THE EFFECT OF DERIVATIVES ACTIVITY ON BANK PROFITABILITY BEFORE AND DURING THE SUBPRIME MORTGAGE CRISIS: EVIDENCE FROM TURKEY [1]

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Abstract

Present study attempts to model the determinants of profitability for the Turkish banking industry. This paper employs a dynamic panel framework for 30 Turkish commercial banks while using a comprehensive set of bank level, industry level and macroeconomic explanatory variables. The novelty of this study is to consider the consequences of the derivatives usage on the banks' profits. The findings point out that derivatives are mainly used for hedging purposes, and the bank managers put the safety of the system in the first place. Accordingly, the internal factors such as capital and the credit risk are the most influential ones.

Key words: Bank profitability; dynamic panel models; derivatives; subprime mortgage crisis

TÜREV ARACI KULLANMANIN BANKA KARLILIĞI ÜZERİNDEKİ ETKİLERİ: KRİZ ÖNCESİ VE SONRASINDA TÜRKİYE ÖRNEĞİ

Özet

Bu çalışma, Türk Bankacılık Sektörü'nde karlılığı belirleyen faktörleri incelemektedir. Bu amaçla, 30 ticari bankanın verileri dinamik panel veri teknikleri ile incelenmiştir. Bu bankalara ilişkin, yönetimsel, sektörel ve makroekonomik pek çok değişken analize dahil edilmiştir. Çalışmanın literatüre katkısı, türev araç kullanımının karlılık üzerindeki etkisini özellikle dikkate almasıdır. Sonuçlar, türev araçların genellikle riskten korunma amaçlı kullanıldığını; banka yöneticilerinin sistemin güvenliğini ilk sırada tuttuklarını göstermektedir. Bununla bağlantılı olarak, sermaye ve kredi riski gibi içsel değişkenlerin karlılık üzerinde en etkili faktörler olduğu ortaya konmuştur.

Anahtar sözcükler: Banka Karlılığı, dinamik panel model, türev araçlar, mortgage krizi

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Introduction

The relationship lending function of banking system can only be achieved properly by a profitable banking sector, which puts forth the importance of determining the factors that add to profitability. This is a motivating research area for bank managements and supervisory institutions. The main purpose of this study is to investigate the determinants of the Turkish banking system profitability in a dynamic framework within a comprehensive set of variables, including the effect of macroeconomic and industry specific as well as bank level determinants.

Literature mainly accounts for the internal and external factors, while investigating the profitability determinants. Athanasoglou, Brissimis, and Delis (2008) generally criticize these studies for only considering the bank level determinants and ignoring the macroeconomic and industry specific factors. Following Berger et al., (2000), they also state that the persistence of bank profitability requires the inclusion of a lagged variable, and therefore, a dynamic model specification. Aforementioned studies have mainly used static models and have not accounted for the persistence feature of bank profits. This may result in biased findings. To avoid this problem, we conduct a dynamic analysis.

Our explanatory variables include capital, credit risk, expenses management, derivatives activity and size on the bank level. To clarify industrial effects, concentration and ownership of banks are added, while inflation and cyclical output are used in order to explain macroeconomic impact. Previous studies provide mixed results for these explanatory variables, depending on the sample and the time period. Hence, it is necessary to evaluate the Turkish banking system once more with the most recent data available.

Previous literature investigating the performance of the Turkish banking system does not account for such a comprehensive set of explanatory variables. We use data from this sector between the years 2003 and 2010. Furthermore, to our knowledge, the direct impact of derivatives activity has not been extensively examined for Turkish banking system. This would constitute an important gap in the literature, since Beaver, McNichols, and Rhie (2005) state that firms with high on-balance sheet leverage usually use off-balance sheet (OBS) items as well. In such a case, the exclusion of derivatives in the analyses may create an omitted variable problem. In addition, particularly after the recent crisis, derivatives usage has brought doubts regarding the possibility to increase the systematic risk of the banking industry, rather than hedging. Such an increase in riskiness would destabilize the banking system, so the whole macro economy. Using derivatives for speculative purposes could be considered as moral hazard, and Demirgüç-Kunt and Detragiache (1998) state moral hazard as one of the reasons of bank failures.

Goddard, Molyneux, and Wilson (2004) and Sayılgan and Yıldırım (2009) examine the impact of OBS activities on bank profitability. Yet, the OBS activities include heavily guaranties and warrants, custody and pledged securities and commitments. Such a study may not elaborately assess the direct impact of derivatives on profitability. Other studies that attempt to examine the sensitivity of bank profitability to derivatives usage do not consider such an extensive set of explanatory variables. In this respect, we believe that the present study brings novelty in terms of considering the direct consequences of derivatives usage on bank profits as well as determining its place among other factors. We also employ another regression to determine the effects of derivatives activity on variations in bank profitability. Our testable hypothesis suggests that if derivatives are used for hedging purposes, their contribution to the quarterly variations in the profitability will be lower. Next, we split our sample into two to evaluate the effect of the latest subprime mortgage crisis on profits and managerial decisions. Following Dietrich and Wanzenried (2010), 2003-2006 is considered as pre-crisis period, while 2007-2010 is post crisis period. By the aid of ownership dummies, we also investigate the impacts of these explanatory variables separately for the state owned versus private banks, and the foreign banks versus national banks.

Literature Review

Studies that explore the factors affecting bank performance usually take into account the internal determinants such as size, capital, expenses management; and the external determinants like inflation rate and market concentration (Demirgüç-Kunt and Huizinga, 1999; Abreu and Mendes, 2002; Goddard et al., 2004; Athanasoglou, Delis, and Staikouras, 2006; Sayılgan and Yıldırım, 2009).

The bank level determinants are considered as credit risk, productivity, expenses, size and derivatives activity, since these factors reflect the managerial decisions. Traditional wisdom in banking suggests that capital is negatively related to bank profitability, because a higher capital to assets ratio (CAR) indicates a lower risk, hence a lower expected return. However, Berger (1995b) finds evidence of a positively related CAR with return on equity (ROE) for the US commercial banks operating between the years 1983 and 1989. Among others, Sayılgan and Yıldırım (2009) point out a positive and significant coefficient for capital variable for Turkish Banks as well. This positive relation may also show the soundness of banking system. Tunay and Silpar (2006), on the other hand, show mixed results depending on the different profitability proxies.

Another determinant of bank profitability is credit risk. Abreu and Mendes (2002) use loan loss provisions to total loans as a proxy for credit risk and demonstrate that it has a positive impact on the banks profitability in European countries. In contrast, Athanasoglou et al., (2006) find negative and significant effect of credit risk on profitability for South Eastern European countries. They suggest that these countries have to concentrate more on this risk variable, since credit risk has been a serious concern in their history. Sayılgan and Yıldırım (2009) find insignificant but positive impact of credits on profitability. Dietrich and Wanzenried (2010) show that loan loss provisions to total loans are much stronger during the 2007 subprime mortgage crisis.

Increased globalization has forced the banks to operate more efficiently and to increase their productivity. Işık and Kabirhassan (2003) find evidence of performance enhancements after deregulation in 1980s for Turkish commercial banks. Işık (2007) also demonstrates that publicly owned banks provide the slowest productivity growth in Turkey, while foreign banks display the fastest.

Previous literature (Demirgüç-Kunt and Huizinga, 1999; Athanasoglou, Brissimis, and Delis, 2008) takes expenses management as a proxy for the impact of efficiency on profitability. Demirgüç-Kunt and Huizinga (1999) argue that differences in expenses may reflect bank service distinctions and their qualities. Athanasoglou et al., (2008), show a negative and significant coefficient for Greek Banks, implying a lack of competence in the expenses management. They state that banks pass part of increased cost to customers, but the remaining part is transferred to profits, due to the high competition in the market.

