn induces banks to increase their risk profiles resulting in higher bank fragility. Hence the results support the franchise value paradigm. Banks with more market power hold more capital relative to assets and they have a lower default risk as reflected in lower risk premiums on certificate of deposits (Keeley 1990; Carletti and Hartman, 2002; Boyd and De Nicolo, 2005; Jimenez *et al.*, 2007).

Demsetz, Saidenberg and Strahan (1996) show that US banks with greater market power also have the largest solvency ratios and hence a lower level of asset risk. Saunders and Wilson (1996), for a sample of US banks, find support for Keeley's results for the period from 1973 to 1992. Brewer and Saidenberg (1996) find a negative relationship between franchise value and risk measured as the volatility of their stock prices for US banks. Hannan and Prager (1998) show that liberalization of interstate branching and operations increases competition in the deposit market and reduced profitability (Jimenez *et al.*, 2007).



Jayaratne and Strahan (1998) contrast Keeley's result. They show that branching restrictions in US banking serve as entry barriers that prevent efficient banks from expanding and therefore reduce the efficiency and performance of the banking system. They find evidence that once these restrictions are lifted and interstate banking is allowed, competition among banks increases and more efficient banks grow at the expense of their less efficient rivals. Hence the efficiency and performance of the banking system improve significantly and most of the reduction in banks' operating costs in turn decreases loan interest rates. Moreover, loan losses decrease as banks improve monitoring of their borrowers enhancing the performance and efficiency of banks in allocating resources to the highest return investments. Thus the authors conclude that increase in competition has the opposite effect of the franchise value paradigm by improving bank performance and stability.

Dick (2006) for the period 1993–1999, examines the effect of the latter stage of nationwide branching deregulation in the US on banking system performance measured by service quality and prices, operating costs, loan portfolio and the rate of return. He finds that the removal of restrictions leads to an increase in bank service quality, so in operating costs and service fees. Spreads fall because of the increase in operating costs and risk. Finally, he also provides evidence of increased charge-off losses and loan loss provisions. Therefore he states that deregulation decreases bank stability.

Another group of papers assess whether larger banks actually fail less often than smaller banks. On the basis of realized bank failure rates Boyd and Graham (1991, 1996) document that on average large banks in the US failed more often than small banks during the 1970s and early 1980s. They explain that the reason of the failure is that better diversification of larger banks does not reduce failure risk because of their greater tendency to take risk potentially as a consequence of an implicit too-big-to-fail protection. Demsetz and Strahan (1995, 1997) argue that due to diversification, larger banks have lower stock return volatility if their portfolios are held constant. But when loan portfolios are allowed to vary, risk is no longer reduced (Carletti *et al.*, 2007). For the US, Boyd and Runkle (1993) assess the relationship between bank size and risk measured by Z-Index for 122 banks over the period 1971-1990. They

find that there is an inverse relationship between size and Z-Index and standard deviation of asset returns. Therefore they find no evidence that large banks are less likely to fail. They explain this result by showing that whereas larger banks benefit from diversification advantages indicated by less volatile asset returns, these advantages do not translate into a lower failure probability since larger banks are highly leveraged (Carletti and Hartmann, 2002; Boyd and De Nicolo, 2005; Beck, 2008).

Capie (1995) studies the stability and efficiency of the UK banking system between 1890 and 1940. He finds this period to be very stable with no banking panic or financial crisis. Regarding market structure in the period in concern, there was an ongoing trend of banking consolidation leading from a system with many banks to an oligopoly. This is consistent with the hypothesis that less competitive banking systems is more stable (Carletti and Hartman, 2002). Salas and Saurina (2003) replicate Keeley's work for Spain and find a very significant and robust relationship between Tobin's  $q$  and the solvency and non-performing loan ratios of Spanish banks. Greater market power is found to be correlated with higher bank solvency ratios and lower credit risk losses (Jimenez *et al.*, 2007).

De Nicolo and Kwast (2001) examine the correlation of stock returns between 22 large and complex US banking organizations from 1988 to 1999. They interpret these correlations as measures of direct and indirect interdependencies arising from balance sheet exposures of banks and these correlations are taken as indicators of systemic risk. They observe that increases in market shares of large and complex banking organizations in 1990s were highly correlated with increasing stock return correlations. They argue that this may be an indication of increased systemic risk in the US banking sector as a consequence of consolidation. The result is inconsistent with the franchise value paradigm of an inverse relationship between concentration and risk (Carletti and Hartman, 2002; Carletti *et al.*, 2007; Beck, 2008).

Jimenez *et al.* (2007) assess the relationship between bank competition and risk taking in the Spanish banking system for the period 1988-2003. Their measure of bank risk taking is the NPL ratio. They use Lerner indices for commercial loans and

deposits as well as their average as a measure of market power. In addition to these, they use concentration measures such as HHI, CR<sub>5</sub> and the number of banks to measure the market power. They control for individual bank characteristics and macroeconomic conditions. They find that the number of banks, CR<sub>5</sub>, HHI indices as well as Lerner indices for deposits do not affect bank NPL ratios so they have no relationship with the level of bank risk-taking. However, Lerner indices for loans and joint loan and deposit Lerner indices have a negative and very significant relationship with bank portfolio risk. This result provides empirical evidence in support of the franchise value paradigm which suggest a negative relationship between market power and risk-taking; as bank market power increases, bank NPL ratios decline.

Fungacova and Weill (2009) provide empirical investigation of the role of bank competition on the occurrence of bank failures for Russian banks for the period 2001-2007. They measure competition by Lerner Index. The bank fragility measure is a dummy variable which equals one for a quarter in which a bank loses its license and zero otherwise. They include five control variables. Size measured by the logarithm of total assets is used since it can have an impact on the probability of bank failure through the too big to fail policies. The ratios of loans and government bonds to total assets are included in the estimations to take into account the structure of assets. They also account for the share of deposits in total assets as sources of financing can influence the occurrence of bank failure. Dummy variables for each quarter and year are also used to control for seasonal and year effects. They find that higher degree of market power reduces the occurrence of failure. Their findings support the competition-fragility view that greater bank competition is detrimental for financial stability.

Tunay (2009) examines the empirical relation between competition and fragility in the Turkish banking system for the years 1988-2007. He uses CR<sub>3</sub> based on total assets as a measure of concentration. As a measure of fragility, he uses non-performing loan ratios as well as a dummy variable which equals 1 for periods of crisis and 0 for normal periods. He also controls for the ownership of banks (government vs. private and domestic vs. foreign) macroeconomic factors such as

GDP growth, changes in the exchange rate, inflation and real interest rates. He includes in the model some measures related to the banking sector such as capital adequacy ratio, profitability and liquidity ratios. He finds that there is a negative relationship between competition and fragility in the Turkish banking system.

There are studies that compare banking market structures and stability across pairs of countries. Bordo, Redish and Rockoff (1995) compare the Canadian and the US banking systems' performances between 1920 and 1980. They observe greater stability for Canadian banks as compared to US banks and relate this to the oligopolistic market structure in Canadian banking compared to the higher degree of competition in US banking. Canadian banks are more profitable than US banks, suggesting that Canada has both a more stable and a more efficient banking sector than the US during this period. Hoggarth, Milne and Wood (1998) compare the relative performances of the United Kingdom (UK) and the German banking systems during the last decades. They observe that profits in the UK banking system are consistently higher than that of Germany but also much more variable. They conclude that higher UK profitability can be explained by higher non-interest income and lower staff costs and greater German stability by lower and more stable inflation as well as less competition particularly from foreign entrants. They find more competition and less stability in the UK and less competition but more stability in Germany consistent with the presence of a trade-off between competition and stability. Staikouras and Wood (2000) compare banking system stability of Greece and Spain for 1990s. They find that Spanish banks are both more profitable and more stable than Greek banks. Moreover, they observe that the Spanish banking system is more competitive than the Greek banking system which has a larger public involvement. Their finding is consistent with the hypothesis of no trade-off between competition and stability (Carletti and Hartman, 2002; Beck, 2008).

#### **4.2.2. Cross-Country Empirical Studies**

De Nicolo (2000) extends Boyd and Runkle (1993) by examining the relationship between bank size, franchise value and insolvency risk measured by Z-Index for 21 industrialized countries for the 1988-1998 period. Country-specific institutional and

regulatory features are taken into account. Consistent with Boyd and Runkle (2003), he finds that franchise values decrease and insolvency risk increases in size. Moreover, returns on assets and capital-to-asset ratios decrease in size; however volatility of returns increases in size. These findings indicate that size-related diversification benefits and economies of scale in bank intermediation either do not exist or they are offset by higher risk taking. Therefore, theoretically predicted positive relationship between size and franchise value, and a negative relationship between size and insolvency risk are rejected.

De Nicolo *et al.* (2003) explore how individual financial firm risk and systemic risk potential is related to consolidation and conglomeration. The relationship between individual financial firm risk, consolidation and conglomeration is tested for the largest 500 financial institutions worldwide for the years 1995 and 2000. The proxy measure of the financial firm risk is given by the Z-Index. Consolidation and conglomeration is captured by increases in firm size and expansion of the scope of activities. Factors affecting financial firms' choice of return, risk and capitalization are also taken into account. Regressions show that consolidation and conglomeration are not associated with lower levels of financial firm risk taking and larger and conglomerate firms exhibit levels of risk-taking higher than smaller and specialized firms. Overall, this evidence suggests that the factors creating incentives for firms to take on more risk appear to have offset the risk reductions through scale or scope economies and geographic or product diversification. The relationship between consolidation and systemic risk potential in banking is tested for the period 1993-2000. Systemic risk potential is proxied by the Z-Index of the largest five banks in each country which measures interdependency and joint probability of failure of these banks. Consolidation is proxied by CR<sub>5</sub>. Also they control for macroeconomic, institutional environments and government intervention, such as bank recapitalizations, restructuring and bailouts. The result is that systemic risk potential in banking is positively and significantly associated with bank concentration across countries indicating that consolidation and conglomeration increase risk profiles of firms.

Beck *et al.* (2003) investigate the impact of concentration and competition on banking system fragility for 70 countries over the period 1980-1997. Banking fragility is measured by the likelihood of suffering a systemic banking crisis as in Demirgüç-Kunt and Detraiche (1998, 2002). Concentration is measured by CR<sub>3</sub> based on assets. In their empirical study, they also include many explanatory variables to control for factors that may influence bank concentration, competition and fragility. Generally speaking, they control for differences in overall competitive/institutional environment, bank regulatory and supervisory policies, ownership structure of banks, and macroeconomic and financial conditions. With respect to the macroeconomic factors, the authors include growth rate of real GDP and GDP per capita, rate of inflation, and change in the external terms of trade to account for the level of economic development. They also account for the short-term real interest rate to capture banks' cost of funds and its effect on default rates and profitability of banks. Bank vulnerability to sudden capital outflows resulting from a run on the currency and bank exposure to foreign exchange risk are measured by the rate of exchange rate depreciation and by the ratio of M2 to foreign exchange reserves. Lagged credit growth is also a control since high rates of credit expansion may finance an asset price bubble that may cause a crisis. To control for international differences in the generosity of deposit insurance regimes index of moral hazard caused by deposit insurance is incorporated into models. Moreover, they control for bank regulation on capital ratios and required reserves, regulatory restrictions on bank entry and bank activities. Furthermore, they take into account cross-country differences in bank ownership by incorporating the degree to which the state and foreigners own banks. They also use variables to capture the extent of banking and economic freedoms.

They have three findings. First of all, the concentration ratio is found to be negatively and significantly associated with the probability of a systemic banking crisis consistent with the concentration-stability view. However, the stabilizing effect is weaker at higher levels of concentration. Second, the paper shows that more competitive banking systems-as indicated by fewer entry and activity regulations-tend to be less likely to suffer a systemic banking crisis. Therefore fewer regulatory restrictions on banks entry and bank activities reduce bank fragility and have a stabilizing effect on banking sector. The authors state that the finding that both

concentrated and competitive banking systems increase stability shows that concentration is not a robust measure of competition. Finally, they find that countries with better-developed institutions and with bank regulations and policies that support openness and competition throughout the economy are less likely to suffer systemic banking crises.

