Do Banks Respond Asymmetrically to the Global Crisis? Evidence From Turkey

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Abstract

This paper tests whether Turkish banks respond asymmetrically to the global crisis with respect to their ownership using bank-level data during 2002Q4-2013Q3 period and employing panel estimation techniques. The dependent variables are selected financial ratios on capital adequacy, asset quality, liquidity, profitability, balance sheet and income-expenditure structure. Main determinants are bank-specific control variables on overdue loans, overhead costs, FX open position and bank size as well as dummy variables for bank listing and bank age. Other determinants include GDP growth, inflation, exchange rate, policy rate and required reserves, which reflect the impact of macroeconomic conditions and the monetary policy on bank structure. Estimation results suggest that Turkish banks respond asymmetrically to the global crisis with respect to their ownership. This result can be attributed to structural, institutional and historical factors, which cause macroeconomic and policy-related explanatory variables to have uneven effects on banks before and after the global crisis. Meanwhile, the impacts of bank-specific determinants are also observed to be disproportionate across different ownership categories between the pre-crisis and the post-crisis periods. These findings highlight the importance of analyzing the Turkish banking sector by an ownership breakdown in order to detect the asymmetric response and the paper also emphasizes the need to perform the analysis by sub-periods to be able to capture the effect of the global crisis.

Keywords: *Global Crisis, Ownership, Panel Estimation, Capital Adequacy, Profitability, Turkish Banking Sector.*

JEL Classification: *C23, E44, E52, G10, G21.*

Özet - Bankalar Krize Asimetrik Tepki mi Veriyor? Türkiye'den Kanıt

Bu çalışmada, banka düzeyinde veri ve panel tahmin teknikleri kullanılarak Türk bankalarının 2002Ç4-2013Ç3 döneminde küresel krize mülkiyete bağlı olarak asimetrik tepki verip vermediği sınanmaktadır. Bağımlı değişkenler; sermaye yeterliliği, aktif kalitesi, likidite, kârlılık, bilanço ve gelir-gider yapısına ilişkin finansal oranlardan oluşmaktadır. Ana belirleyicileri ise vadesi geçmiş krediler, faaliyet giderleri, döviz açık pozisyonu ve banka büyüklüğü gibi bankaya özgü kontrol değişkenleri ile bankaların borsada işlem görmesi ve banka yaşına ilişkin kukla değişkenler oluşturmaktadır. Makroekonomik koşulların ve para politikasının banka yapısı üzerindeki etkisini yansıtan GSYİH büyümesi, enflasyon, döviz kuru, politika faizi ve zorunlu karşılıklar diğer belirleyiciler arasında yer almaktadır. Tahmin sonuçları, Türk bankalarının küresel krize mülkiyetlerine bağlı olarak asimetrik tepki verdiğini göstermektedir. Bu sonuç, küresel kriz öncesi ve sonrasında makroekonomik koşullar ve politikayla ilgili açıklayıcı değişkenlerin bankalar üzerinde eşit olmayan etkiler göstermesine neden olan yapısal, kurumsal ve tarihsel etkenlerle açıklanabilir. Bunun yanı sıra, bankaya özgü belirleyicilerin etkilerinin kriz öncesi ve sonrası dönemde farklı mülkiyet kategorileri arasında aynı oranda olmadığı gözlemlenmektedir. Bu bulgular, Türk bankacılık sektörünün asimetrik tepkisini tespit edebilmek için mülkiyet ayrımında incelenmesinin önemini ve küresel krizin etkisini yakalayabilmek için analizin alt dönemler itibarıyla yapılması gerektiğini vurgulamaktadır.