Evidence shown by Clark (1996) indicates that scale can improve a bank's operating efficiency only up to a point. Goddard et al.,(2004) and Athanasoglou et al., (2008) cannot find a significant relation between size and bank profitability; Dietrich and Wanzenried (2010) demonstrate only a weak evidence of negative relation for the largest banks, while Tunay and Silpar (2006) point out a positive relation for the Turkish Banking sector.

The main purpose behind the derivatives activity is to hedge the interest rate and exchange rate risk. An early look to derivatives hedging ability is provided by Koppenhaver (1990). In this study, 356 US Banks are analyzed for the period between 1983 and 1987. He shows empirically that both long and short future positions are used to hedge the balance sheet interest rate risk; however, the estimated hedge ratios are small. Shanker (1996) also explores interest rate derivatives in the US banking market for the years 1986 to 1993. In particular, she suggests that an effective and hedging purposed derivatives usage will lower the interest rate

exposure of banks. If the aim is not hedging against risks or hedging is not successful, banks will be exposed to higher interest rate risk. The results indicate that interest rate exposure of the banks using derivatives is significantly lower than non-users, implying that hedging is the main purpose.

It is very natural that derivatives activity literature mainly focuses on risk and hedging, since Shanker's (1996) findings bring the agency problem between shareholders and managers into the picture. Similarly, Demirgüç-Kunt and Detragiache (1998) point out the moral hazard problem as one of the main drivers behind the bank failures. Derivatives can be used for excess risk taking- a kind of moral hazard problem- as well as hedging purposes. In this case, it will increase the likelihood of a bank failure and decreases the bank profitability.

Hentschel and Clifford (1997) discuss the derivatives activity in a different manner. They argue that default risk in derivatives strongly depends on how they are used, but their risk is always lower than any other fixed claim. The possible consequence of this argument is that if derivatives do not cause risk, no effect on profitability can be observed.

Some studies examine the impact of OBS activities as a whole on banks profitability. Goddard et al., (2004) only find a positive and significant relation for the UK, but not for the other European Banks. Sayılgan and Yıldırım (2009) analyze the effect of OBS items for the Turkish Banking Sector for the years 2002 and 2007, and they find a significant and negative impact on profitability. However, they state that in these years profitability is very stable, partly because of hedging.

Li and Yu (2010) directly investigate the effect of derivatives activity on the commercial banks based on a panel dataset from 18 large US bank holding companies. They find that in general derivatives activity enhances the bank performance, but increases the risk level as well. Yet, Li and Yu (2010) do not evaluate the place of derivatives among other factors that determine bank performance, such as expense management, concentration or inflation. In our paper, on the other hand, we attempt to assess the importance of derivatives activity among the other determinants.

Ownership status and the market structure in terms of concentration are the determinants that affect bank profitability on the industry level. The profitability analysis for the European Banks displays little evidence of systematic variation in profitability based on the ownership type (Goddard et al., 2004). The results of Demirgüç-Kunt and Huizinga (1999) and Athanasoglou et al., (2006) are in favor of internalization of banking sector, suggesting that foreign banks realize significantly higher profitability than domestic banks. Demirgüç-Kunt and Huizinga (1999) argue

that this finding may reflect the technological strength of foreign banks operating in developing countries. Athanasoglou et al., (2006) find that ownership and capital are positively associated for foreign banks in the South Eastern Europe. Therefore, capital is a more important determinant of bank profits for foreign banks. Athanasoglou et al., (2008) cannot show a significant coefficient for the ownership status of banks. In contrast, Dietrich and Wanzenried (2010) state that the privately owned banks were operating more profitably than the state owned banks in Switzerland before the 2007 crisis. During the crisis, however, they were not less profitable than the privately owned banks.

Heggestad (1977) shows that concentration in the market provides monopolistic positions to the banks, so it positively affects their profitability. Smirlock (1985) criticizes the traditional structure-conduct-performance (SCP) hypothesis, which suggests that high seller concentration in the market decreases the costs of collusion, thus, allow firms to earn monopoly rents in terms of paying lower deposit rates or charging higher loan rates. He suggests that once market share is taken into consideration properly, concentration has no impact on bank profitability.

Accordingly, Berger (1995a) puts forth that only the larger firms are able to exercise market power in pricing through advertising, location, or other advantages. Empirical finding on the effect of this determinant is mixed, however. While Demirgüç-Kunt and Huizinga (1999) and Tunay and Silpar (2006) point out the positive impact of concentration on the bank profitability in international level for Turkish Banks; Athanasoglou et al., (2008); Dietrich and Wanzenried (2010) cannot observe a significant relationship for Greek and Switzerland banks, respectively.

The macroeconomic determinants of bank profitability are cited in the literature as inflation and cyclical output. The impact of inflation on banks profitability has to be compared with the rate of increase in the wages and costs (Athanasoglou, et al., 2008). Moreover, stabilization programs in the high inflation countries may decrease the banks' profitability, if their proceedings are mainly from the price fluctuations in the payments Demirgüç-Kunt and Detragiache (1998) demonstrate that macroeconomic problems significantly increase the likelihood of systemic problems in the banking industry. Literature mainly finds a positive impact of inflation on bank profitability (Demirgüç-Kunt and Huizinga, 1999; Athanasoglou et al., 2008). Nevertheless, some demonstrates a negative relationship as well (Abreu and Mendes, 2002).

Kaya and Doğan (2005) evaluate the efficiency and monitor the developments of the banking industry for the 2002-2004 periods for Turkey. They show that banks attempt to increase their net operational income due to the decrease in their net interest income. Tunay and Silpar

(2006) confirm the importance of inflation for the bank profitability and illustrate a positive impact for the Turkish banks in 2004. In contrast, Sayılgan and Yıldırım (2009) discover a negative impact of inflation on the Turkish Banking industry for the years 2002-2007.

The other macroeconomic determinant of profitability is the cyclical output. Demirgüç-Kunt and Huizinga (2000) and Bikker and Hu (2001) evaluate the correlation between cyclicality and banks profit. Bikker and Hu (2001) illustrate the upward and downward moving of bank profits with business cycle, and capital accumulates in the rise periods. However, they conclude that the deformation of bank profitability due to procyclicality is limited. The empirical evidence, however, varies depending on the sample.

This study attempts to examine the sensitivity of bank profits to a variety of variables that accounts for bank level, macroeconomic and industry specific factors. While doing so, it aims to fill the gap regarding to derivatives usage and its consequences for the Turkish banking system.

Model Specification and Data

Data

The main data source of this study is The Banks Association of Turkey (BAT) where banks balance sheets and income statements as well as off balance sheet items are reported on a quarterly basis. Unconsolidated statements are employed for the analysis. Number of employees is again provided by BAT for all banks in Turkish banking system. Inflation and real GDP growth data is obtained from Turkish Statistical Institute.

Our sample is a panel data set of 30 banks for the years between the years 2003-2010. Quarterly data is used. Following Dietrich and Wanzenried (2010), in order to investigate the effects of subprime mortgage crisis, the sample is divided into two time periods, namely 2003-2006 as pre-crisis period and 2007-2010 as post-crisis period.

The Model

The static model attempted to be estimated can be seen below:

$$\pi_{it} = c + \sum_{j=1}^{J} \beta_j X_{it}^j + \sum_{l=1}^{L} \beta_l X_{it}^l + \sum_{m=1}^{M} \beta m X_{it}^m + \varepsilon_{it} \ , \ \varepsilon_{it} = v_i + u_{it} \qquad (1)$$

In this model, π_{it} denotes for the bank i profitability at time t, and $i = 1,....N, t = 1....T$. c is the constant term, while the following terms represent respectively bank specific, industry specific, and macroeconomic explanatory variables. The disturbance term, ε_{it}, is composed of unobserved bank specific effect, v_{it}, and idiosyncratic error, u_{it}.