Demirgüç-Kunt *et al.* (2004) examine the influence of market structure, bank regulations and national institutional development on bank net interest margins and overhead expenditures for 77 countries. Net interest margin and overhead expenditures reflect operational efficiency and performance of a bank, and the competitive nature of the banking market. Net interest margin equals interest income minus interest expenses divided by interest-bearing assets. It measures the effect of market power on cost of financial intermediation and operational efficiency. The overhead expenditure is the ratio of bank overhead costs to total assets and it reflects cost inefficiencies due to market power. They use CR<sub>3</sub> based on assets as a measure of concentration. They control for bank-specific characteristics and cross-country differences in bank regulations, macroeconomic and financial sector conditions, and national institutions. At a bank level, they control for bank size and market share, the liquidity of assets, ratio of equity to assets, the degree of income raised from fees and commissions and the standard deviation of return on assets. At a country-level, they control for regulations concerning restrictions on bank entry and activities as well as property rights protection and the degree of economic freedom to account for the impact of regulatory and institutional framework on the cost of intermediation. They also control for inflation which may lead to larger interest margins due to informational asymmetries. Also, the level of equity market development is controlled for since competition from other segments of the financial system may influence the cost of intermediation. They include GDP growth to account for business cycle fluctuations and the state-ownership of banks which influence loan and deposit rates.

Demirgüç-Kunt *et al.* (2004) find that bank characteristics explain a substantial part of the within-country variation in intermediary costs. High net interest margins and overhead expenditures is associated with small banks, banks that hold a low fraction

of liquid assets and a relatively low amount of capital, banks without substantial income from fee-based activities, and banks with a large market share. The latter finding is consistent with the view that banks that are relatively large compared to the market can exert market power to increase rents. Second, they show that tighter regulations on bank entry and activities increase bank net interest margins. Finally, for relationship between concentration and net interest margins, they are positively and significantly related when bank-specific factors are controlled for. However this relationship breaks down when controlling for regulatory restrictions and institutional environment. This shows that bank regulations reflect national approaches to competition and concentration measures are not a good proxy for the competitiveness in banking markets.

Micco and Panizza (2005) analyze the relationship between bank concentration and credit volatility for 93 industrial and developing countries for the period 1990-2002. They test whether bank concentration is correlated with the way in which external shocks affect domestic credit. The study states that any mechanism that amplifies the effect of an external shock also increase the degree of macroeconomic volatility through credit availability. Micco and Panizza (2005) define real external shock as the weighted average of GDP growth in country's export partners and controls for financial development, bank ownership, bank size, and lack of competition measured by entry barriers. The study finds that there is a strong negative relationship between bank concentration and credit sensitivity to external shocks. Hence in countries with higher bank concentration, domestic credit reacts less to external shocks and maintain economic stability.

Beck *et al.* (2006a, 2006b) assess the relationship between bank concentration and the probability of a systemic banking crisis for 69 countries over the period 1980–1997 and provide evidence on whether particular mechanisms linking concentration and fragility-competition, diversification or ease of monitoring-account for the identified relationship between concentration and stability. They use Demirgüç-Kunt and Detraiche (1998, 2002) method to measure systemic banking crises. Concentration is measured by CR<sub>3</sub> ratio based on bank assets. They control for many country characteristics, including banking system supervisory and regulatory



practices, institutional factors and macroeconomic factors that may also influence banking system fragility. To control for macroeconomic factors such as real GDP growth, changes in the external terms of trade, the rate of inflation, the short-term real interest rate, the rate of exchange rate depreciation, the ratio of M2 to foreign exchange reserves and lagged credit growth. They also include measure of deposit insurance generosity into their model. To control for bank regulation and supervision, they include fraction of entry denied, activity restrictions index, required reserves, capital regulatory index, official supervisory power index. They also control for state or foreign ownership structure of banks. They also account for banking freedom and economic freedom indicators which show the relative openness of banking system and the economy as a whole respectively. Finally, they account for overall level of institutional development by using an index including voice and accountability, government effectiveness, political stability, regulatory quality, rule of law and control of corruption.

Beck *et al.* (2006a, 2006b) find that more concentrated banking systems are subject to lower probability of systemic banking crisis and hence are more stable which is consistent with the concentration-stability view. They also find that banking crises are more likely in countries with more generous deposit insurance, less developed legal systems, higher levels of inflation and exchange rate depreciation, and less likely in growing countries with higher GDP per capita and higher real interest rates. Moreover, they provide evidence on the potential mechanisms namely competition, diversification, and ease of monitoring underlying the positive relationship between concentration and stability. First, to assess whether concentration proxies for competition, they include bank regulatory indicators towards bank entry and activities; bank ownership and measures of several indicators of national institutional development that affect competition. Even when they control for these regulatory and institutional measures of the degree of competition, they continue to find that concentration is negatively associated with systemic crises. Therefore their results emphasize that concentration measures are not a reliable and sufficient indicator of the lack of competition.

Second, Beck *et al.* (2006a, 2006b) assess whether concentration proxies for diversification or ease of monitoring. For diversification, they control for the size of the economy and restrictions on making loans abroad which affect the ability of banks to diversify domestically and internationally respectively; bank size which may be positively correlated with diversification. For ease of monitoring, they control for the number of banks, banks size since larger banks may be more complex than smaller banks; activity restrictions on banks which indicate complexity of banks, capital regulatory requirements, deposit insurance, and other prudential regulations. If including these variables eliminates the relationship between concentration and fragility, it means that concentration acts as a proxy for diversification or the cost of monitoring banks. They find evidence that more concentrated banking systems have better-diversified banks and therefore diversification is one of the mechanisms underlying the negative relationship between concentration and banking system fragility. On the other hand, they do not find any support that it is easier for bank supervisors to monitor more concentrated banking systems with a few large banks and hence concentrated banking systems are more stable.

Boyd *et al.* (2006) examine the relationship between competition and risk-taking by using two models in which banks face a non-trivial asset allocation decision. The first model predicts a negative relationship between banks' risk of failure and concentration, indicating a trade-off between competition and stability. The second model predicts a positive relationship. They explore these predictions by using two samples with different characteristics. The first one is a cross-sectional sample of about 2,500 small, rural banks operating in only one market area within the US in 2003 and the second one is a panel data set of about 2,700 banks in 134 non-industrialized countries over the period 1993 to 2004. Their risk measure is the Z-index and the degree of competition is measured using HHI. In both the samples, they find that the relationship between competition and probability of failure is negative and significant. This finding is consistent with the competition-stability view. Therefore they provide empirical evidence supporting the risk-shifting model which says that more concentrated banking markets are associated with greater risk of bank failures.

Schaeck *et al.* (2006) analyze the effect of competition and concentration on banking system soundness for 45 countries over the period 1980–2005. They use Demirgüç-Kunt and Detragiache (1998, 2002) method to measure systemic banking distress. H-statistic is used as a measure of competition. Moreover, to explore whether concentration and competition measure different characteristics of banking systems they simultaneously incorporate in their models measures of concentration. They also use variables related to macroeconomic, institutional and regulatory framework such as that have the potential to impact banking system competition and soundness. They include the following macroeconomic variables in their model: GDP growth, the real interest rate, inflation rate, changes in the terms of trade, the foreign exchange rate, and real credit growth. They account for deposit insurance by incorporating a moral hazard index. Additionally, they control for legal origin of the country, activity and entry restrictions, capital regulation, ownership structure of banks, official supervisory power and private monitoring of banking system.

In their empirical study, Schaeck *et al.* (2006) find independent effects of the concentration ratios and H-statistics on both the likelihood and timing of systemic crises, they point out that concentration and competition describe different characteristics of banking systems meaning that concentration is an inappropriate proxy for competition. They find that more competitive banking systems are less prone to experience a systemic crisis and that time to crisis is longer in more competitive banking systems. They also find evidence that banking system concentration is associated with higher probability of a crisis and shorter time to crisis. Therefore they reject the franchise value hypothesis. They suggest that well executed policies promoting competition among banks have potential to improve banking system stability.

De Nicolo and Loukoianova (2007) examine the joint effects of bank ownership and market structure on banks' risk profiles and financial stability for 133 non-industrialized countries for 1993-2004. They present a model of banking industry which has two main features. First, banks compete both in the loan and deposit markets and both the borrowers and the banks are subject to moral hazard, as in Boyd and De Nicolo (2005). Second, banks differ in two dimensions: the efficiency

of the screening technology to identify borrowers' quality and the level of bankruptcy costs such as managerial reputation costs and implicit or explicit government guarantees. The model assumes that both state-owned and foreign banks have either larger screening and/or monitoring costs or lower bankruptcy costs than private domestic banks, banks' differences in market shares, screening or bankruptcy costs are not too large, and loan markets are sufficiently segmented across bank of different ownership.

In the empirical analysis, Z-Index and HHI are used as a measure of bank risk and concentration respectively. They control for cross-country differences in macroeconomic factors such as GDP per capita, real GDP growth, inflation and the nominal exchange rate. The firm-specific variables are used such as logarithm of asset size and the loan-to-asset, deposits- to-liabilities and cost-to-income ratios, which control for banks' differences in size, asset and liability structure and cost efficiency. The results of the empirical study indicate positive and significant relation between bank concentration and bank risk of failure and this relation is stronger when state-owned banks have sizeable market shares. The authors also find that conditional on country and firm specific characteristics, the risk profiles of foreign banks are on average higher than those of private domestic banks and private domestic banks take on more risk as a result of larger market shares of both state-owned and foreign banks.

Schaeck and Cihak (2007) assess the impact of bank competition and concentration on bank safety and soundness for ten European countries over the period 1999-2004. They use  $CR_3$  and H-statistic as a measure of concentration and competition respectively. They use capital ratios (the ratio of equity to total assets) to account for soundness of banks. Higher capital ratios are regarded as good for safety and soundness. They also consider bank level, regulatory, institutional, macroeconomic and financial system control variables that may have an effect on bank capital. Their results indicate that banks hold more capital as a buffer against default when operating in a more competitive environment. Thus, these results suggest that competition is positively linked with bank soundness. However, this relationship is weakened when banking industry is more concentrated and the level of economic

development increases. On the other hand, they find no consistent relationship between concentration and capital ratios in contrast to the traditional literature. This independent effect arising from competition and concentration for capital ratios indicate that concentration is an inappropriate measure of competition in banking.

Martinez Peria and Mody (2004) analyze the impact of foreign participation and high concentration on Latin American bank spreads during the late 1990s. Bank spread is the difference between the rate charged to borrowers and the rate paid by depositors and it is usually interpreted as a measure of the cost of financial intermediation. High spreads can hinder the growth of savings and investment and imply that the cost of using the financial system may become prohibitive for certain borrowers. This in turn negatively affects the performance and stability of financial system. They find that higher degree of concentration in the banking system has a positive and significant impact on both spreads.

Levy Yeyati and Micco (2007) examine the impact of concentration on competitive behavior of banks and financial stability for eight Latin American countries. They use  $CR_3$ ,  $CR_5$  and HHI based on total bank assets to measure banking system concentration; H-statistic to measure banking system competitiveness; and Z-index to proxy insolvency risk of banks. They observe no evidence that concentration significantly reduces competition. In terms of banking sector stability, increased concentration is found to have no influence on bank insolvency risk. However, they find that bank solvency risk is positively related with competition which supports the franchise value paradigm.

Berger *et al.* (2009) test the impact of market structure on the risk potential of banks for 23 industrialized countries. They construct a nonlinear relationship between financial stability and market structure in banking. They use NPL and Z-Index and equity to total assets ratio to proxy banking system stability and Lerner index and HHI based on deposits and loans as a proxy for market power and concentration. Furthermore, bank size, activity restrictions, banking freedom, and the percent of foreign- and government-owned banks are used as instrumental variables in the analysis. They also include in their estimation country-level data on business

regulations to proxy for the business environment in a particular country and an index of legal rights to measure the degree to which collateral and bankruptcy laws facilitate lending. They use the log value of GDP per capita to control for variations in economic development. Berger *et al.* (2009) find that more market power leads to riskier loan portfolios consistent with competition-stability view. However, they also find that overall bank risk is reduced with market power at least in part because banking institutions are likely to hold significantly more equity capital. This result implies that banks enjoying more market power seem to be exposed to less overall bank risk, most likely as a result of their higher franchise value. Therefore they argue even if market power in the loan market results in riskier loan portfolios, the overall risks of the banks need not increase. If banks enjoy higher franchise value resulting from market power, they may protect this value from the higher loan risk through more equity capital, a smaller loan portfolio, or other risk-mitigating techniques. Therefore they conclude that when banks charge higher rates for business loans and have a riskier loan portfolio, they may still choose a lower overall risk level.

To sum up, like theoretical studies, empirical studies suggest that the relationships between banking concentration and competition and banking system performance and stability are complex and depend upon multi-faceted aspects. There is no clear conclusion from different empirical studies on the validity of either the competition-stability or the competition-fragility hypotheses. Therefore there exists neither compelling theoretical arguments nor robust empirical evidence that banking stability decreases with the degree of competition.