Anahtar Kelimeler: *Küresel Kriz, Mülkiyet, Panel Tahmini, Sermaye Yeterliliği, Kârlılık, Türk Bankacılık Sektörü.*

JEL Sınıflandırması: *C23, E44, E52, G10, G21.*

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1. Introduction

The Turkish banking sector has gone through major reforms in the aftermath of the financial crisis in 2001. The key elements of these reforms included far-reaching measures for prudential regulation and supervision as well as restructuring and recapitalization of banks.[1] As a result of the successful implementation of these reforms, the Turkish banking sector was fairly insulated against the negative effects of the global crisis in 2008. In particular, the global crisis was assessed to have a relatively limited, if any, unfavorable effect on the Turkish banking sector, even though Turkey was severely hit by the crisis.[2]

Despite the seemingly immunized nature of Turkish banks, the banking sector was still challenged by the global crisis. In fact, Yörükoğlu and Atasoy (2010), Erdem (2010), Aras (2010) and Uygur (2010) show that the Turkish banking sector was affected by the global crisis. However, these previous works only provide a general outlook about whether the banking sector was influenced by the crisis, without emphasizing the role of bank-specific, macroeconomic or policy-related conditions.

On the other hand, Ganioğlu and Us (2014) and Us (2015a) highlight the effect of these conditions and find that the global crisis has indeed changed the structure of the Turkish banking sector by displaying that determinants of some major financial ratios differ dramatically between the pre-crisis and the post-crisis periods. Furthermore, both studies report that ownership status of a bank is a major explanatory variable of banking sector dynamics by influencing these ratios significantly throughout the analyzed period.[3]

The previous evidence on the changing structure of Turkish banks after the global crisis accompanied by the empirical finding that ownership contributes notably to the evolution of bank-specific financial ratios bring up a question. In particular, does the global crisis affect the structure of banks differently depending on their ownership category? In other words, do banks respond asymmetrically to the global crisis with respect to their ownership?

In spite of the vast literature on the link between bank ownership and perfor-

1 Ganioğlu and Us (2014) provide detailed information about the restructuring of the Turkish banking sector. Accordingly, the main pillars of the program include measures for prudential regulation and supervision as well as restructuring of state banks, prompt resolution of insolvent banks and recapitalization of private banks.

2 Real GDP growth registered negative values for four consecutive quarters after the crisis and declined sharply by posting a year-on-year contraction of 15 percent during the first quarter of 2009 (Alp and Elekdağ, 2011).

3 Meanwhile, Kansoy (2012) also provides evidence that ownership matters; yet by only focusing on the net interest margin of Turkish banks and without mentioning the effect of the global crisis.

mance[4] and another array of research analyzing the impact of the global crisis on the banking sector[5], there are only a few attempts that try to address this issue.[6] In addition, the fact that the ownership structure of the Turkish banking sector has changed extensively during the last decade poses an additional challenge.[7]

Hence, this paper tries to fill this gap by seeking to find out whether banks respond asymmetrically to the global crisis with respect to their ownership categories. In doing so, pioneering works by Demirgüç-Kunt and Huizinga (1999), De Haas and van Lelyveld (2006) as well as Ganioğlu and Us (2014) and Us (2015a) provide the empirical basis.

In view of the methodologies adopted by these previous studies, this paper tries to contribute to the current literature on the Turkish banking sector[8] by analyzing the effects of bank-specific as well as macroeconomic and policy-related factors on Turkish banks by an ownership breakdown. Accordingly, a broad variety of variables are used to evaluate the capital adequacy, asset quality, liquidity, profitability, balance sheet and income-expenditure structure of the Turkish banking sector. Furthermore, in order to capture the effect the global crisis, the analysis is performed for the overall period as well as by sub-periods covering the pre-crisis and the post-crisis periods.

The paper is organized as follows: The next section provides an overview of earlier works analyzing the link between ownership and bank performance. The following section presents data and some stylized facts accompanied by the econometric methodology. The succeeding section reports the estimation results. Finally, the last section concludes.

4 Demirgüç-Kunt and Huizinga (1999), Claessens et al. (2001), Iannotta et al. (2007), Micco et al. (2007), Hasan and Marton (2003), Jemric and Vujcic (2002) and Weill (2003) are pioneering works that analyze the effect of ownership on bank performance.