Berger et al. (2000) show the persistency in the bank profits over time, which reflects the barriers on the competition and the lack of transparency in the banking industry. Following Goddard et al., (2004) and Athanasoglou et al., (2008), the lagged dependent variable is included among the explanatory variables and a dynamic specification of the model, Eq. (2), is obtained.

$$\pi_{it} = c + \delta \pi_{it-1} + \sum_{j=1}^{J} \beta_j X_{it}^j + \sum_{l=1}^{L} \beta_l X_{it}^l + \sum_{m=1}^{M} \beta m X_{it}^m + \varepsilon_{it} \qquad (2)$$

In this model, π_{it-1} denotes for the one period lagged profitability and δ reflects the speed of adjustment to equilibrium. The persistence of profits will be shown by the value of δ. A value between 0 and 1 indicates the persistence, but the profits will return eventually to their normal levels. A fairly competitive industry, in other words, a high speed of adjustment, will be seen, if the value is close to 0. On the other hand, a less competitive structure, that is a very slow adjustment can be inferred from a value close to 1.

In order to control the effects of derivatives activity on profitability change, another control regression is added to the model. This model can be seen below:

$$\Delta \pi_{it} = c + \delta \pi_{it-1} + \sum_{j=1}^{J} \beta_j X_{it}^j + \sum_{l=1}^{L} \beta_l X_{it}^l + \sum_{m=1}^{M} \beta m X_{it}^m + \varepsilon_{it} \qquad (3)$$

The only difference between Eq (2) and Eq (3) is the change in the ROA, the dependent variable. The aim is to specify the reasons of quarterly changes in bank profitability since we hypothesize that larger change in the profitability between two quarterly periods can only be observed due to the derivatives activity. If the bank uses derivatives activity for hedging purposes, we do not expect to see large variations in the profitability, because the main aim would

be smoothing. On the other hand, if larger changes occur in the profitability in such a small time period, then one may conclude that these are due to speculative usage of derivatives. In other words, we expect to observe larger contribution to variations in profitability due to speculative derivatives usage, and little contribution to changes in profitability in case of hedging. Eq (3) also provides a comparative basis with Eq (2).

Determinants of Bank Profitability

Dependent Variable

Three alternative measures of profitability can be specified: Return on assets (ROA) indicates the ability to generate profits from the bank's assets, and measured by ratio of profits to assets. Return on equity (ROE), which is profits to equity ratio, refers to returns on shareholders on their equity. Net interest margin (NIM), which is the ratio of the difference between total interest income and total interest expenses to total assets, can be considered as the last proxy for profitability in the banking industry. Some studies (Goddard et al., 2004; Sayılgan and Yıldırım, 2009) take both of these specifications in two different models, while others (Demirgüç-Kunt and Huizinga, 1999; Athanasoglou, et al., 2008; Dietrich and Wanzenried, 2010) consider that ROA is a better measure, since ROE may not account for the risks related with high leverage. Our paper uses ROA and NIM as the measure of the bank profitability.

Independent Variables

Bank Specific Determinants

Bank specific determinants are important to show the impact of managerial decisions on the banks' profitability. Following the prior literature, capital, credit risk, productivity, expenses Management, size and derivatives activity proxies are used in the analyses.

Capital: Capital to asset ratio (CAR) can be seen as a proxy for risk, since it absorbs unforeseen losses and acts as a safety net. According to the traditional theory, a higher return is expected from the banks operating with low levels of capital, since it indicates a riskier situation. On the other hand, banks with high levels of CAR are safer, and they can remain profitable in financially difficult times. Low levels of CAR may also point out a low level of rating, and may increase the bank's external financing costs. Therefore, the net impact of capital on bank profitability is ambiguous.

Credit Risk: Loans under follow up to total loans ratio (LL) is used as a proxy for the credit quality. A higher ratio points out a lower credit quality, a higher riskiness, therefore, a lower profitability. Hence, the expected sign of LL is negative.

Productivity: Işık and Kabirhassan (2003) and Işık (2007) state that the effects of institutional and legal developments, particularly technological changes since 1980s, will be seen as increases in productivity, hence in the banks' performance. Therefore, one may observe positive effects of productivity on bank performance in Turkey. Labor productivity, measured by total interest income and non-interest income over the number of employees, as a proxy of overall productivity level is included into the model.

Expenses Management: Operating expenses to total assets ratio, an indicator of management performance, is expected to be negatively related to the bank profitability, Its decline will increase the managerial efficiency, and the bank profitability.

Size: Size can create scale economies and increases bank performance as well as it may create bureaucracy and negatively impacts the bank profitability. Therefore, its expected sign is ambiguous. To investigate the size-profitability relation, the number of branches, the logarithm of real assets and the logarithm of squares of real assets, in case of nonlinearities, are included in the model.

Derivatives Activity: Most of the previous literature, including Sayılgan and Yıldırım (2009) and Goddard et al., (2004), investigates the OBS items impact as a whole on bank profitability. Unlike other studies, this paper attempts to determine the direct impact of derivatives activity on bank profitability. In this context, derivative instruments reported in the OBS items divided by the total assets ratio is used as a proxy. The net effect of derivatives activity will be seen in the results of Eq (2).

Further, the impact of hedging or speculative purposes can be examined through Eq (3). A larger contribution to variation is expected in profitability if the derivatives activity is used for speculative purposes. On the other hand, a little impact on ROA and NIM change will be observed if the main aim is hedging.

Industry Specific Determinants

Besides the managerial decisions, sectoral determinants are also important while determining the profitability. Hence, banks' ownership structure and market concentration are added into the model.

Ownership: As of the beginning of 2011, there are 30 commercial banks in Turkey, 3 of them are state owned, and the rest is privately owned[3]. Therefore, the ownership may be influential in the bank sector profits in Turkey. To show the impact of the ownership status, two separate dummies are included to the model.

Concentration: According to the SCP paradigm, small banks tend to collude (Goddard et al., 2004; Dietrich and Wanzenried, 2010). This tendency may result in monopolistic earnings as well as a higher competition in the sector. Hence, its net effect is unknown. To consider this effect, Herfindahl-Hirschman-Index (HHI) is included into the model.

Macroeconomic Determinants of Profitability

The inflation policies and the upward and downward moving in the economy itself are taken into account as the macroeconomic variables.

Inflation: The current inflation rate is used as a proxy for inflation expectations. The expected sign for the inflation variable is unknown, since it depends on the rate of increase on the wages as well.

Cyclical Output: The downswings in the economy may cause a decline in extending new loans which may trigger a credit crunch (Bikker and Hu, 2001). In economic boom periods, on the other hand, the demand for credit and stock market transactions reinforces substantially, and positively affects the bank's profitability (Demirgüç-Kunt and Huizinga, 1999 and Dietrich and Wanzenried ,2010). Following the literature, real GDP growth will be used as a proxy for cyclicality.

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[3] http://www.tbb.org.tr/tr/Banka_ve_Sektor_Bilgileri/banka_listesi.asp?tarih=01.02.2011

Empirical Results

Econometric Methodology

We use a strongly balanced panel for Turkish commercial banks for the years 2003-2010. Descriptive statistics are provided in Table 1. The model defined in Eq. (1) is in static form, which is usually analyzed by a fixed effect-random effect model. Our basic model defined in Eq. (2), on the contrary, has a lagged variable, so the parameters become biased in fixed effect-random effect models. This is why we use a dynamic Arellano and Bover (1995) specification.