## CHAPTER 5

### STRUCTURE OF THE TURKISH BANKING SYSTEM

Before moving to the empirical analysis of the relation between competition and stability in the Turkish banking system, we proceed with a brief review of the banking system in Turkey. In this context, we first explain the evolution of the banking system since the 1980s very briefly by focusing on the major structural features of the economy and the banking sector. We then discuss the structure of the banking system in the context of some competition and stability indicators presented in the earlier sections of this study.

#### 5.1. Evolution of the Turkish Banking System<sup>1</sup>

In the early 1980s, the Turkish economy witnessed some important structural changes including financial liberalization and banking system regulation. In this context, ceilings on interest rates were abolished, foreign exchange rates were freed, Interbank Money Market was set up in order to regulate liquidity in the banking system, Capital Markets Board and Istanbul Stock Exchange were established to enhance the efficiency and competition in the financial markets. After capital account liberalization, the transition to full convertibility of the Turkish Lira was achieved in 1989. In order to increase efficiency and competition in the banking system, new entry to the banking sector was eased and foreign banks were encouraged to come to Turkey. Furthermore, Turkish banks began to do business abroad through purchasing banks in foreign countries or opening branches and

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<sup>1</sup> See Akyüz and Boratav (2002), Özatay and Sak (2003), Alper and Öniş (2004), Hekimoglu *et al.* (2008), Sayılğan and Yıldırım (2009) and Bankacılıkta Yapısal Gelişmeler (2006, 2008 and 2009) for the recent analyses of the Turkish economy and banking system.

representative offices. The liberalization of foreign exchange regulations increased bank foreign exchange transactions.

Despite these financial liberalization policies and favorable developments in the 1980s, many structural problems started to arise in the Turkish banking system in the 1990s. First of all, there was a significant weight of public banks in the banking system. The distortions resulting from the duty losses of these banks marked the 1990s. Furthermore, the granting of new bank licenses and hence entry of new banks into the sector in those years was mainly on the basis of political criteria which had a detrimental effect on the development and efficiency of banking sector (Alper and Öniş, 2004). Moreover, the regulation and supervision of the banking system was weak and the political authority was directly involved in the regulatory process (Alper and Öniş, 2004). During this period, the presence of foreign banks was negligible due to the lack of a well-regulated and closely supervised banking system.

During the 1990s, private banks had significant elements of instability. First of all, at the beginning of the 1990s, government changed its borrowing policy from external sources towards internal debt instruments. As a result of the favorable returns of government securities, banks began to decrease the amount of traditional banking activities such as lending to the real sector and invested more in risk free government debt instruments. This also motivated new entries into the sector especially during the early 1990s. Moreover, new banks which belong to industrial groups were established in order to finance their own companies using the sources collected as deposits. Hence increase in the number of banks continued in 1990s. In an environment of free movement of capital, majority of banks, especially the private banks tried to take advantage of arbitrage opportunities. They borrow in foreign currency and mainly hold Turkish Lira denominated government securities. Hence they had open positions which made them extremely vulnerable to speculative attacks. Moreover, inadequate level of capital, maturity mismatch, high level of open positions, insufficient risk management practices, and bad governance contributed to the structural problems of the Turkish banking sector (Akyüz and Boratav, 2002; Sayılğan and Yıldırım, 2009).



All of these features made the banking system highly vulnerable to macroeconomic crises. Financial crises of 2000-2001 aggravated the weak financial stance of banks. 21 banks were transferred to the Saving Deposits Insurance Fund (SDIF) between 1997 and 2002 as they were not able to meet their liabilities (Özatay and Sak, 2003). After the financial crises of 2000-2001, with the initiation of the “Program for Transition to a Strong Economy”, the Turkish economy has experienced a notable improvement. An important part of this program was the restructuring program of the banking sector and it produced positive results. The financial and operational restructuring of public banks and strengthening of state, private banks and the improvement of the regulatory and supervisory framework contributed to improvement of the banking sector. The banks taken by SDIF were sold, merged or liquidated. Consequently, the number of deposit taking banks declined. The number of deposit banks also started to decline due to mergers and acquisitions as a result of the consolidation in the sector. Besides, favorable macroeconomic conditions, recapitalizing and restructuring processes in the banking sector boosted foreign interest and direct capital flows towards the banking sector which enhanced the consolidation process. Banking system which was the main source of financing public deficits in 1990s returned back to their traditional role of intermediation and financing the households and the real sector and hence supporting the economic growth.

## **5.2. Structure of the Turkish Banking System**

In this section, we consider some structural indicators of Turkish banking system during the period. In this context, we present basic indicators including the number of banks, composition of banks according to their ownership and field of activity, competition measures ( $CR_3$ ,  $CR_5$ , HHI and H-Statistics)<sup>2</sup> and stability measures (Z-Index and NPL)<sup>3</sup>.

Table 5.1 presents the number of banks in the Turkish banking system between 2000 and 2008. It also shows the composition of the total number according to the field of

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<sup>2 3</sup> See, respectively, Chapters 4 and 6 for the definitions and computations of these indicators.

operation (deposit vs. development and investment) and ownership of banks. As already noted in the first subsection of this chapter, during 1990s due to the easiness of setting up a bank and attractiveness of banking business, the number of banks has continuously increased. While it was 66 and 68 in 1990 and 1995, the number reached to 79 in 2000. As presented in the table, the number of banks has changed drastically since 2000. It started to decline during the financial crisis in 2000-2001 since many banks went bankrupt and transferred to SDIF. The number has continued to decrease after 2001 and it has been relatively constant since 2005. In 2008, 45 banks were operating in Turkey. The reason of the decline after 2002 is mainly due to the consolidation of Turkish banks especially with foreign ones which is a result of the positive outcomes of the restructuring process of banking system and favorable macroeconomic conditions (BRSA, 2006, 2007, 2008).

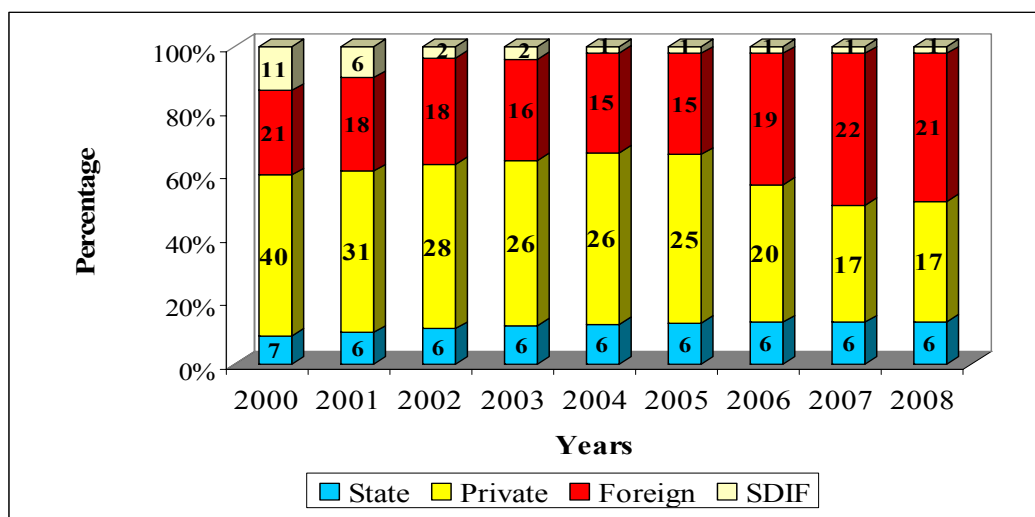
**Table 5.1: Number of Banks in the Turkish Banking System: 2000-2008**

	2000	2001	2002	2003	2004	2005	2006	2007	2008
<b>Deposit Banks</b>	<b>61</b>	<b>46</b>	<b>40</b>	<b>36</b>	<b>35</b>	<b>34</b>	<b>33</b>	<b>33</b>	<b>32</b>
State-Owned Banks	4	3	3	3	3	3	3	3	3
Private Banks	28	22	20	18	18	17	14	11	11
Banks transferred to SDIF	11	6	2	2	1	1	1	1	1
Foreign Banks	18	15	15	13	13	13	15	18	17
<b>Development and Investment Banks</b>	<b>18</b>	<b>15</b>	<b>14</b>	<b>14</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>
State-Owned Banks	3	3	3	3	3	3	3	3	3
Private Banks	12	9	8	8	8	8	6	6	6
Foreign Banks	3	3	3	3	2	2	4	4	4
<b>Total</b>	<b>79</b>	<b>61</b>	<b>54</b>	<b>50</b>	<b>48</b>	<b>47</b>	<b>46</b>	<b>46</b>	<b>45</b>

*Source: The Banks Association of Turkey, Bank Regulation and Supervision Agency (BRSA)*

Figure 5.1 shows the changes in the composition of banks according to their ownership for the period 2000-2008. As it is seen from the figure, the ratio of privately owned domestic banks is continuously declining. The number of private

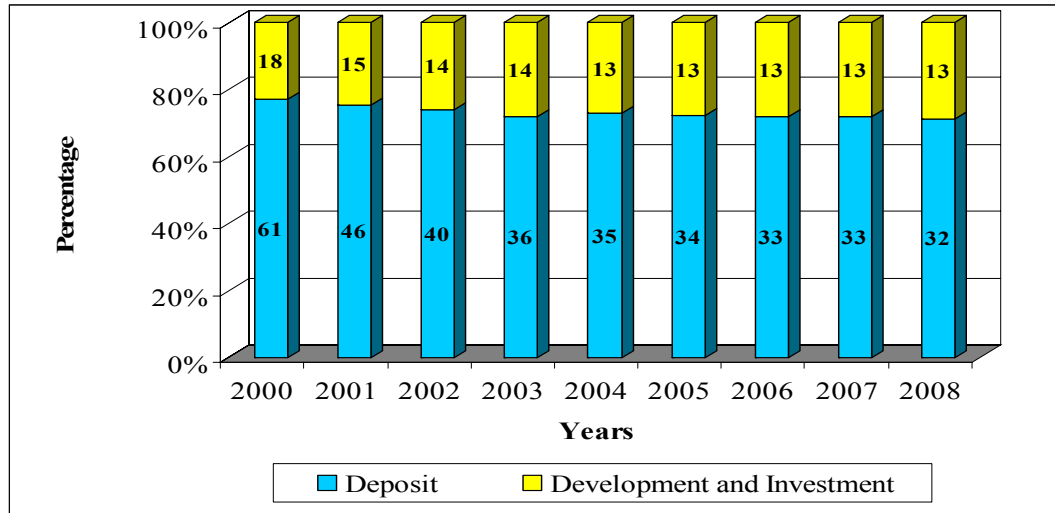
banks decreased from 40 in 2000 to 17 in 2008. The decrease at the beginning of the 2000s was mainly due to the banks transferred to SDIF. However, in recent years the decline is the result of the consolidation especially with foreign banks. Furthermore, the share of foreign banks is at an increasing trend. First it declined after 2000-2001 crises; however, the favorable macroeconomic stance and improvement in the banking sector after the crisis increased the interest of foreign banks in Turkey. Lastly, the number and the percentage of state-owned banks have been relatively constant since 2000.



**Figure 5.1: The Ownership Composition of Banks in Turkey: 2000-2008**

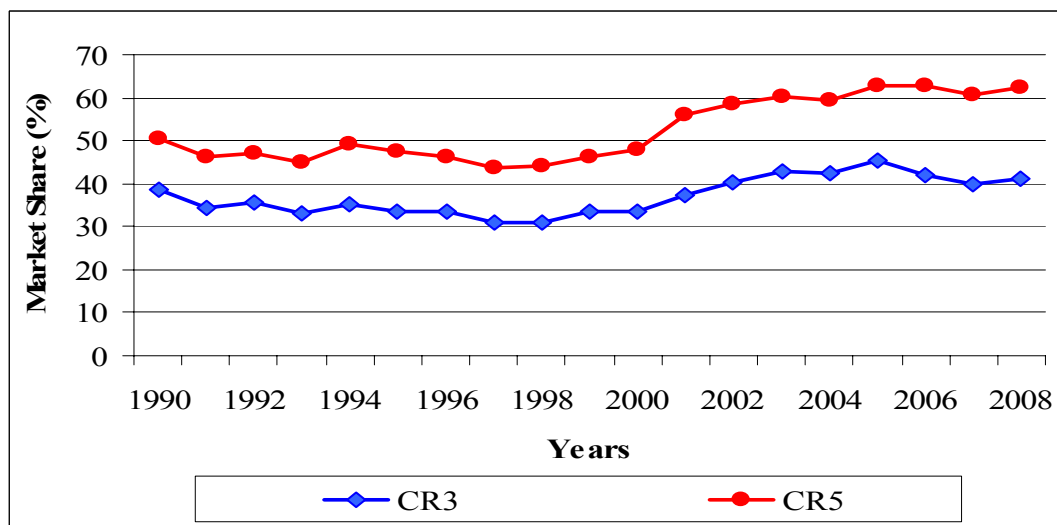
*Source: The Banks Association of Turkey, Bank Regulation and Supervision Agency*

Figure 5.2 shows the composition of banks according to their field of operation for 2000-2008 period. The share of deposit banks is higher than that of development and investment banks. Deposit banks constitute approximately 75% of the Turkish banking system. Although the number of deposit banks has continuously declined from 61 in 2000 to 32 in 2008, the ratio of it has been relatively constant during the period between 2000 and 2008.