5 Ganić (2012), Ashamu and Abiola (2012), Pomerleano (2009), Şafaklı and Eyyam (2012), Demirgüç-Kunt et al. (2013), Beltratti and Stulz (2012), Berger and Bouwman (2013), Angıner et al. (2012) and Čihák et al. (2012) analyze the effect of the global crisis on the banking sector.

6 Us (2015b, 2015c) also assess the role of ownership on the Turkish banking sector structure.

7 The domestic financial crises in 2000 and 2001 resulted in intensive take-overs by Savings Deposit Insurance Fund (SDIF). Meanwhile, efforts for improving the regulatory framework had already started prior to the financial crises as 11 banks were already seized by SDIF from 1997 till November 2000. In the meantime, 14 additional banks were taken over by SDIF following the financial crisis in February 2001. In May 2001, the Banking Regulation and Supervision Agency (BRSA) introduced the Banking Sector Restructuring Program as a direct response to the crisis with the objective to restructure state banks, private banks, and banks, which are under the control of the SDIF. Accordingly, the SDIF banks were restructured through mergers, sales or liquidation. This eventually caused a change in the ownership structure as some of these banks, which had formerly been owned by state, were now acquired by private parties, and some which had previously been private, were now owned by foreigners. More specifically, within the banking sector reform package, 6 of these troubled banks were merged and sold to a private bank; 8 banks were merged as SDIF bank and 4 banks taken over by SDIF were sold individually to either private or foreign banks, while other banks under SDIF were liquidated (BRSA, 2010).

8 Alper et al. (2001a, 2001b), Van Rijckeghem (1999), Steinherr et al. (2004), Alper and Öniş (2004), Metin-Özcan and Kafalı (2007) and Akçay (2003) are previous studies analyzing the Turkish banking sector.

2. Literature Review

There is a vast literature analyzing the link between ownership and bank performance. Most of these studies focus on evaluating the performance of state banks relative to others. Accordingly, Micco et al. (2007) find that state banks in developing countries have lower profitability and higher costs than their private counterparts. Iannotta et al. (2007) also argue that state banks have lesser profits than the privately owned banks in spite of their lower costs.

On the other hand, Gürsoy and Aydoğan (2002) discuss that state banks have high risk taking and performance, while Bonin et al. (2005a) show that state banks in transition countries perform better than private banks. This result is also confirmed by Najid and Rahman (2011), which demonstrate that state ownership is positively related to performance. Meanwhile, Fries and Taci (2005) find that private banks are more efficient than state banks and privatized banks with foreign ownership are the most efficient of all banks.

Other studies concentrate on the performance of foreign banks relative to other banks. In this regard, Claessens et al. (2001) analyze the effect of foreign ownership on the banking sector and find that an increased share of foreign banks implies lower profitability for domestic banks. Hasan and Marton (2003), Jemric and Vujcic (2002), Weill (2003), Grigorian and Manole (2006), Yıldırım and Philippatos (2007) and Bonin et al. (2005a, 2005b) find that foreign banks are significantly more cost-efficient than domestic banks.

In the meantime, Dages et al. (2000) argue that foreign banks perform better than domestic banks due to their advantages such as having higher capital and expertise as well as the opportunity for diversification and working with multinational clients. Similarly, Mian (2003) and Lensink and Naaborg (2007) report that foreign banks have higher cost-efficiency and better performance than domestic banks.

On the other hand, Demirgüç-Kunt and Huizinga (1999) discuss that foreign banks are less effective at recovering impaired loans than domestic banks. Rivard and Thomas (1997) also find that a rise in foreign ownership negatively affects bank performance. In a related study, Pettway and Sinkey (1980) indicate that foreign banks in developed countries are less profitable than domestic banks, but perform better than domestic banks in developing countries. Likewise, Nikiel and Opiela (2002) observe that foreign banks are less profitable than private banks.