Table 1. Descriptive Statistics for the Period from 2003 to 2010

Variable	Mean	Std. Dev.	Min	Max
CAR	0.186	0.159	0.039	0.916
Credit Risk	0.528	7.576	0.000	155.414
Productivity	5836.260	26772.670	0.200	288858.600
Expense Management	-1.196	7.710	-116.680	0.000
Size 1	245.410	332.149	0.000	1398.000
Size 2	10.728	2.234	5.707	14.748
Size 3	21.456	4.467	11.414	29.495
Derivatives Ratio	0.676	1.074	0.000	10.524
HHI	0.101	0.003	0.095	0.105
Inflation Expectations	0.855	0.500	0.122	2.533
Real GDP Growth	5.028	5.787	-14.700	12.000
ROA	0.009	0.039	-0.632	0.220
NIM	0.032	0.031	-0.217	0.240
Change in ROA	0.001	0.033	-0.237	0.615
Change in NIM	0.001	0.031	-0.184	0.199

First of all, we checked the stationary properties of our model by the unit root tests. The results for levels and first differences are shown in the appendix. Although there are unit roots in levels for some variables, they disappear in the first differences at 0.01 level. Thus, the data is integrated of order 1.

Next, the data is analyzed by dynamic panel data techniques to avoid the inconsistencies that are possible with static estimations. One of the common methods in dynamic specifications is Arellano and Bond (1991) who recommend the usage of lagged explanatory variables as GMM

type instruments. However, this method loses its efficiency with small number of time periods (Arellano and Bover, 1995). Here, we evaluate the entire period as well as pre and post crisis periods, which decreases our number of T. Hence, we have decided to use two-step Arellano and Bover, (1995) GMM estimator.

Following Athanasoglou et al., (2008), we run various regressions to understand the best way of modeling CAR and credits ratio. Looking at Sargan-test for over identification, we have chosen to not to model CAR as endogenous and pre-determined, respectively. For all regressions, the Sargan test cannot reject the null hypothesis stating that over identifying restrictions are valid at 0.01 level. The level of significance for the explanatory variables is computed with Z-statistics.

Results

For the different profitability measures, the results are separately reported in the pre-crisis, post-crisis and the entire period columns, in Table 2. In these models, ownership dummy variables are included, while size 2 variable (logarithm of real assets) is excluded due to multicollinearity problems. All of the models have a significant Wald test, showing a fine goodness of fit and, Sargan tests fail to reject the validity of over identifying restrictions at 1% level. First and second order autocorrelation tests show no indication of autocorrelation in the pre-crisis period, whereas the null hypothesis of no autocorrelation is rejected at 1% level in some cases. Therefore, the results must be interpreted with caution.

Table 2. GMM Estimation for the different periods (dependent variables: ROA, NIM, ΔROA, ΔNIM)

Dependent Variable	Pre - Crisis Period (2003 - 2006)								Post - Crisis Period (2007 - 2010)							
	ROA		NIM		ΔROA		ΔNIM		ROA		NIM		ΔROA		ΔNIM	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Lag. Dependent	0.419	0.000	0.223	0.000	-0.474	0.000	-0.160	0.001	-0.055	0.388	-0.156	0.001	-0.260	0.000	-0.326	0.000
CAR	-0.303	0.000	0.193	0.000	-0.334	0.000	-0.109	0.012	0.165	0.000	0.148	0.018	0.080	0.039	0.119	0.047
Credit Risk	0.002	0.000	-0.001	0.000	0.004	0.000	0.000	0.006	-0.087	0.026	-0.065	0.345	-0.017	0.630	-0.125	0.182
Productivity	0.000	0.515	0.000	0.189	0.000	0.689	0.000	0.000	0.000	0.131	0.000	0.000	0.000	0.533	0.000	0.000
Expense Man.	0.000	0.711	-0.002	0.028	-0.001	0.624	-0.004	0.000	-0.010	0.652	-0.031	0.382	-0.042	0.196	-0.098	0.122
Size1	0.000	0.004	0.000	0.008	0.000	0.095	0.000	0.923	0.000	0.995	0.000	0.250	0.000	0.799	0.000	0.745
Size3	0.008	0.000	0.005	0.024	0.016	0.000	-0.012	0.001	-0.002	0.400	0.006	0.347	-0.002	0.645	0.000	0.976
D1	0.038	0.548	0.492	0.056	0.046	0.668	-0.221	0.059	0.050	0.390	-0.218	0.281	0.073	0.202	(dropped)	
D2	0.092	0.000	0.040	0.198	-0.045	0.162	-0.068	0.051	-0.045	0.240	-0.019	0.735	(dropped)		0.012	0.846
Derivatives Ratio	0.002	0.619	-0.018	0.000	0.015	0.032	-0.009	0.308	-0.004	0.000	-0.003	0.386	-0.007	0.000	0.004	0.122
HHI	1.204	0.034	-1.629	0.000	1.004	0.159	-2.615	0.000	0.904	0.241	1.308	0.072	0.543	0.313	0.564	0.355
Inflation Exp.	0.004	0.000	0.004	0.000	-0.001	0.334	0.001	0.493	0.005	0.000	0.014	0.000	0.001	0.153	-0.003	0.121
Real GDP Growth	-0.001	0.000	-0.001	0.000	-0.003	0.000	-0.002	0.000	0.000	0.065	0.000	0.000	0.000	0.080	0.000	0.000
Constant	-0.281	0.000	0.012	0.798	-0.382	0.000	0.611	0.000	-0.031	0.767	-0.189	0.330	-0.031	0.689	-0.070	0.691

Table 2 – Continued. GMM Estimation for the different periods (dependent variables: ROA, NIM, ΔROA, ΔNIM)

Entire Period (2003 - 2010)

Dependent Variable	ROA		NIM		ΔROA		ΔNIM	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Lag. Dependent	0.597	0.000	-0.009	0.795	-0.429	0.000	-0.212	0.000
CAR	-0.171	0.000	0.220	0.000	-0.289	0.000	0.002	0.962
Credit Risk	0.002	0.000	-0.001	0.000	0.004	0.000	0.000	0.215
Productivity	0.000	0.439	0.000	0.003	0.000	0.935	0.000	0.001
Expense Man.	0.000	0.945	-0.002	0.000	0.000	0.839	-0.003	0.000
Size1	0.000	0.626	0.000	0.438	0.000	0.037	0.000	0.477
Size3	0.010	0.000	0.005	0.003	0.005	0.006	-0.001	0.674
D1	-0.003	0.409	-0.002	0.496	0.005	0.006	0.006	0.028
D2	-0.022	0.601	0.059	0.558	-0.102	0.005	-0.052	0.918
Derivatives Ratio	0.125	0.000	0.098	0.000	0.031	0.056	0.013	0.940
HHI	-0.104	0.870	-0.611	0.021	0.691	0.123	-1.393	0.070
Inflation Exp.	0.002	0.013	0.010	0.000	-0.006	0.000	-0.003	0.001
Real GDP Growth	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Constant	-0.226	0.000	-0.084	0.002	-0.147	0.001	0.173	0.183

As shown in Table 2, the results differ considerably in terms of significance and coefficients across subgroups and the entire period. Nearly all the lagged variable coefficients are significant at 1% level, confirming the dynamic nature of the profitability. In the pre-crisis period, lagged variables for ROA and NIM are positive and on average equals to 0.32, indicating a moderate, but eventually returning to the normal level persistence in profitability. This also shows that the banking sector in Turkey was fairly competitive between the years 2003 and 2006. On the contrary, the lagged variable for ROA is not significant in the post-crisis period. It is significant, but negative for NIM in this period, demonstrating a non persistent profitability structure. For the entire period, while ROA is found to be significant and persistent, NIM is insignificant. This finding is in line with Goddard et al., (2004), who indicate the weakness of profit persistence in the European banks.