**Figure 5.2: Composition of Banks According to Field of Operation: 2000-2008**

*Source: The Banks Association of Turkey, Bank Regulation and Supervision Agency*

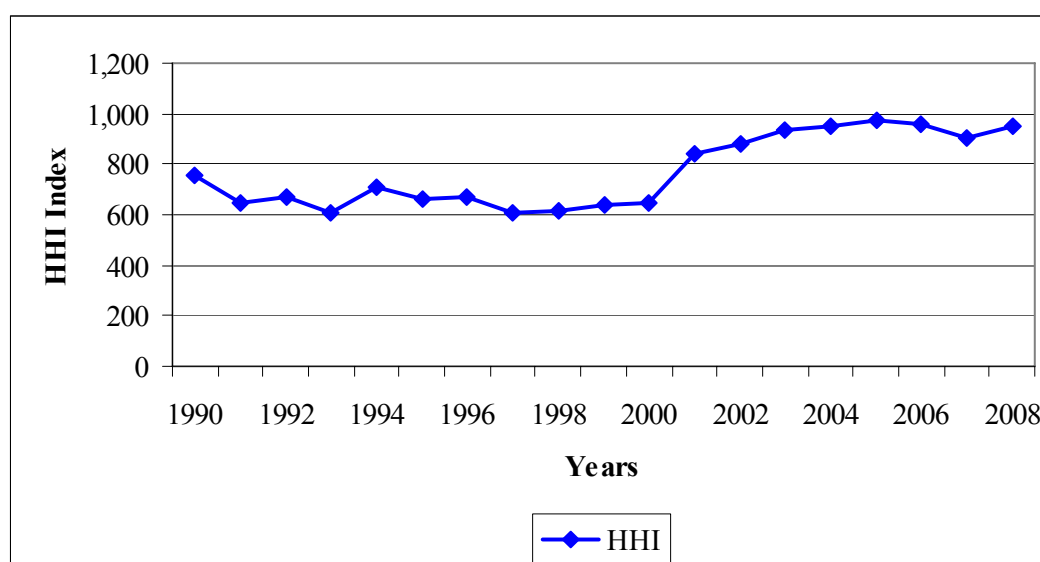


**Figure 5.3: CR<sub>3</sub> and CR<sub>5</sub> in the Turkish Banking System: 1990-2008**

*Source: The Banks Association of Turkey*

Figure 5.3 demonstrates the trends of two concentration ratios, CR<sub>3</sub> and CR<sub>5</sub> based on total assets, of the Turkish banking system in the period 1990-2008. CR<sub>3</sub> and CR<sub>5</sub> have a parallel trend meaning that the total market shares of the biggest three and

five banks change approximately at the same rate. Trends of  $CR_3$  and  $CR_5$  were relatively stable between 1990 and 2000. However, they both began to increase after 2000. They reached the maximum value at the year 2005 and after a slight decrease, they reached a relatively stable trend again. However, there was a slight decrease in 2006 and they began to rise after 2007 again. The increase in the concentration in the banking system after 2000 was mainly the result of exit of troubled banks from the system in 2000-2001 crisis and bank merger and acquisitions that took place after 2002.



**Figure 5.4: HHI of the Turkish Banking System: 1990-2008**

*Source: The Banks Association of Turkey*

In Figure 5.4, the evolution of Herfindahl-Hirschman Index (HHI) based on total assets between 1990 and 2008 is presented. Similar to  $CR_3$  and  $CR_5$ , HHI has been relatively stable until 2000 and it start to rise after that year. There was a slight decrease in 2006 and after 2007, it started to increase again. Again as in  $CR_3$  and  $CR_5$ , the increase in HHI in the banking system after 2000 was mainly the result of

exit of troubled banks from the system in 2000-2001 crisis and bank merger and acquisitions that took place after 2002.

As a non-structural measure of competition we consider the H-Statistics proposed by Panzar and Rosse (1982, 1987). Following Claessens and Laeven (2004), Schaeck and Cihak (2007) and Bikker and Spierdijk (2008), the H-Statistics for the Turkish banking system is calculated by estimating the following reduced form revenue equation:

$$\ln(P_{it}) = \alpha + \beta_1 \ln(W_{1,it}) + \beta_2 \ln(W_{2,it}) + \beta_3 \ln(W_{3,it}) + \gamma_1 \ln(Y_{1,it}) + \gamma_2 \ln(Y_{2,it}) + \gamma_3 \ln(Y_{3,it}) + \varepsilon_{it} \quad (5.1)$$

where  $P_{it}$  is the ratio of gross interest revenue to total assets,  $W_{1,it}$  is the ratio of interest expenses to total deposits,  $W_{2,it}$  is the ratio of personnel expenses to total assets,  $W_{3,it}$  is the ratio of other operating and administrative expenses to total asset,  $Y_{1,it}$  is the ratio of equity to total assets,  $Y_{2,it}$  is the ratio of net loans to total assets and  $Y_{3,it}$  is the total assets. The subscript  $i$  denotes bank, and the subscript  $t$  denotes year.

The fixed effects<sup>4</sup> panel data (unbalanced) estimation of equation (5.1) for the Turkish bank level accounting annual data for the 1990-2008 period yielded the following results:

$$\begin{aligned} \ln(P_{it}) = & \frac{0.105}{(0.136)} + \frac{0.204}{(0.022)} \ln(W_{1,it}) + \frac{0.225}{(0.041)} \ln(W_{2,it}) + \frac{0.181}{(0.039)} \ln(W_{3,it}) \\ & + \frac{0.00008}{(0.018)} \ln(Y_{1,it}) - \frac{0.00006}{(0.022)} \ln(Y_{2,it}) - \frac{0.002}{(0.007)} \ln(Y_{3,it}) \\ & N = 907, \quad R^2 = 0.520 \end{aligned}$$

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<sup>4</sup> The Hausman test yielded 8.67 (p=0.19) suggesting that the fixed effects model results are not significantly different from the random effects. However, the Likelihood Ratio (LR) test for the redundant cross-sectional fixed effects yielded 6.35 (p = 0.00) preferring the fixed effects model. Consequently, we report the results from the fixed effects model albeit they are essentially the same from the random effects.

The numbers in parenthesis are the standard deviations. The coefficients of  $\ln(W_{1,it})$ ,  $\ln(W_{2,it})$  and  $\ln(W_{3,it})$  are all significant at 1% significance level. But, the coefficients of  $\ln(Y_{1,it})$ ,  $\ln(Y_{2,it})$  and  $\ln(Y_{3,it})$  are not significantly different from zero. The H-Statistics equals to the sum of the coefficients of  $\ln(W_{1,it})$ ,  $\ln(W_{2,it})$  and  $\ln(W_{3,it})$ . Hence, H-Statistics in Turkish banking system for the period 1990-2008 is 0.61.

As the validity of the H statistic crucially depends on the existence of equilibrium condition, we also estimate the following equation for the whole sample.

$$\ln(ROA_{it}) = \alpha + \beta_1 \ln(W_{1,it}) + \beta_2 \ln(W_{2,it}) + \beta_3 \ln(W_{3,it}) + \gamma_1 \ln(Y_{1,it}) + \gamma_2 \ln(Y_{2,it}) + \gamma_3 \ln(Y_{3,it}) + \varepsilon_{it} \quad (5.2)$$

The fixed effects<sup>5</sup> estimation of equation (5.2) yielded the following results:

$$\begin{aligned} \ln(ROA_{it}) = & -3.057 + 0.017 \ln(W_{1,it}) - 0.253 \ln(W_{2,it}) + 0.256 \ln(W_{3,it}) \\ & (0.325) \quad (0.051) \quad (0.110) \quad (0.108) \\ & + 0.099 \ln(Y_{1,it}) + 0.031 \ln(Y_{2,it}) - 0.121 \ln(Y_{3,it}) \\ & (0.043) \quad (0.049) \quad (0.017) \\ & N=797, \quad R^2=0.500 \end{aligned}$$

For the equilibrium condition, the sum of coefficients of  $\ln(W_{1,it})$ ,  $\ln(W_{2,it})$  and  $\ln(W_{3,it})$  ( $\beta_1 + \beta_2 + \beta_3$ ) in equation (5.2) should be equal to zero (Panzar and Rosse, 1982, 1987 and Claessens and Laeven, 2004). The test of hypothesis that the sum of the coefficients is equal to zero yields F-statistics as 0.038 ( $p=0.84$ ) suggesting the presence of the equilibrium condition.

As stated in Chapter 4, the value of H-Statistics ranges between 0 and 1 and H-Statistics is interpreted as follows:  $H < 0$  indicates monopoly,  $H = 1$  indicates perfect competition and  $0 < H < 1$  indicates monopolistic competition. H-Statistics which has a value of 0.61 means that for the period 1990-2008, the Turkish banking system

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<sup>5</sup> The Hausman and the LR redundant cross-sectional fixed effects tests yielded 18.00 ( $p=0.01$ ) and 7.46 ( $p=0.00$ ), respectively, supporting our choice of the fixed effects procedure.

has a market structure characterized as monopolistic competition. In other words, there is a moderate competition in Turkish banking system in this period.

Claessens and Laeven (2004) calculate H-Statistics for 50 developed and developing countries for the period 1994-2001. In that study, the H-Statistics for Turkey is found as 0.46. In Table 5.2, the H-Statistics of selected countries are presented. As the table shows, the Turkish banking system with H-Statistics at a level of 0.61 is more competitive than that of United States and Japan. With respect to the European Union countries, Turkish banking system is less competitive than France, Netherlands, Italy and Greece banking systems and more competitive than banking systems of Denmark and Germany. Finally, Brazil and Argentina have a more competitive banking system than Turkey.

**Table 5.2: H-Statistics of Selected Countries: 1994-2001 and 1998-2005**

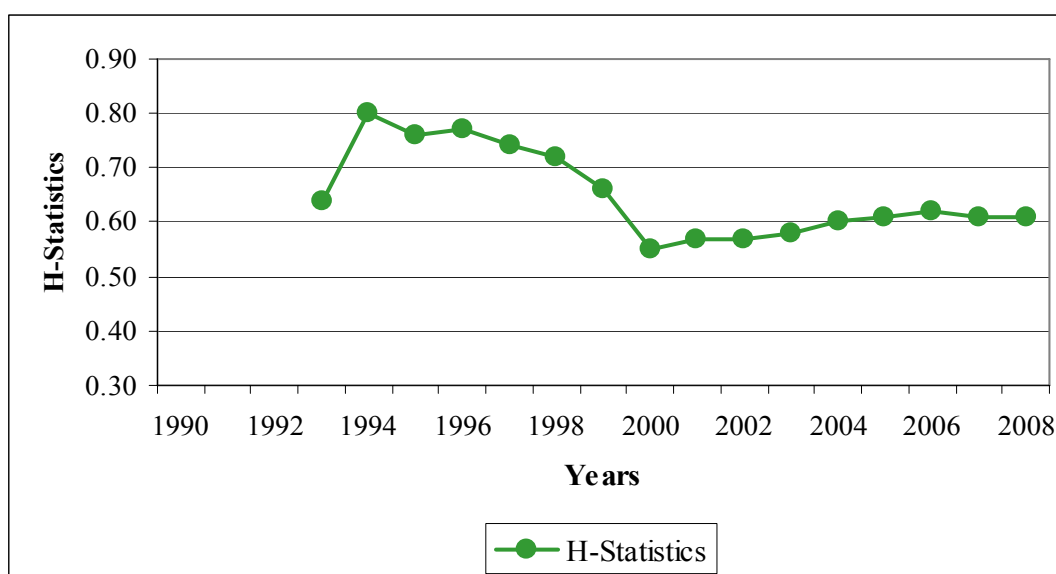
<b>Country</b>	<b>H-Statistics (1994-2001)</b>	<b>H-Statistics (1998-2005)</b>
United States	0.41	0.24
Japan	0.47	0.27
Russian Federation	0.54	-
France	0.69	0.21
Germany	0.58	0.16
Denmark	0.50	0.31
Netherlands	0.86	0.15
Italy	0.60	0.11
Greece	0.76	0.15
Brazil	0.83	0.38
Argentina	0.73	0.15