The evidence in terms of the impact of CAR is mixed, but always significant for the entire and sub-periods. Between the years 2003 and 2006, the coefficient for this ratio is negative and positive for ROA and NIM, respectively. Tunay and Silpar (2006) have investigated Turkish banking sector with linear panel regression forms and have pointed out mixed findings for ROA, ROE and NIM for the years between 1988 and 2004. After the subprime mortgage crisis, it is natural to observe that for both profitability measures have been affected positively and significantly from CAR, because safety becomes more important again. In the entire period, again similar to Tunay and Silpar (2006), CAR is negatively and significantly influential on ROA, while positively and significantly impacts on NIM. The consistent positive impact of CAR on NIM aligns with positive findings of Sayılgan and Yıldırım (2009).

The examination of the credit risk variable reveals that it has a significant and positive impact on ROA in the pre crisis period, but significantly negative after the crisis. Analyzing a period before the crisis, Sayılgan and Yıldırım (2009) also show the same structure for Turkish banks. Dietrich and Wanzenried (2010) have recently demonstrated that this variable has more importance during the crisis. The greater coefficient of ROA in terms of absolute value for the second period confirms this implication as well. Together with the CAR findings, it seems that safer banks are more profitable in the post-crisis years. This risk-averse behavior can be observed from the descriptive statistics as well. Mean ROA has increased in the post-crisis period together with the enhancement in CAR and decline in credit risk.

The impact of this variable on NIM is consistently negative for two sub-periods, but not significant in the last period. The entire period results demonstrate a positive impact on ROA, whereas lower but negative coefficient is found for NIM.

The coefficient for productivity turns out to be very small and usually insignificant for all the periods. In the literature, it has been stated that the improvements on the supervisory systems enhance the efficiency particularly at the beginning of 2000s (Işık and Kabirhassan, 2003). Based on this efficiency increase, one would expect a positive impact especially in the pre-crisis period. The lack of significance may be explained as such: Other explanatory variables such as credit risk and capital may have more importance in determining the banking profitability in the Turkish banking system.

Another proxy for efficiency is considered as expenses management. Similar to the productivity findings, the coefficient for expense management is found to be insignificant across all the periods. The likely explanation for this coefficient is the same with the productivity variable.

The likelihood of the sign of size variables is mixed in the literature. Unlike the positive effect shown in the paper of Tunay and Silpar (2006) for the Turkish banks, present study cannot find a statistical relation between this explanatory variable and profitability independently from the period analyzed. This finding is actually in line with the previous literature as well (Athanasoglou et al., 2008; Goddard et al., 2004).

Further, the impact of ownership is examined by the aid of two dummies (D1 and D2). Here, D1 reflects the impact of the private versus state-owned banks, while D2 stands for the foreign versus national banks. Although the determinants of profitability based on the ownership structure will be investigated more extensively in the next tables, Table 2 represents the general view. The discrimination between the state owned versus private bank is found to be insignificant independently from the period analyzed. In other words, it seems that privately owned banks do not operate more profitable than public banks in Turkey. This finding is consistent with the findings for the European banks (Athanasoglou et al., 2008 and Goddard et al.,2004).

Similarly, present study cannot find strong evidence in favor of the internalization of the banking system, since all the coefficients, except the one for ROA in the pre-crisis period, are insignificant for all the periods. This is in contrast to the suggestions of Demirgüç-Kunt and Huizinga (1999) and Athanasoglou et al., (2006) for the developing countries and the South Eastern European countries, respectively.

Derivatives ratio shows mixed results for different periods for ROA and NIM. Although the coefficients are small in terms of absolute value, they are significant at 1% level for the entire period, implying that its exclusion may cause an omitted variable problem. Regarding the models

where the dependent variables are ROA and NIM, respectively, one may observe smoother patterns in the profitability. Derivatives ratio is mostly insignificant. The low standard deviation in the profitability measures for the entire period supports this finding as well.

Examining the sub-periods reveals that only the change in ROA is significant at 5% and 1% levels in the pre and post-crisis periods, respectively. The coefficients turn out to be positive in the pre-crisis period and negative in the post-crisis period. Change in NIM is always insignificant across sub-periods. Even the small but significant positive coefficients in the pre-crisis period may indicate some speculative purposed derivates usage, particularly in the post-crisis period; the hedging purpose is in the first place. This explanation is somewhat close to Sayılgan and Yıldırım (2008) analysis for the Turkish banks, in which OBS items are statistically negatively impacts to the profitability between the years 2002 and 2007, but stable profitability is observed due to hedging portion of these items. Interpreting all results together demonstrate that the Turkish banks mostly use derivatives for hedging purposes.

The concentration, measured with HHI, often loses its significance in different sub-periods and in the entire period, but it is mostly negative. This finding cannot be evidence in favor of SCP hypothesis in the Turkish Banking system. In line with Smirlock (1985) and Berger (1995a), once the other explanatory variables are controlled, concentration has no effect on the bank profitability.

Turning to the macroeconomic variables show that inflation expectations are positively and significantly related to bank profitability at 1% level in all periods. This positive effect can be attributable to the enhanced interest rate forecasting ability of the bank managers in the analyzed period. Real GDP growth, on the other hand, has a mostly significant and consistently negative, but a very small effect on the bank profitability in Turkey. Overall, comparing to the previous time periods, Turkey has had a very stable macroeconomic environment in the entire 2003-2010 period, which lightens the influence of inflation and real GDP growth on the bank profits.

Table 3 and 4 respectively demonstrates the determinants of bank profitability for various ownership structures. As in full model analysis, all of the Sargan test fails to reject the null hypothesis stating that over identified restrictions are valid. Wald tests show fine goodness of fit. However, some indication of autocorrelation is present, although in most cases first and second order tests fail to reject no autocorrelation hypothesis. Again, the results should be interpreted with caution.

Table 3a. Determinants of Bank Profits for Private Banks

| Dependent Variable | Pre - Crisis Period (2003 - 2006) | | | | | | | | Post - Crisis Period (2007 - 2010) | | | | | | | |
| | ROA | | NIM | | ΔROA | | ΔNIM | | ROA | | NIM | | ΔROA | | ΔNIM | |
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Lag. Dependent	0.436	0.000	0.059	0.247	-0.459	0.000	-0.182	0.001	0.494	0.000	-0.028	0.267	-0.296	0.000	-0.296	0.000
Capital Ratio	-0.416	0.000	0.214	0.000	-0.405	0.000	-0.031	0.416	-0.311	0.000	0.161	0.011	0.055	0.269	0.061	0.416
Credit Risk	0.002	0.000	-0.001	0.000	0.004	0.000	0.000	0.003	0.002	0.000	0.029	0.036	-0.002	0.947	-0.005	0.900
Productivity	0.000	0.003	0.000	0.053	0.000	0.685	0.000	0.113	0.000	0.000	0.000	0.000	0.000	0.550	0.000	0.000
Expense Man.	0.000	0.387	-0.002	0.000	-0.001	0.581	-0.002	0.001	0.000	0.234	-0.002	0.943	-0.027	0.446	-0.025	0.622
Size1	0.000	0.161	0.000	0.013	0.000	0.045	0.000	0.903	0.000	0.891	0.000	0.024	0.000	0.730	0.000	0.955
Size3	0.000	0.823	0.005	0.007	0.002	0.308	-0.002	0.496	0.001	0.416	0.003	0.122	-0.003	0.365	-0.002	0.481
Derivatives Ratio	0.017	0.000	-0.008	0.003	0.006	0.195	-0.014	0.024	0.006	0.000	0.005	0.006	-0.007	0.000	0.009	0.005
HHI	0.974	0.000	-0.888	0.023	0.049	0.896	-2.516	0.000	1.058	0.000	0.215	0.435	-0.257	0.774	0.040	0.953
Inflation Expect.	0.002	0.000	0.006	0.000	-0.002	0.078	0.003	0.002	0.001	0.103	0.012	0.000	-0.001	0.316	-0.003	0.026
Real GDP Growth	0.000	0.019	-0.001	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.247	0.000	0.000
Constant	-0.043	0.068	0.000	0.994	0.023	0.568	0.308	0.000	-0.080	0.003	-0.086	0.054	0.078	0.515	0.036	0.736

Table 3b. Determinants of Bank Profits for State Owned Banks

| Dependent Variable | Pre - Crisis Period (2003 - 2006) | | | | | | | | Post - Crisis Period (2007 - 2010) | | | | | | | |
| | ROA | | NIM | | ΔROA | | ΔNIM | | ROA | | NIM | | ΔROA | | ΔNIM | |
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Lag. Dependent	0.502	0.000	0.018	0.658	-0.437	0.000	-0.198	0.000	0.003	0.976	0.015	0.548	-0.405	0.000	-0.220	0.000
Capital Ratio	-0.304	0.000	0.175	0.000	-0.297	0.000	0.001	0.960	0.146	0.000	0.161	0.000	-0.286	0.000	0.010	0.670
Credit Risk	0.002	0.000	-0.001	0.000	0.004	0.000	0.000	0.001	-0.026	0.034	-0.001	0.000	0.003	0.000	0.000	0.000
Productivity	0.000	0.000	0.000	0.019	0.000	0.886	0.000	0.159	0.000	0.088	0.000	0.004	0.000	0.913	0.000	0.019
Expense Man.	0.000	0.609	-0.002	0.002	0.000	0.841	-0.002	0.003	-0.015	0.434	-0.002	0.000	0.000	0.853	-0.002	0.000
Size1	0.000	0.676	0.000	0.303	0.000	0.019	0.000	0.000	0.000	0.265	0.000	0.000	0.000	0.577	0.000	0.072
Size3	0.003	0.038	0.003	0.070	0.005	0.000	-0.001	0.690	0.001	0.679	0.004	0.028	0.001	0.187	-0.001	0.732
Derivatives Ratio	0.004	0.004	0.000	0.946	0.006	0.000	0.007	0.003	-0.005	0.000	0.001	0.601	0.004	0.012	0.008	0.000
HHI	0.928	0.013	-0.593	0.001	0.720	0.036	-1.759	0.000	-0.335	0.423	-0.517	0.149	0.837	0.052	-1.480	0.001
Inflation Expect.	0.001	0.331	0.007	0.000	-0.005	0.000	-0.003	0.000	0.005	0.000	0.007	0.000	-0.005	0.000	-0.003	0.000
Real GDP Growth	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.138	0.000	0.000	0.000	0.000	0.000	0.000
Constant	-0.107	0.007	0.004	0.937	-0.141	0.000	0.211	0.000	0.003	0.931	-0.012	0.712	-0.075	0.054	0.174	0.000

The results are mostly in line with the entire banking sector analysis. The profitability of private banks is affected significantly by capital ratio, credit risk, derivatives ratio, inflation expectations and the real GDP growth. The lagged dependent variable is significant at 1% level. Unlike the entire sample analyses, the productivity is found to be significant particularly after the subprime mortgage crisis for private banks. Although the coefficients are very small in the absolute values, the positive impact may reflect that some part of the income produced by productivity enhancements is transferred to the private banks as profit. Next, concentration is found to be significant before and after the crisis for ROA for the private banks. Nevertheless, the evidence is weak, because the results are often mixed for ROA and NIM. The relation between the derivatives ratio and between the changes in profitability variables is mostly significant and implies that the private banks usually use derivates for hedging purposes. This inference is valid for two sub-periods, since changes in profitability cannot be largely explained by this variable.

Table 4a. Determinants of Bank Profits for Foreign Banks

Dependent Variable	Pre - Crisis Period (2003 - 2006)								Post - Crisis Period (2007 - 2010)							
	ROA		NIM		ΔROA		ΔNIM		ROA		NIM		ΔROA		ΔNIM	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Lag. Dependent	0.485	0.000	0.096	0.000	-0.445	0.000	-0.161	0.005	0.157	0.365	-0.047	0.000	-0.131	0.111	-0.374	0.001
Capital Ratio	-0.324	0.000	0.180	0.000	-0.317	0.000	0.022	0.155	0.144	0.000	0.143	0.000	0.039	0.304	0.018	0.616
Credit Risk	0.002	0.000	-0.001	0.000	0.004	0.000	0.000	0.001	-0.019	0.014	-0.005	0.576	-0.011	0.704	-0.020	0.634
Productivity	0.000	0.000	0.000	0.326	0.000	0.245	0.000	0.514	0.000	0.131	0.000	0.254	0.000	0.086	0.000	0.001
Expense Man.	0.000	0.407	-0.002	0.021	-0.002	0.221	-0.001	0.012	0.001	0.189	-0.002	0.063	0.001	0.021	-0.002	0.000
Size1	0.000	0.552	0.000	0.357	0.000	0.028	0.000	0.487	0.000	0.569	0.000	0.078	0.000	0.965	0.000	0.522
Size3	0.004	0.001	0.001	0.553	0.004	0.024	-0.002	0.578	0.001	0.448	0.004	0.098	-0.001	0.661	0.004	0.420
Derivatives Ratio	0.002	0.080	0.001	0.474	0.003	0.021	0.001	0.787	-0.004	0.000	0.001	0.496	-0.005	0.000	0.008	0.000
HHI	0.440	0.004	-0.739	0.000	0.570	0.505	-2.291	0.000	-0.652	0.130	0.239	0.119	-0.265	0.416	-0.801	0.135
Inflation Exp.	0.001	0.249	0.006	0.000	-0.005	0.000	0.001	0.334	0.003	0.000	0.012	0.000	-0.002	0.001	-0.006	0.001
Real GDP Growth	0.000	0.000	0.000	0.000	-0.001	0.000	-0.001	0.001	0.000	0.040	0.000	0.000	0.000	0.273	-0.001	0.000
Constant	-0.079	0.000	0.058	0.182	-0.111	0.111	0.280	0.000	0.027	0.425	-0.081	0.136	0.060	0.396	0.008	0.905

Table 4b. Determinants of Bank Profits for National Banks

Dependent Variable	Pre - Crisis Period (2003 - 2006)								Post - Crisis Period (2007 - 2010)							
	ROA		NIM		ΔROA		ΔNIM		ROA		NIM		ΔROA		ΔNIM	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Lag. Dependent	0.451	0.000	0.013	0.573	-0.451	0.000	-0.160	0.000	0.466	0.000	0.061	0.094	-0.445	0.000	-0.211	0.000
Capital Ratio	-0.380	0.000	0.208	0.000	-0.357	0.000	0.016	0.566	-0.256	0.000	0.213	0.000	-0.257	0.000	0.029	0.375
Credit Risk	0.002	0.000	-0.001	0.000	0.004	0.000	0.000	0.000	0.002	0.000	-0.001	0.000	0.003	0.000	0.000	0.002
Productivity	0.000	0.000	0.000	0.000	0.000	0.226	0.000	0.053	0.000	0.516	0.000	0.000	0.000	0.071	0.000	0.002
Expense Man.	0.000	0.120	-0.002	0.000	-0.002	0.171	-0.002	0.000	-0.002	0.850	0.013	0.024	-0.050	0.165	-0.009	0.698
Size1	0.000	0.016	0.000	0.001	0.000	0.346	0.000	0.364	0.000	0.667	0.000	0.037	0.000	0.667	0.000	0.082
Size3	0.001	0.623	0.003	0.007	0.003	0.008	0.001	0.568	0.003	0.035	0.001	0.802	0.002	0.002	-0.002	0.410
Derivatives Ratio	0.019	0.000	-0.005	0.009	0.003	0.538	-0.004	0.273	-0.003	0.667	0.001	0.654	0.003	0.048	0.005	0.007
HHI	1.053	0.000	-0.462	0.095	0.546	0.233	-1.572	0.000	0.904	0.102	-0.654	0.212	0.713	0.023	-0.708	0.227
Inflation Exp.	0.001	0.000	0.006	0.000	-0.003	0.000	-0.002	0.000	0.001	0.017	0.008	0.000	-0.005	0.000	-0.001	0.207
Real GDP Growth	0.000	0.000	0.000	0.000	0.000	0.242	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Constant	-0.059	0.012	-0.008	0.819	-0.068	0.111	0.152	0.000	-0.131	0.094	0.058	0.379	-0.091	0.024	0.142	0.047