*Source: Claessens and Laeven (2004) and Schaeck, Cihak and Wolfe (2006)*



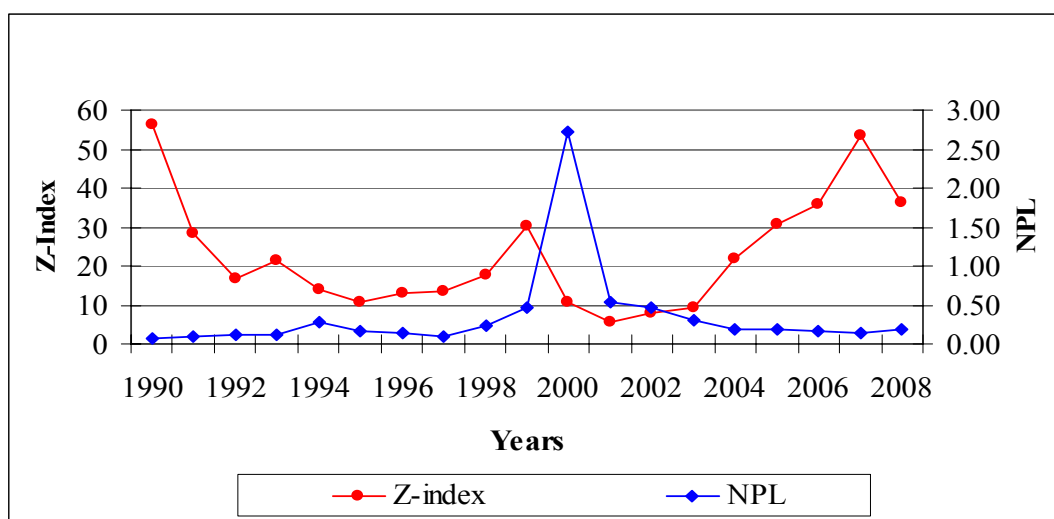
Schaeck, Cihak and Wolfe (2006) calculate H-Statistics for 45 developed and developing countries for the period 1998-2005 by using the same method as Claessens and Laeven (2004). In their study the H-Statistics for Turkish banking system is found as 0.61. Table 5.2 also shows, the H-Statistics of selected countries calculated Schaeck, Cihak and Wolfe (2006). For the 1998-2005 period, the Turkish banking system is more competitive than the countries listed in Table 5.2.

The results from the estimation of equation (5.1) may not be very helpful as it maintains that the competition structure is remained constant for the whole period. Following Bikker and Spierdijk (2008), we estimate equation (5.1) recursively to assess the change in the banking system competition structure in Turkey during the period.



**Figure 5.5: Recursively Estimated H-Statistics of the Turkish Banking System: 1993-2008**

Figure 5.5 plots the estimated H-Statistics based on the recursive fixed effects panel estimation of equation (5.1)<sup>66</sup>. The level of competition in the market increases as the value of H-Statistics approaches to 1. With respect to the trend of H-Statistics for the Turkish banking system, after 1994 when it has a maximum value of approximately 0.80, it starts to decline and reaches its minimum level of approximately 0.55 in 2000. After this year, although it slightly increased, the H-Statistics has a relatively stable trend around the value of 0.60. The decline in the value of H-Statistics until 2000 means that competition in the banking sector decreased, and after this year there is a stable level of competition in the sector.



**Figure 5.6: Z-Index and NPL in the Turkish Banking System: 1990-2008**

*Source: The Banks Association of Turkey*

Figure 5.6 presents two alternative stability measures for the Turkish banking system, namely Z-Index and NPL. These indicators are calculated for each bank and then the bank averages are taken for each year. Z-Index of the Turkish banking started to decline from a relatively high level in 1990 and it reached the lowest level

<sup>66</sup> For the recursively estimated H-Statistics, the equilibrium condition holds for the periods 1990-2000, 1990-2001, 1990-2002, 1990-2003, 1990-2004, 1990-2005, 1990-2006, 1990-2007 and 1990-2008. However, it does not hold for the periods 1990-1993, 1990-1994, 1990-1995, 1990-1996, 1990-1997, 1990-1998 and 1990-1999.

of the 1990-2000 period in 1995. It started to increase after this year and sharply declined after 1999. After the 2000-2001 crisis, it again started to increase until 2007. As the figure shows, NPL of the Turkish banking system was relatively stable between 1990 and 1997 except from the 1994 when a crisis was occurred in Turkish economy. However, NPL started to increase after 1997 and it had a big jump in 2000. After 2000, it started to decline again. Since 2004 it has a stable trend.

## CHAPTER 6

### BANK COMPETITION AND BANK STABILITY IN TURKEY: EMPIRICAL RESULTS

In this chapter, we investigate the empirical relationship between bank competition and bank stability in Turkey during the 1990-2008 period. The following section presents the model and data. We then proceed with the presentation and the interpretation of the results of the empirical study<sup>77</sup>.

#### 6.1. The Model and Data

To analyze the effect of the level of competition in the banking system on the stability of banks, bank stability measure is regressed on different measures of competition. However, since bank stability depends also on macroeconomic stance of the country and some specific characteristics of banks, macroeconomic as well as bank specific indicators are included as explanatory variables in the regression equation. Therefore the regression equation takes the following general form:

$$Stab_{it} = \beta_0 + \beta_1 Comp_t + \beta_2 Macro_t + \beta_3 BankChar_{it} + u_{it} \quad (6.1)$$

where “*Stab*” stands for bank stability measure, “*Comp*” is the competition measure, “*Macro*” denotes macroeconomic indicators and “*BankChar*” stands for bank specific indicators. *u* is the error term. In equation (6.1), *i* denotes the *i*<sup>th</sup> bank and *t* denotes year. While competition measures and macroeconomic indicators vary only with time but the same for all banks in each year; stability measures and banks specific indicators change bank to bank and in time. Therefore, the data set that is

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<sup>77</sup>All the regressions in this study are estimated by using E-Views 6.0 program.

used in the estimation is characterized as panel data having both bank and time dimensions. The empirical study is conducted for the period between the years 1990 and 2008. Annual data is used. All the banks operating in Turkey are included in the regression. Therefore, the empirical estimation covers deposit banks and development and investment banks, both domestic and foreign, operating in the Turkish banking system. The dataset contains also the banks transferred to SDIF. Table A1 in Appendix A summarizes the variables that are used in the empirical analysis.

**Bank Stability Measures:** In the empirical analysis of the relation between competition and stability in the Turkish banking system, we focus on the individual bank stability or fragility and do not examine the systemic bank stability or distress. As a proxy for bank stability, Z-Index and non-performing loan ratio (NPL) which are the two commonly used measures of individual bank stability or fragility in the literature are used.

The first bank stability indicator is the Z-Index which is a proxy for the probability of insolvency of a bank and an inverse measure of overall bank risk. For a specific year, the Z-Index for bank  $i$  is given by;

$$Z_i = \frac{(ROA_i + E/TA_i)}{\sigma(ROA_i)} \quad (6.2)$$

where ROA is the return on assets calculated by the ratio of pre-tax profits to total assets, E/TA is the equity to total assets ratio and  $\sigma(ROA)$  is the standard deviation of return on assets. This index combines in a single indicator the profitability, given by ROA; capitalization level or leverage, given by EA; and return volatility, given by the standard deviation of returns on asset ( $\sigma(ROA)$ ). The Z-Index increases with profitability and capitalization level and decreases with return volatility of assets. Thus, a larger value of Z-Index indicates a smaller risk profile for a bank and higher bank stability. The second bank stability indicator which is NPL which is the ratio of the volume of non-performing loans to total loans of a bank and it measures credit or

loan risk. Higher levels of NPL indicate higher insolvency risk so higher bank fragility or lower bank stability.

Z-Index and NPL of banks are calculated using accounting data of banks. Accounting data are collected from financial statements of banks published every year by The Banks Association of Turkey. For the Z-Index, ROA and E/TA are calculated by taking the ratios of pre-tax profits and equity to total assets respectively. In calculation of the standard deviation of ROA, we follow Levy Yeyati and Micco (2007) and calculate it by using three year moving standard deviation method. NPL is calculated by dividing non-performing loans to total loans for each bank.

**Competition Measures:** In the estimations, both structural and non-structural measures of competition for the Turkish banking system are used. As for the structural measures of competition, concentration ratios, namely CR<sub>3</sub>, CR<sub>5</sub> and HHI based on total assets are employed. CR<sub>3</sub> and CR<sub>5</sub> are calculated by using the formula (4.2) and HHI is calculated by using the formula (4.3) presented in Chapter 4. As it is stated before, increase in values of CR<sub>3</sub>, CR<sub>5</sub> and HHI means that the level of concentration in the banking system increases and hence competition in the system declines.

As a non-structural measure of competition H-Statistics is used in the empirical analysis. H-Statistics is explained in Chapter 4 in detail. The methodology of Claessens and Laeven (2004), Schaeck and Cihak (2007) and Bikker and Spierdijk (2008) is followed to calculate the H-Statistics for the Turkish banking system. Following Claessens and Laeven (2004), Schaeck and Cihak (2007) and Bikker and Spierdijk (2008), the H-Statistics is calculated by estimating the following reduced form revenue equation:

$$\ln(P_{it}) = \alpha + \beta_1 \ln(W_{1,it}) + \beta_2 \ln(W_{2,it}) + \beta_3 \ln(W_{3,it}) + \gamma_1 \ln(Y_{1,it}) + \gamma_2 \ln(Y_{2,it}) + \gamma_3 \ln(Y_{3,it}) + \varepsilon_{it} \quad (6.3)$$

where  $P_{it}$  is the ratio of gross interest revenue to total assets,  $W_{1,it}$  is the ratio of interest expenses to total deposits,  $W_{2,it}$  is the ratio of personnel expenses to total assets,  $W_{3,it}$  is the ratio of other operating and administrative expenses to total asset,  $Y_{1,it}$  is the ratio of equity to total assets,  $Y_{2,it}$  is the ratio of net loans to total assets and  $Y_{3,it}$  is the total assets. The subscript  $i$  denotes bank and the subscript  $t$  denotes year.

Following Bikker and Spierdijk (2008), equation (6.3) is estimated employing a fixed effects recursive panel estimation procedure. It should be noted that the value of H-Statistics ranges between 0 and 1,  $H=0$  means monopolistic market structure and  $H=1$  means perfect competition. Therefore, the increase in value of H-Statistics is associated with the increase in the level of competition in the banking system.

**Macroeconomic Indicators:** To control for the effect of macroeconomic stance of Turkey on the stability of Turkish banking system, some macroeconomic indicators are used in the estimation. These are the growth of real GDP, inflation rate, the ratio of public deficit to GDP, real deposit interest rate, real interest rate of total domestic debt stock and the depreciation rate of the real exchange rate. These indicators are obtained from Central Bank of the Republic of Turkey, Turkish Statistical Institute, Republic of Turkey Prime Ministry State Planning Organization and Republic of Turkey Prime Ministry Undersecretariat of Treasury.

**Banks Specific Characteristics:** Since stability of a bank is also affected by bank specific characteristics, some selected bank specific indicators are included in the regression equation. These are the size of banks calculated by dividing total asset of an individual bank to total assets in the banking system, loan to total assets ratio and the ratio of treasury bonds and bills that an individual bank holds to the total assets of that bank. Furthermore, since bank ownership also matters for the bank performance and stability, in the empirical study, ownership of banks is also taken into account. Specifically, a distinction is made between private and state-owned banks and banks taken by SDIF. Moreover, foreign ownership is also controlled for by using a dummy variable.

## 6.2. Empirical Results and Their Implications

To investigate the relationship between bank stability and competition, we first consider the following generic equation:

$$Stab_{it} = \beta_0 + \beta_1 Comp_t + \beta_2 Macro_t + u_{it} \quad (6.4)$$

In (6.4) *Stab* and *Comp* are the bank stability (Z-Index and NPL) and competition measures ( $CR_3$ ,  $CR_5$ , HHI and H-statistics), respectively and *Macro* is the macroeconomic variables. We also consider bank specific variables including bank ownership type such as public, private and banks taken by SDIF along with domestic and foreign ownership. To this end, we estimate the following equations:

$$Stab_{it} = \beta_0 + \beta_1 (Comp * PRIV)_{it} + \beta_2 (Comp * GOV)_{it} + \beta_3 (Comp * SDIF)_{it} + \beta_4 Macro_t + \beta_5 BankChar_{it} + u_{it} \quad (6.5)$$

$$Stab_{it} = \beta_0 + \beta_1 (Comp * DOM)_{it} + \beta_2 (Comp * FOR)_{it} + \beta_3 Macro_t + \beta_4 BankChar_{it} + u_{it} \quad (6.6)$$

In equation (6.5), *PRIV*, *GOV* and *SDIF* are dummy variables defining private banks, state-owned banks and banks taken by SDIF, respectively. In equation (6.6), *DOM* and *FOR* denote dummy variables for domestic banks and foreign banks, respectively.

In the final specification, we consider the difference between the periods 1990-2000 and 2001-2008. The aim is to take into account the changes in concentration, competition and stability in the banking system after the crisis occurred in 2000 and 2001. For this reason, we estimate the equation (6.7) for HHI and H-Statistics. In Equation (6.7) *Y1* denotes dummy variable which takes value 1 for the period 1990-2000 and 0 otherwise. *Y2* denoted dummy variable which takes value 1 for the period 2001-2008 and 0 otherwise. The coefficients of *Y1* and *Y2* measures the



different impact of competition in banking on stability of the banking system in the periods 1990-2000 and 2001-2008 respectively.

$$Stab_{it} = \beta_0 + \beta_1(Comp * Y1)_{it} + \beta_2(Comp * Y2)_{it} + \beta_3 Macro_t + \beta_4 BankChar_{it} + u_{it} \quad (6.7)$$

### 6.2.1. Dependent Variable: Z-Index

We first consider the Z-Index as the bank stability measure. Table 6.1 reports the fixed effects estimation of the equation (6.4) with alternative competition measures, namely CR<sub>3</sub>, CR<sub>5</sub>, HHI and H-Statistics. In all the equations without the macroeconomic condition variables, the competition measures appear to be statistically insignificant at the 5% level as reported by equations (1.1), (1.3), (1.5) and (1.7) in Table 6.1. However, with the inclusion of the macroeconomic variables (inflation rate (INF), the ratio of public deficit to GDP (PUBDEF) and the domestic debt real interest rate (DEBTINT)), the competition measures became all highly significant. The negative coefficients of CR<sub>3</sub>, CR<sub>5</sub> and HHI indicate that as concentration in the Turkish banking system declines or inversely as competition increases, Z-Index increases. Therefore this result supports the competition-stability hypothesis stating that there is a positive relation between competition and stability in the banking system. However, the negative sign of the coefficient of H-Statistics implies that as H-Statistics, hence the level of competition in the banking system rises, stability of banks declines. This result is in line with the competition-fragility view which presumes that competition in banking system increases fragility of banks. Therefore, because of this contradictory result, it can be said that there is a difference between concentration ratios which are structural measures of competition and H-Statistics, one of the non-structural measures of competition.

**Table 6.1: Z-Index, Competition and Macroeconomic Factors**

	(1.1)	(1.2)	(1.3)	(1.4)	(1.5)	(1.6)	(1.7)	(1.8)
CONSTANT	-3.35 (15.94)	119.43*** (31.32)	-3.34 (14.34)	107.49*** (29.62)	6.90 (10.48)	97.61*** (21.67)	23.21* (13.90)	115.10*** (40.35)
CR <sub>3</sub>	68.61 (43.62)	-176.21** (71.26)						
CR <sub>5</sub>			48.71* (27.85)	-104.00** (47.05)				
HHI					0.01 (0.01)	-0.05*** (0.02)		
H							-5.70 (20.90)	-127.29* (67.94)
INF		-58.54*** (16.13)		-60.68*** (16.81)		-64.82*** (17.04)		-52.29*** (14.96)
PUBDEF		275.94*** (57.81)		268.05*** (57.50)		271.86*** (57.51)		443.27*** (112.45)
DEBTINT		24.25* (13.72)		26.95** (13.64)		29.79** (13.63)		65.91*** (22.14)
N	1127	1127	1127	1127	1127	1127	948	948
R <sup>2</sup>	0.59	0.60	0.59	0.60	0.59	0.60	0.15	0.19
DW	1.75	1.79	1.75	1.79	1.75	1.79	1.75	1.83
F	13.72	14.09	13.73	14.06	13.71	14.10	1.50	1.91

Notes: <sup>a</sup> In each column, numbers in parentheses are the standard deviations.

<sup>b</sup> N denotes number of observations. DW and F are Durbin-Watson and F statistics.

<sup>c</sup> \*\*\*, \*\*, and \* indicate statistical significance at 10%, 5% and 1% respectively

As for the effect of macroeconomic indicators on the stability of banks, all the regression equations produce similar results<sup>8</sup>. Estimation results show that rate of inflation has a significant and negative impact on stability of banks. This finding has an economic sense since high inflation levels lead to fragility of many agencies including banks. Secondly, the ratio of public deficit to GDP seems to have a significant but positive impact on bank stability. This is an interesting result since, from an economic point of view, it is expected that increase in deficit to GDP ratio, which is a sign of a bad macroeconomic stance of a country, is expected to lead to bank instability. However, as the data indicates this is not the case for Turkish banking system. This situation should be interpreted by taking into account the specific features of banking system in Turkey. The reason is that until recently and especially in 1990s, bank assets were mainly composed of treasury bills and bonds which are sold to banks by government to finance deficits. Therefore, as public deficits increased, sale of government securities to banks increased. Banks demanded these securities due to their higher rate of return. Moreover, since treasury bills and bonds are relatively safer securities, holding of these add to the decrease in banks solvency risks. Similar to the ratio of public deficit to GDP, real interest rate of total domestic debt stock significantly and positively influences the stability of banks. The reasoning of this positive effect is the same as in the public deficit to GDP ratio.

Table 6.2 reports the estimation results of the equations augmented with dummy variables defining bank ownership as the bank specific variables<sup>9</sup>. To this end we define three dummy variables PRIV, GOV and SDIF to represent private banks (including foreign banks), state-owned banks and the SDIF banks, respectively. The interaction of these dummy variables with the competition measures (CR<sub>3</sub>, CR<sub>5</sub>, HHI and H-Statistics) estimates the different impacts of competition on bank stability for

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<sup>8</sup> We also considered growth of real GDP, rate of real exchange rate depreciation and real deposit interest rates as additional macroeconomic variables in the estimated equations. However neither of these variables are found to be statistically significant in explaining bank stability. Therefore, we do not report these results to save the space.

<sup>9</sup> We also considered some other alternative bank specific variables including bank size, private loans to total assets ratio and government loans to total asset ratio. However all these variables are found to be statistically insignificant and thus not reported to save the space.

these types of bank ownership. For CR<sub>3</sub>, CR<sub>5</sub> and HHI, bank stability appears not to be affected by the degree of competition for the state owned banks as suggested by

**Table 6.2: Z-Index, Competition, Macroeconomic Factors and Bank Ownership-1**

	(2.1)	(2.2)	(2.3)	(2.4)
CONSTANT	38.10*** (9.56)	38.96*** (9.51)	45.42*** (9.08)	136.27*** (68.17)
INF	-42.81*** (15.07)	-42.20*** (15.14)	-44.09*** (15.32)	-51.47*** (14.96)
PUBDEF	222.18*** (58.36)	222.53*** (58.45)	223.74*** (58.44)	435.67*** (112.40)
DEBTINT	26.97** (13.72)	26.46* (13.70)	26.17** (13.71)	64.81*** (22.12)
CR <sub>3</sub> *PRIV	-214.34*** (71.85)			
CR <sub>3</sub> *GOV	50.96 (83.42)			
CR <sub>3</sub> *SDIF	-261.27*** (82.17)			
CR <sub>5</sub> *PRIV		-109.85*** (47.67)		
CR <sub>5</sub> *GOV		-12.74 (56.11)		
CR <sub>5</sub> *SDIF		-148.62*** (51.78)		
HHI*PRIV			-0.05*** (0.02)	
HHI*GOV			-0.01 (0.02)	
HHI*SDIF			-0.09*** (0.03)	
H*PRIV				-136.27** (68.17)
H*GOV				-135.16* (72.37)
H*SDIF				-169.29** (71.37)
N	1127	1127	1127	948
R <sup>2</sup>	0.61	0.61	0.61	0.19
DW	1.85	1.83	1.86	1.84
F	14.25	14.05	14.05	1.91

Notes: <sup>a</sup> In each column, numbers in parentheses are the standard deviations.

<sup>b</sup> N denotes number of observations. DW and F are Durbin-Watson and F statistics.

<sup>c</sup> “\*”, “\*\*” and “\*\*\*” indicate statistical significance at 10%, 5% and 1% respectively.

the statistically insignificant coefficients of  $CR_3*GOV$ ,  $CR_5*GOV$  and  $HHI*GOV$  in the equations. Consequently, the stability of state-owned banks measured by the probability of insolvency (Z-Index) is not affected by the level of concentration in the banking system.

However, for private banks, concentration in the banking system still significantly and negatively affects their stability supporting the competition-stability view. For the H-Statistics, on the other hand, the situation appears to be slightly different from other competition measures. As reported by equation (2.4) in Table 6.2, all the coefficients of the ownership dummy variables interacted with the H-Statistics are negative and significant at the 10% level. This suggests that the fragility increases with competition also for the state owned banks. Consequently, when the H-Statistics is used as a competition measure, the results support the competition-fragility view regardless of the ownership type.

In the literature, although there are studies that control for ownership of banks by including the ratio of private and state-owned banks into the estimation, mainly the effects of competition on stability of domestic and foreign banks are not differentiated. However, as the results in Table 6.2 demonstrate, although competition has a significant effect on the stability of all the banks; the distinction in the ownership of banks shows that this is not true for state-owned banks. Hence, there is a difference in the behaviour of state-owned and private banks and this should be taken into account.

In the final specification, a distinction is made between domestic and foreign ownership of banks operating in the Turkish banking system. For this purpose two dummy variables (DOM and FOR) are included in the regression equation together with macroeconomic variables. DOM stands for domestic private banks. State-owned banks are not included in it since there is no significant relationship between stability of state-owned banks and competition as stated above. Hence the aim is to find out the differences between domestic private banks and foreign banks. The results presented in Table 6.3 show that for all the competition measures, there is no difference between domestic private banks and foreign banks. The levels of  $CR_3$ ,

CR<sub>5</sub>, HHI and H-Statistics in the Turkish banking system negatively and significantly affect the stability of both the domestic and foreign banks. For H-Statistics, this means that as the competition increases, the stability of domestic private banks and foreign banks decline. Furthermore, the coefficients of Comp\*DOM and Comp\*FOR are statistically the same, meaning that the impact of competition measures for the two different types of banks are statistically identical.

**Table 6.3: Z-Index, Competition, Macroeconomic Factors and Bank Ownership-2**

	(3.1)	(3.2)	(3.3)	(3.4)
CONST.	80.35*** (18.72)	66.68*** (17.70)	61.79*** (12.92)	88.43*** (27.51)
INF	-54.34*** (9.66)	-23.44*** (6.08)	-56.07*** (10.18)	-41.77*** (10.66)
PUBDEF	239.97*** (35.02)	179.60*** (32.06)	235.61*** (34.93)	357.19*** (77.07)
DEBTINT	28.69*** (8.47)		32.05*** (8.38)	46.36*** (15.55)
CR <sub>3</sub> *DOM	-98.02** (42.70)			
CR <sub>3</sub> *FOR	-111.95** (44.31)			
CR <sub>5</sub> *DOM		-47.71* (28.46)		
CR <sub>5</sub> *FOR		-53.29* (29.10)		
HHI*DOM			-0.02* (0.01)	
HHI*FOR			-0.03** (0.01)	
H*DOM				-80.30* (46.42)
H*FOR				-89.92* (46.98)
N	943	943	943	793
R <sup>2</sup>	0.24	0.23	0.24	0.27
DW	1.56	1.55	1.56	1.31
F	2.72	2.53	2.70	2.73

Notes: <sup>a</sup> In each column, numbers in parentheses are the standard deviations.

<sup>b</sup> N denotes the number of observations. DW and F is Durbin-Watson and F statistics.

<sup>c</sup> “\*”, “\*\*” and “\*\*\*” indicate statistical significance of 10%, 5% and 1% respectively.

### **6.2.2. Dependent Variable: NPL**

The same estimation procedure is repeated for the second dependent variable, NPL. First of all, NPL is regressed only on the competition measures CR<sub>3</sub>, CR<sub>5</sub>, HHI and H-statistics respectively. Table 6.4 presents the estimation results for this baseline model. The outcome is that, while the coefficients of CR<sub>3</sub>, CR<sub>5</sub> and HHI are insignificant, the coefficient of H-statistics is negative and significant at 1% significance level. This means that as the competition level measured by H-Statistics increases, nonperforming loan ratio declines and stability of banks increases.