For the public banks, the most important explanatory variables are CAR and credit risk. Especially after the crisis, safety becomes an important factor of profitability. This implication is based on the positive and significant coefficient of the capital ratio, and the negative and significant coefficient of credit risk. Here, the lagged variable becomes mostly insignificant which indicates that public bank profitability is not persistent across time periods; and it is appropriate to analyze this section by static models. Size is found to be insignificant. The effect of macroeconomic variables is very small, but significant as in the full model.

Productivity and expense management have some minor impact on profitability for the public banks. The derivatives ratio is always significant and positive while explaining the changes in ROA and NIM. This finding confirms our first conclusion that derivatives are used for hedging purposes independently from their ownership structure. The bad experience of the financial crash in 2000 may be influential on this attitude of the managers. The concentration of the market seems to be influential in the pre-crisis period, but it has lost its impact in the post-2007 term.

Turning to the foreign versus national bank difference demonstrates that particularly in the pre-crisis period, the profitability of foreign banks are highly persistent and but the departures from a competitive market structure is not serious. The capital ratio and credit risk are the crucial determinants of bank profitability. Although the coefficient of ROA shows little evidence of that risk taking seemingly awarded in 2003-2006 period, the safety policy is still important in the two sub periods. In line with the full model, productivity, expense management, size and macroeconomic variables are found mostly insignificant or little impactful.

The derivatives ratio of the foreign banks does not significantly explain the profitability changes before the crisis, while this ratio becomes significant in the post-crisis era. It is noted that ROA and the change in ROA are negatively impacted from the derivatives ratio. It may signal that the foreign banks attempt to use derivatives for reasons other than hedging to improve their profitability which is hurt from the recent crisis. Here, the main difference from the foreign banks is again in the derivatives ratio of national banks. While before crisis, derivatives ratio is significant at 1% level, it becomes insignificant in the post-crisis period. It may signal that national banks hesitate more than foreign banks while using derivatives and the main purpose of derivatives usage is hedging.

Conclusion

Present study attempts to determine the factors that affect the Turkish banking system profitability, using dummies for the recent subprime mortgage crisis and different ownership structures. These factors should be known by the bank managers and policy makers in order to sustain a stable banking sector, and hence, a stable financial system. The importance of this study comes from the inclusion of derivatives usage, which may constitute a considerable omitted variable problem in these analyses when excluded. Moreover, unlike the other studies examining the Turkish banking system, we use an extensive set of explanatory variables in a dynamic framework.

From the above analysis, one can understand that the most influential factors in explaining the profitability of Turkish banks are internal ones, namely CAR and credit risk. Particularly, in the post-crisis period, safety adds more to the profitability of the sector. In consistent with this finding, it is also seen that bank managers use derivatives with caution, only for hedging purposes. In this specific attitude, we think that the heavy consequences of the 2000 crisis play a crucial role.

The macroeconomic variables do not substantially affect the banking sector profitability. This may be a corollary of relatively stable macroeconomic environment in Turkey after 2000. We find evidence that although the banking sector operates with a small number of banks, the profits are moderately persistent. In addition, this study cannot verify the SCP hypothesis, so the concentration is not influential on bank profits.

The discrimination across various ownership types shows consistent findings with the full model, implying that bank-level determinants form profitability independently from its ownership status. However, there is a slight indication that national banks are more eager to use derivatives for hedging purposes than foreign banks.

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Appendix

Table A1. Panel Unit Root Results (Levels)

		LL and Chu t test		Breitung		IPS		ADF - Fisher Chi square		PP - Fisher Chi Square		Hadri	
		Statistics	Prob	Statistics	Prob	Statistics	Prob	Statistics	Prob	Statistics	Prob	Statistics	Prob
ROA	Intercept	-11.26720	0.00000	-3.92054	0.00000	-8.97169	0.00000	215.17700	0.00000	415.10300	0.00000	8.76925	0.00000
NIM		0.66196	0.74600	-1.74347	0.04060	-8.53115	0.00000	201.16000	0.00000	443.11000	0.00000	9.67819	0.00000
CAR		1.90290	0.97150	-1.58478	0.05650	-6.27527	0.00000	154.03000	0.00000	140.32800	0.00000	10.28580	0.00000
Credit Risk		-4.08982	0.00000	-0.76558	0.22200	-7.36321	0.00000	157.98000	0.00000	175.84400	0.00000	9.99842	0.00000
Productivity		-11.62060	0.00000	1.29573	0.90250	-2.91507	0.00180	110.83500	0.00000	253.94000	0.00000	13.27240	0.00000
Expense Management		-14.90430	0.00000	-0.76727	0.22150	-12.81440	0.00000	214.32400	0.00000	318.98700	0.00000	12.69330	0.00000
Size1		-4.10039	0.00000	2.45707	0.99300	1.28965	0.90140	45.70730	0.56730	89.40810	0.00100	17.37740	0.00000
Size2		0.96954	0.83390	0.52570	0.70050	0.76983	0.77930	55.26630	0.64900	79.58040	0.04620	14.41070	0.00000
Size3		0.96951	0.83390	0.52568	0.70040	0.76979	0.77930	55.26630	0.64900	79.58030	0.04620	14.41070	0.00000
Derivatives Ratio		-5.94617	0.00000	-2.25753	0.01200	-6.26316	0.00000	158.86200	0.00000	144.94700	0.00000	10.45400	0.00000
Inflation Expectations		-10.81430	0.00000	-0.13737	0.44540	-21.08220	0.00000	495.11800	0.00000	575.75300	0.00000	15.40150	0.00000
Real GDP Growth		-0.20425	0.41910	-1.79040	0.03670	-2.75136	0.00300	72.79870	0.12420	91.07720	0.00590	3.01237	0.00130
HHI		-8.87653	0.00000	-6.01971	0.00000	-4.92522	0.00000	103.01000	0.00050	186.53000	0.00000	10.79190	0.00000
ΔROA		-26.81600	0.00000	-9.58413	0.00000	-28.62120	0.00000	674.18700	0.00000	995.18300	0.00000	2.64036	0.00410
ΔNIM		-26.89080	0.00000	-14.77790	0.00000	-29.68350	0.00000	701.21200	0.00000	1036.90000	0.00000	1.67604	0.04690
ROA	Trend	-1.35188	0.08820	-2.46118	0.00690	-7.56032	0.00000	165.45900	0.00000	451.21400	0.00000	5.67389	0.00000
NIM		11.25090	1.00000	-4.69173	0.00000	-4.90532	0.00000	131.52600	0.00000	576.91300	0.00000	11.14050	0.00000
CAR		3.65204	0.99990	-0.44386	0.32860	-4.08079	0.00000	112.77400	0.00000	109.73200	0.00010	11.52030	0.00000
Credit Risk		-10.71810	0.00000	-2.13303	0.01650	-7.08744	0.00000	396.00100	0.00000	340.15900	0.00000	10.32800	0.00000
Productivity		-21.74660	0.00000	2.92608	0.99830	-5.17277	0.00000	570.44200	0.00000	299.11400	0.00000	11.60890	0.00000
Expense Management		-11.31490	0.00000	2.06071	0.98030	-10.21390	0.00000	411.86600	0.00000	739.59100	0.00000	33.98370	0.00000
Size1		0.04469	0.51780	3.56311	0.99980	2.03866	0.97930	40.14960	0.78250	34.88950	0.96720	12.18340	0.00000
Size2		-1.36320	0.08640	1.15040	0.87500	-1.06403	0.14370	89.89410	0.00750	76.71960	0.07170	6.83409	0.00000
Size3		-1.36298	0.08640	1.15039	0.87500	-1.06396	0.14370	89.89200	0.00750	76.71960	0.07170	6.83409	0.00000
Derivatives Ratio		-8.98734	0.00000	-3.84248	0.00010	-7.07244	0.00000	156.92100	0.00000	148.04900	0.00000	7.52734	0.00000
Inflation Expectations		1.99777	0.97710	-0.10824	0.45690	-7.27226	0.00000	141.49500	0.00000	552.62000	0.00000	16.35480	0.00000
Real GDP Growth		3.91209	1.00000	0.24432	0.59650	2.05666	0.98010	25.82800	1.00000	39.35590	0.98190	1.82464	0.03400
HHI		-14.10220	0.00000	-1.92456	0.02710	-8.15835	0.00000	165.15500	0.00000	137.79300	0.00000	13.38990	0.00000
ΔROA		-22.63940	0.00000	-8.54822	0.00000	-25.58830	0.00000	554.83900	0.00000	3205.38000	0.00000	18.44240	0.00000
ΔNIM		-22.18110	0.00000	-12.31110	0.00000	-27.04850	0.00000	588.63200	0.00000	3941.54000	0.00000	12.63540	0.00000