When macroeconomic indicators are added to the regression equation, the results drastically change for CR<sub>3</sub>, CR<sub>5</sub> and HHI. As seen from Table 6.4, when NPL is regressed on CR<sub>3</sub> along with the inflation rate, the ratio of public deficit to GDP and real interest rate of total domestic debt stock, the coefficients of CR<sub>3</sub> turns out to be significant at 5% level. When regression is conducted by using CR<sub>5</sub> and HHI as explanatory variables respectively along with the ratio of public deficit to GDP and real interest rate of total domestic debt stock, the coefficients of these concentration ratios become significant at 1% significance level. Moreover, the coefficients of CR<sub>3</sub>, CR<sub>5</sub> and HHI are negative suggesting that nonperforming loans ratio which is a solvency measure based on loan risk of banks declines as concentration ratio increases or competition lessens. Therefore, it can be said that the results are in line with the competition-fragility paradigm since stability increases with concentration. When the rate of inflation and real interest rate of total domestic debt stock are used as explanatory variables with H-Statistics, the sign and the significance level of the coefficient of H-Statistics do not change. However, the negative sign of the coefficient means that NPL declines with the competition in the banking system and this in turn enhances the stability, which is in favor of the competition-stability hypothesis.

**Table 6.4: NPL, Competition and Macroeconomic Factors**

	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)	(4.7)	(4.8)
CONST	0.71 (1.04)	4.38** (2.10)	0.27 (0.94)	4.91*** (1.69)	0.61 (0.68)	4.04*** (1.21)	4.24*** (1.12)	5.02*** (1.43)
CR <sub>3</sub>	-0.95 (2.87)	-9.38** (4.75)						
CR <sub>5</sub>			0.199 (1.83)	-7.12*** (2.74)				
HHI					-0.0003 (0.0009)	-0.003*** (0.001)		
H							-5.77*** (1.69)	-7.40*** (2.64)
INF		2.52** (1.07)						3.88*** (1.17)
PUBDEF		-12.69*** (3.95)		-10.69*** (3.76)		-10.63*** (3.75)		
DEBTIN		-4.12*** (0.89)		-2.24*** (0.54)		-2.23*** (0.51)		-2.73*** (1.08)
T								
N	1221	1221	1221	1221	1221	1221	996	996
R <sup>2</sup>	0.12	0.14	0.12	0.13	0.12	0.13	0.13	0.14
DW	1.71	1.73	1.71	1.73	1.71	1.73	1.77	1.77
F	1.32	1.56	1.32	1.49	1.32	1.51	1.29	1.38

Notes: <sup>a</sup> In each column, numbers in parentheses are the standard deviations.

<sup>b</sup> N denotes the number of observations. DW and F is Durbin-Watson and F statistics.

<sup>c</sup> “\*”, “\*\*”, and “\*\*\*” indicate statistical significance of 10%, 5% and 1% respectively.



As for the macroeconomic variables, when inflation rate, public deficit to GDP ratio and real interest rate of total domestic debt stock enter into the regression equation along with CR<sub>3</sub>; public deficit to GDP ratio and real interest rate of total domestic debt stock enter into the regression equation along with CR<sub>5</sub> and HHI; as the results shown in Table 6.4 suggest that these macroeconomic variables are important in determining the level of NPL of banks. The positive and significant coefficient of inflation rate means that inflation in an economy contributes to the increase in credit or loan risk and fragility of banks. Since the coefficients of public deficit ratio and real interest rate of domestic debt stock are negative, it is understood that a surge in deficit and the real interest rate of domestic debt in an economy leads to a decline in NPL and increase in stability. This result is similar to the case when the dependent variable is Z-Index. In the regression of NPL on H-Statistics, among the macroeconomic variables, only the coefficients of inflation rate and real interest rate of total domestic debt stock are significant. The sign of the coefficients of these two variables are positive and negative respectively.

Next, dummy variables are integrated in the estimation to take into account the ownership of banks<sup>10</sup>. Tables 6.5 and 6.6 present the results of the estimations. Firstly, a distinction is made between private, state-owned banks and banks taken by SDIF. The results demonstrate that for CR<sub>3</sub> and HHI, the concentration in the banking system significantly and negatively change the NPL of private banks, while it has an insignificant effect on the NPL and hence the stability of state-owned banks. However, for CR<sub>5</sub>, inclusion of ownership dummy variables does not change the results, since stability of both private and state-owned banks are positively affected by the concentration ratio. For the H-Statistics, there is also a distinction between state and privately owned banks. NPL of state-owned banks is not affected from the competition level in the banking system. However, as competition among banks increases, nonperforming loan ratio hence the fragility of private banks decline.

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<sup>10</sup> As in the case of Z-Index, we also considered some other alternative bank specific variables including bank size, private loans to total assets ratio and government loans to total asset ratio. However all these variables are found to be statistically insignificant and thus not reported to save the space.

**Table 6.5: NPL, Competition, Macroeconomic Factors and Bank Ownership-1**

	(5.1)	(5.2)	(5.3)	(5.4)
CONSTANT	3.68* (2.07)	4.66*** (1.67)	3.79*** (1.20)	3.30** (1.46)
INF	2.55* (1.06)			3.78*** (1.16)
PUBDEF	-8.55** (3.97)	-6.39* (3.78)	-6.60* (3.78)	
DEBTINT	-3.58*** (0.88)	-1.77*** (0.54)	-1.78*** (0.51)	-2.74** (1.07)
CR <sub>3</sub> *PRIV	-8.31* (4.76)			
CR <sub>3</sub> *GOV	-6.95 (5.58)			
CR <sub>3</sub> *SDIF	3.55 (5.26)			
CR <sub>5</sub> *PRIV		-7.11*** (2.75)		
CR <sub>5</sub> *GOV		-6.18* (3.51)		
CR <sub>5</sub> *SDIF		1.28 (3.10)		
HHI*PRIV			-0.003*** (0.001)	
HHI*GOV			-0.003 (0.001)	
HHI*SDIF			0.001 (0.001)	
H*PRIV				-5.04** (2.68)
H*GOV				-3.88 (3.36)
H*SDIF				2.32 (3.26)
N	1221	1221	1221	996
R <sup>2</sup>	0.16	0.16	0.16	0.17
DW	1.78	1.78	1.78	1.83
F	1.84	1.78	1.76	1.63

Notes: <sup>a</sup> In each column, number in parentheses is the standard deviation.

<sup>b</sup> N denotes the number of observations. DW and F is Durbin-Watson and F statistics.

<sup>c</sup> “\*”, “\*\*” and “\*\*\*” indicate statistical significance of 10%, 5% and 1% respectively.

Finally, the effects of competition measures on NPL levels of banks are separated for domestic and foreign banks and the regression results are presented in Table 6.6. The resultant figures show that for both domestic private and foreign banks, CR<sub>3</sub>, HHI and H-statistics significantly affect the levels of NPL and hence the stability of banks. However, there is no significant influence of CR<sub>5</sub> on NPL of both domestic private and foreign banks. The direction of the impact of CR<sub>3</sub>, HHI and H-Statistics

on NPL is negative for both domestic and foreign banks. Hence, there is no difference on the effects of these competition measures on stability of domestic private and foreign banks. Furthermore, the coefficients of Comp\*DOM and Comp\*FOR are statistically the same, meaning that the impact of competition measures for the two different types of banks are statistically identical.

**Table 6.6: NPL, Competition, Macroeconomic Factors and Bank Ownership-2**

	(6.1)	(6.2)	(6.3)	(6.4)
CONSTANT	4.06** (1.83)	1.06 (1.86)	2.40** (1.17)	4.96** (1.98)
INF		2.13** (1.04)		1.73** (0.87)
PUBDEF	-5.51 (3.64)	-8.41** (3.82)	-5.97 (3.64)	5.36 (5.38)
DEBTINT	-1.35** (0.53)	-2.51*** (0.86)	-1.17** (0.49)	
CR <sub>3</sub> *DOM	-8.66** (4.26)			
CR <sub>3</sub> *FOR	-9.11** (4.40)			
CR <sub>5</sub> *DOM		-1.61 (2.98)		
CR <sub>5</sub> *FOR		-1.66 (3.05)		
HHI*DOM			-0.002* (0.001)	
HHI*FOR			-0.002* (0.001)	
H*DOM				-7.78** (3.27)
H*FOR				-8.51** (3.34)
N	1035	1035	1035	841
R <sup>2</sup>	0.09	0.09	0.08	0.09
DW	2.27	2.26	2.26	2.33
F	0.84	0.81	0.85	0.94

Notes: <sup>a</sup> In each column, numbers in parentheses are the standard deviations.

<sup>b</sup> N denotes the number of observations. DW and F is Durbin-Watson and F statistics.

<sup>c</sup> “\*”, “\*\*” and “\*\*\*” indicate statistical significance of 10%, 5% and 1% respectively.

**Table 6.7. The Impact of Competition on Stability in the Periods 1990-2000 and 2001-2008**

	Z-Index				NPL			
	(7.1)	(7.2)	(7.3)	(7.4)	(7.5)	(7.6)	(7.7)	(7.8)
CONST.	-8.49 (27.23)	114.58*** (35.48)	5.91 (18.10)	111.74*** (40.32)	1.34 (1.74)	2.74 (2.40)	6.69*** (1.43)	5.72*** (1.52)
HHI*Y1	0.04 (0.04)	-0.08* (0.05)			-0.001 (0.002)	-0.002 (0.003)		
HHI*Y2	0.03 (0.02)	-0.07** (0.03)			-0.001 (0.001)	-0.002 (0.002)		
H*Y1			16.17 (25.53)	-108.02* (63.35)			-8.87*** (2.03)	-7.25*** (2.64)
H*Y2			27.98 (30.78)	-120.83* (67.89)			-10.57*** (2.44)	-8.49*** (2.75)
INF		-31.24* (10.64)		-70.98*** (17.56)		2.70** (1.34)		2.75* (1.43)
PUBDEF		246.50* (65.09)		390.06*** (115.29)		-12.84*** (4.45)		
DEBTINT				61.17*** (22.22)		-3.94*** (0.96)		-2.53** (1.09)
N	1127	1127	948	948	1221	1221	996	996
R <sup>2</sup>	0.59	0.60	0.15	0.19	0.12	0.14	0.14	0.14
DW	1.75	1.80	1.75	1.83	1.72	1.73	1.78	1.78
F	13.58	14.01	1.50	1.94	1.31	1.53	1.36	1.39

Notes: <sup>a</sup> In each column, numbers in parentheses are the standard deviations.

<sup>b</sup> N denotes the number of observations. DW and F is Durbin-Watson and F statistics.

<sup>c</sup> “\*\*\*”, “\*\*”, and “\*” indicate statistical significance of 10%, 5% and 1% respectively.

### **6.2.3. Impact of Competition on Stability in the Periods 1990-2000 and 2001-2008**

We also consider the difference in the impact of competition on stability of the banking system in the periods 1990-2000 and 2001-2008. The estimation results are presented in Table 6.7. HHI and H-Statistics are used as competition measures. The results imply that for Z-Index, both HHI and H-Statistics do not affect the stability of the banking system for the two periods when macroeconomic variables are not included in the estimation. However, when macroeconomic variables are added in the regression, competition measures turn out to significantly affect the stability for the two periods. Furthermore, the signs of the coefficients of HHI and H-Statistics are the same in the two periods meaning that the direction of the relationship between competition and stability are identical before and after the year 2001.

For NPL, the results of the estimation demonstrate that with and without macroeconomic variables HHI insignificantly affects stability in both the two periods. However, without and with macroeconomic variables H-Statistics significantly affects the stability in the two periods. The signs of the coefficients of H-Statistics are the same meaning that the direction of the relationship is identical before and after 2001. Finally, it should be noted that the hypothesis that the coefficients of the variables  $Comp*Y1$  and  $Comp*Y2$  are statistically the same is not rejected meaning that the effect of competition on stability in the banking system for the periods 1990-2000 and 2001-2008 are statistically the same.

### **6.2.4. Implications of Empirical Results**

The results of the empirical study are explained in the preceding subsection. The empirical investigation of the relation between competition and stability in the Turkish banking system provided several important outcomes. In this part of the chapter, the implications of these outcomes are discussed.

The results of the estimation of the relation between competition and stability using macroeconomic indicators as control variables and without differentiating the

ownership of banks are summarized in Table 6.8 below. The table presents the sign of the relation between bank stability and competition measure and whether this result supports the competition-stability or competition-fragility view. First of all, it should be noted in advance that there is a contradiction between the outcomes of the two bank stability measures. When Z-Index is used as a proxy for individual bank stability and concentration ratios, namely CR<sub>3</sub>, CR<sub>5</sub> and HHI, are used as an indicator for the level of competition in the system, the results support the competition-stability view or reject the concentration-stability view. Specifically, this result is the opposite of the franchise value paradigm stating that as the banking market becomes more concentrated, the franchise value of banks arising from higher levels of profit discourages banks to take risk and so enhance stability. However, it is in line with the risk shifting paradigm which argues that as competition increases, loan rates decline and this has a mitigating effect on moral hazard and adverse selection incentives of borrowers and hence has a positive impact on bank stability. However, when NPL is used as a proxy for bank stability, the results seem to be in line with the competition-fragility view. Specifically, this result seems to support the franchise value paradigm since franchise values arising from concentration and market power may mitigate the risk taking of banks on their loan portfolio and reject the risk shifting paradigm.

**Table 6.8: Summary of the Empirical Results-I**

	<b>Z-index</b>		<b>NPL</b>	
	<b>Sign</b>	<b>The view supported</b>	<b>Sign</b>	<b>The view supported</b>
<b>CR<sub>3</sub></b>	(-)	competition-stability	(-)	competition-fragility
<b>CR<sub>5</sub></b>	(-)	competition-stability	(-)	Competition-fragility
<b>HHI</b>	(-)	competition-stability	(-)	Competition-fragility
<b>H-Statistics</b>	(-)	competition-fragility	(-)	Competition-stability

*Source: Tables 6.1 and 6.2.*

As a result, direction of the impact of competition or concentration on the stability of banks depends on the specification of the bank stability measure. Z-Index measures bank stability by taking into account the return on assets or profitability, leverage or capitalization level of banks and the standard deviation of profitability. It provides a proxy for a probability of bank's going into bankruptcy or bank insolvency. It is an overall measure of bank risk. However, NPL measures only the risk of bank arising from the asset side of the balance sheet or more specifically arising from the loan or credit portfolio of banks. Therefore, the results of the empirical study can be interpreted as, while the level of competition in the banking sector enhances the riskiness of banks arising from loan or credit portfolio, it suppresses the overall riskiness of banks arising from all of the operations. This result can also be interpreted like this: competition has some mitigating effects on the risk of banks arising from banking operations other than providing loans to agents; hence overall, it has a positive impact on stability.

The second implication of the estimation results is that selection of the competition measure is also important. As seen from Table 6.8, for both stability measures, concentration ratios and H-Statistics have the opposite effects on bank stability. Specifically, stability measured by Z-Index declines with H-Statistics and stability measured by NPL rises with H-Statistics. This result supports the view in the literature saying that structural measures of competition such as concentration ratios and non-structural measures of competition calculated based on firm level data are different proxies of competition level in an industry.

Another important result arises when differences in ownership of banks are taken into account. The results of the estimation by differentiating the ownership of banks are summarized in Table 6.9 below. First of all, generally speaking, stability of state-owned banks is not affected by the level of competition on the system while that of private banks is significantly affected. This supports the view in the literature that ownership of banks should also be taken into account when making an interpretation. On the other hand, no difference is found among domestic private and foreign banks in their responsiveness of competition in the banking system.

**Table 6.9: Summary of the Empirical Results-II**

		<b>Z-index</b>		<b>NPL</b>	
<b>Bank Ownership</b>	<b>Comp. Measure</b>	<b>Sign</b>	<b>The view supported</b>	<b>Sign</b>	<b>The view supported</b>
<b>Private</b>	<b>CR<sub>3</sub></b>	(-)	Competition-stability	(-)	Competition-fragility
	<b>CR<sub>5</sub></b>	(-)	Competition-stability	(-)	Competition-fragility
	<b>HHI</b>	(-)	Competition-stability	(-)	Competition-fragility
	<b>H-Stat.</b>	(-)	Competition-fragility	(-)	Competition-stability
<b>State</b>	<b>CR<sub>3</sub></b>	insig.	No effect	insig.	No effect
	<b>CR<sub>5</sub></b>	insig.	No effect	(-)	Competition-fragility
	<b>HHI</b>	insig.	No effect	insig.	No effect
	<b>H-Stat.</b>	(-)	Competition-fragility	insig.	No effect
<b>Domestic-private</b>	<b>CR<sub>3</sub></b>	(-)	Competition-stability	(-)	Competition-fragility
	<b>CR<sub>5</sub></b>	(-)	Competition-stability	insig.	No effect
	<b>HHI</b>	(-)	Competition-stability	(-)	Competition-fragility
	<b>H-Stat.</b>	(-)	Competition-fragility	(-)	Competition-stability
<b>Foreign</b>	<b>CR<sub>3</sub></b>	(-)	Competition-stability	(-)	Competition-fragility
	<b>CR<sub>5</sub></b>	(-)	Competition-stability	insig.	No effect
	<b>HHI</b>	(-)	Competition-stability	(-)	Competition-fragility
	<b>H-Stat.</b>	(-)	Competition-fragility	(-)	Competition-stability

*Source: Tables 6.2, 6.3, 6.5 and 6.6*



## **CHAPTER 7**

### **CONCLUSION**

There is a conventional wisdom in the literature that more competition in banking system is associated with greater instability. This so called competition-fragility or concentration-stability view is mainly based on franchise value paradigm stating that franchise values reduce banks' incentive to take excessive risk and make them relatively conservative which in turn contribute to the stability of the whole banking system. Higher competition, instead, erodes profit margins causing banks' franchise value to drop, thus reducing incentives for prudent behavior and leading to more aggressive risk taking in an attempt to earn higher profits. Therefore, less concentrated banking systems are more prone to experience crises. A counter-argument for the trade-off between competition and stability states that greater competition among banks contributes to banking system stability. This competition-stability or concentration-fragility view is mainly built on the risk shifting paradigm which argues that increase in market power and the resulting higher loan rates have the potential to negatively affect the stability of banks due to moral hazard and adverse selection problems on the part of borrowers. There is also a third line of research stating that the relation between market structure and stability of banking sector is not straightforward and the sign of the relation is not clear. They argue that this relation has important interactions with macroeconomic, regulatory and institutional framework of countries and changes with different model specifications.

Similar to the theoretical literature, empirical studies examining the impact of banking system structure on its stability produce mixed finding. These studies differ in many aspects. Some of the studies are based on one country and others offer a cross-country analysis. Furthermore, while some of the studies focus on individual bank stability, others base their studies on systemic bank stability or distress.

Moreover, earlier studies measure competition by structural measures such as concentration ratios, relatively recent studies use non-structural measures which are based on bank level data and measure the actual conduct of banks.

The empirical analysis of the impact of competition on stability for the Turkish banking system is conducted for the period 1990-2008. All the banks operating at least one year in this period are included in the empirical study. The empirical investigation is based on individual bank stability measures which are Z-Index and non-performing loan ratio. As a proxy for competition, both structural ( $CR_3$ ,  $CR_5$  and HHI) and non-structural measures (H-Statistics) of competition are used. All these measures are calculated using bank level accounting data obtained from financial statements published by The Banks Association of Turkey. Therefore, the empirical study draws on a panel data set which has both bank and time dimension. Furthermore, macroeconomic and some bank specific factors as well as the ownership of banks that have the potential to impact stability are controlled for in the empirical analysis.

The empirical investigation of the relation between competition and stability in the Turkish banking system provides several important results. First of all, while majority of the competition measures have insignificant impact on the two stability measures alone, the impact of all the competition measures turns out to be significant when macroeconomic indicators enter into the regression. This implies that besides competition level in the banking system, macroeconomic stance of the country is an important determinant of banking system stability.

Secondly, the sign of the relation between competition and stability depends on the specification of the bank stability measure. When Z-Index which is an overall measure of bank risk is regressed on  $CR_3$ ,  $CR_5$  and HHI, the results support the competition-stability view. Specifically, the outcome is the opposite of the franchise value paradigm and it is in line with the risk shifting paradigm. However, when NPL which measures only the risk of bank arising from the asset side of the balance sheet or more specifically arising from the loan or credit portfolio of banks is regressed on  $CR_3$ ,  $CR_5$  and HHI, the results seem to be in line with the competition-fragility view.

This evidence supports the franchise value paradigm and rejects the risk shifting paradigm. The results of the empirical study show that while the level of competition in the banking sector enhances the riskiness of banks arising from loan or credit portfolio, overall it suppresses the overall riskiness of banks arising from all of the operations. This result can also be interpreted like this: competition has some mitigating effects on the risk of banks arising from banking operations other than providing loans to agents; hence overall, it has a positive impact on stability.

The third result is that concentration ratios and H-Statistics have the opposite effects on bank stability since for both stability measures; the sign of the effect of H-Statistics is the opposite of that of the concentration ratios. This result supports the view in the literature saying that structural measures of competition such as concentration ratios and non-structural measures of competition calculated based on firm level data are different proxies of competition level in an industry.

Another important result arises when differences in ownership of banks are taken into account. Stability of state-owned banks is not affected by the level of competition on the system while that of private banks is significantly affected. This supports the view in the literature that ownership of banks should also be taken into account when making an interpretation. On the other hand, no difference is found among domestic and foreign banks, the stability of both domestic private and foreign banks is significantly affected by the level of competition in the banking system.

To conclude, the empirical study of the impact of competition on stability of the Turkish banking system for years between 1990 and 2008 supports both the competition-stability and competition fragility views depending on the different definitions of stability and competition. In other words, the evidence for the Turkish banking supports the line of research stating that the relation between competition and stability of banking sector is complex and not straightforward and the sign of the relation changes with different model specifications.

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## APPENDICES

### APPENDIX A – Definitions and Descriptive Statistics of Variables

**Table A 1: Definitions of Variables Used in Estimation**

Variable	Name	Calculation	Explanation / Source
Z	Z-Index	$Z = \frac{(ROA + E/TA)}{\sigma(ROA)}$	Proxy for bank stability. ROA is the return on assets ratio, E/TA is the equity to total assets ratio and $\sigma(ROA)$ is the standard deviation of return on assets. / Own calculation.
NPL	Non-performing Loan Ratio	Non-performing Loans / Total Loans	Proxy for bank stability. / Own calculation.
CR <sub>3</sub>	3-Bank Concentration Ratio	$CR_3 = \sum_{i=1}^3 s_i$	Measure of competition. S <sub>i</sub> is market share of bank i, based on total assets. / Own calculation.
CR <sub>5</sub>	5-Bank Concentration Ratio	$CR_5 = \sum_{i=1}^5 s_i$	Measure of competition. S <sub>i</sub> is market share of bank i, based on total assets. / Own calculation.
HHI	Herfindahl-Hirschman Index	$HHI = \sum_{i=1}^n s_i^2$	Measure of competition. S <sub>i</sub> is market share of bank i, based on total assets. n is total number of banks. / Own calculation.
H	H-Statistics		Measure of competition. It is the sum of the elasticities of total revenue of banks with respect to the bank's input prices. It is calculated from reduced-form bank revenue equation. / Own calculation.
INF	Inflation Rate	Consumer Price Index (1987=100)	Central Bank of the Republic of Turkey, Turkish Statistical Institute.
PUBDEF	Ratio of Public Deficit to GDP	Public Deficit / GDP	Undersecretariat of Treasury. Turkish Statistical Institute
DEBTINT	Real Interest Rate of Total Domestic Debt Stock		Calculation of Undersecretariat of Treasury.

**Table A 1: Definitions of Variables Used in Estimation (Cont'd)**

<b>Variable</b>	<b>Name</b>	<b>Calculation</b>	<b>Explanation / Source</b>
PRIV	Dummy Variable for Private Banks	-	Includes privately owned domestic deposit and development and investment banks. Includes also foreign deposit and development and investment banks.
GOV	Dummy Variable for State-Owned Banks	-	Includes state-owned domestic deposit and development and investment banks.
SDIF	Dummy Variable for Banks Transferred to SDIF	-	Includes banks transferred to Saving Deposit Insurance Fund.
DOM	Dummy Variable for Domestic Banks	-	Includes privately owned domestic deposit and development and investment banks.
FOR	Dummy Variable for Foreign Banks	-	Includes also foreign deposit and development and investment banks
Y1	Dummy Variable for the Period 1990-2000	-	It takes the value 1 in the period 1990-2000 and 0 otherwise.
Y2	Dummy Variable for the Period 2001-2008	-	It takes the value 1 in the period 2001-2008 and 0 otherwise.

**Table A 1: Descriptive Statistics of Variables Used in Estimation**

<b>Variable</b>	<b>Obs.</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min.</b>	<b>Max.</b>
Z	1127	21.60	76.56	-13.91	959.63
NPL	1221	0.37	3.60	0	94
CR <sub>3</sub>	19	37.10	4.39	31.18	45.43
CR <sub>5</sub>	19	52.42	7.22	43.71	62.80
HHI	19	769.16	142.88	606.87	973.41
H	16	0.65	0.08	0.55	0.8
INF	19	0.31	0.52	0.08	1.06
PUBDEF	19	0.03	-0.05	-0.01	-0.03
DEBTINT	19	0.34	0.63	0.18	1.09