Table A1 – continued. Panel Unit Root Results (First Differences)

		LL		Breitung		IPS		ADF		PP		Hadri	
		Statistics	Prob	Statistics	Prob	Statistics	Prob	Statistics	Prob	Statistics	Prob	Statistics	Prob
ROA	Intercept	-5.42124	0.00000	-9.35804	0.00000	-19.78950	0.00000	410.92500	0.00000	995.18200	0.00000	2.64036	0.00410
NIM		24.23130	1.00000	-7.21226	0.00000	-11.13070	0.00000	197.70900	0.00000	1036.90000	0.00000	1.67604	0.04690
CAR		-22.05190	0.00000	-12.14120	0.00000	-26.78040	0.00000	627.28400	0.00000	787.63300	0.00000	6.24965	0.00000
Credit Risk		-7.13015	0.00000	-3.34358	0.00040	-11.70270	0.00000	288.67500	0.00000	323.07700	0.00000	5.67885	0.00000
Productivity		8.55680	1.00000	-7.81327	0.00000	-17.05270	0.00000	345.29700	0.00000	880.97900	0.00000	1.14596	0.12590
Expense Management		3.06161	0.99890	-8.75173	0.00000	-25.14360	0.00000	463.58800	0.00000	928.37500	0.00000	12.15390	0.00000
Size1		-9.23549	0.00000	-8.44879	0.00000	-11.43840	0.00000	230.47700	0.00000	301.29900	0.00000	4.96502	0.00000
Size2		-38.42810	0.00000	-8.97529	0.00000	-24.65130	0.00000	444.60200	0.00000	490.13500	0.00000	1.52517	0.06360
Size3		-38.42870	0.00000	-8.97529	0.00000	-24.65130	0.00000	444.60000	0.00000	490.13400	0.00000	1.52517	0.06360
Derivatives Ratio		-28.17450	0.00000	-18.42360	0.00000	-28.91070	0.00000	639.80600	0.00000	764.95600	0.00000	-0.41357	0.66040
Inflation Expectations		-21.30600	0.00000	-14.54480	0.00000	-36.66030	0.00000	862.29300	0.00000	1051.47000	0.00000	7.23218	0.00000
Real GDP Growth		-17.99060	0.00000	-13.76210	0.00000	-17.83200	0.00000	388.96200	0.00000	383.86900	0.00000	-2.16763	0.98490
HHI		-20.19260	0.00000	-12.67580	0.00000	-19.77290	0.00000	448.64100	0.00000	1085.51000	0.00000	12.24740	0.00000
ΔROA		-25.34760	0.00000	-19.73040	0.00000	-28.83590	0.00000	674.82000	0.00000	706.81300	0.00000	1.26355	0.10320
ΔNIM		-24.35130	0.00000	-22.86510	0.00000	-28.41840	0.00000	665.90000	0.00000	589.33900	0.00000	0.22118	0.41250
ROA	Trend	-0.48025	0.31550	-7.82052	0.00000	-19.89720	0.00000	637.28000	0.00000	3205.38000	0.00000	18.44240	0.00000
NIM		30.51750	1.00000	-5.94442	0.00000	-12.12020	0.00000	631.17600	0.00000	3941.54000	0.00000	12.63540	0.00000
CAR		-20.13520	0.00000	-9.33378	0.00000	-24.47200	0.00000	617.21100	0.00000	2263.71000	0.00000	24.53360	0.00000
Credit Risk		17.26680	1.00000	-5.21981	0.00000	-6.37230	0.00000	264.99200	0.00000	798.15200	0.00000	35.01970	0.00000
Productivity		-3.13862	0.00080	-6.99389	0.00000	-24.00900	0.00000	1648.99000	0.00000	3297.30000	0.00000	10.62000	0.00000
Expense Management		-0.52070	0.30130	-5.54880	0.00000	-31.67940	0.00000	1696.40000	0.00000	5127.67000	0.00000	56.03470	0.00000
Size1		-11.18360	0.00000	-8.34650	0.00000	-12.69910	0.00000	452.05100	0.00000	309.39700	0.00000	6.22775	0.00000
Size2		-16.43260	0.00000	-10.92610	0.00000	-16.44440	0.00000	347.87400	0.00000	476.78200	0.00000	5.57666	0.00000
Size3		-16.43270	0.00000	-10.92620	0.00000	-16.44440	0.00000	347.87300	0.00000	476.77300	0.00000	5.57665	0.00000
Derivatives Ratio		-23.70640	0.00000	-18.04710	0.00000	-25.94840	0.00000	578.74400	0.00000	3797.09000	0.00000	8.45152	0.00000
Inflation Expectations		-17.86740	0.00000	-11.53920	0.00000	-40.65460	0.00000	1006.33000	0.00000	7901.72000	0.00000	14.84180	0.00000
Real GDP Growth		-14.64140	0.00000	-11.55720	0.00000	-14.34090	0.00000	283.35600	0.00000	278.11600	0.00000	2.13137	0.01650
HHI		-16.54750	0.00000	-13.23670	0.00000	-16.24910	0.00000	335.00700	0.00000	3176.80000	0.00000	56.80110	0.00000
ΔROA		-20.07730	0.00000	-20.34500	0.00000	-25.87720	0.00000	559.13700	0.00000	7424.32000	0.00000	14.96170	0.00000
ΔNIM		-19.16850	0.00000	-16.91850	0.00000	-25.52410	0.00000	549.65800	0.00000	7895.43000	0.00000	11.09060	0.00000