3. Data, Stylized Facts and the Econometric Methodology

After the overview in the previous section, this section describes the variables that are selected for the analysis and also presents the stylized facts and the econometric methodology. The database covers 21 deposit banks, yielding a balanced panel of 924 observations for the period between 2002Q4 and 2013Q3.[9,10] All banks are categorized by ownership. Accordingly, of these 21 banks, 3 of them are state banks; 10 of them are private banks; and finally 8 of them are foreign banks.[11]

3.1. Data

The dependent variables are financial ratios on capital adequacy, asset quality, liquidity, profitability, balance sheet and income-expenditure structure[12], while independent variables represent macroeconomic conditions and policy actions along with bank-specific financial ratios, which presumably explain the banking sector dynamics.[13] Accordingly, the dependent variables can be defined as follows: EQUITY/ASSETS is the ratio of shareholders' equity to total assets; LOANS/ASSETS is the ratio of total loans and receivables to total assets; LIQUID/ASSETS is the ratio of liquid assets to total assets; PROFITS/ASSETS is the net return on assets, which is computed as the ratio of net profits (loss) to total assets; DEPOSITS/ASSETS is the ratio of deposits to total assets; NII/ASSETS is the net interest margin, which can be measured as the ratio of net interest income to total assets.

Bank-specific independent variables can be described as follows: ODL/LOANS is the ratio of overdue loans to total loans and receivables, which captures the impact of loan quality.[14] OTHEREXP/ASSETS is the ratio of other operating expenses to total assets, which represents overhead costs quantifying the effect of operating efficiency.[15] FXASSETS/FXLIABILITIES is the ratio of FX assets to FX liabilities, which proxies FX open position[16] and signifies the effect of currency mismatch.[17]

9 Bank-level data are compiled using the quarterly balance sheets of deposit banks, which are available at www.tbb.org.tr. The macroeconomic data are obtained from the electronic data dissemination system of the CBRT at http://evds.tcmb.gov.tr/.

10 The analysis is based on deposit banks, while deposit banks that were taken over by SDIF or founded during the analyzed period are excluded. Deposit banks with a status change are also ignored.

11 The ownership decision is based on the categorization by Banks Association of Turkey. The analysis excludes foreign banks having branches in Turkey and only includes foreign banks founded in Turkey.

12 Financial ratios are in compliance with the CAMELS system, which evaluates banks according to their capital adequacy, asset quality, management quality, earnings, liquidity and sensitivity.

13 The expected impacts of these independent variables on the Turkish banking sector structure are discussed extensively in Ganioğlu and Us (2014).

14 King and Plosser (1984), Bernanke and Gertler (1989), Kiyotaki and Moore (1997) and Bernanke et al. (1998) analyze the link between loan quality and financial activity.

15 Demirgüç-Kunt and Huizinga (1999) show a negative relation between overhead costs and performance.

16 Kaplan (2002) offers an excellent survey on risks associated with FX open position by providing various definitions for FX open positions, which are individually monitored by regulatory authorities.

17 Ranciere et al. (2010) discuss that currency mismatch exposes an emerging economy to systemic risk through balance sheet vulnerabilities. More specifically, in case FX borrowers cannot hedge against exchange rate risk, an abrupt devaluation results in a large share of FX loans to be non-paid and the number of overdue loans to increase substantially. This can have a dramatic effect on the capital adequacy and raise systemic risk issues for the economy.

ASSETS/GDP is the ratio of total assets to GDP, which denotes bank size.[18,19] DBIST is the dummy variable for whether a bank is listed at the Borsa Istanbul.[20,21] D1800s, DEARLY1900s, D1980s and D1990s are the dummy variables for bank age, which represent banks founded in 1800s, early 1900s (between 1924 and 1953), 1980s (between 1977 and 1987) and 1990s, respectively.[22,23]

Definitions for macroeconomic and policy-related determinants are as follows: GDP indicates the year-on-year growth rate of the real GDP in logs.[24] INFLATION is the year-on-year change in the consumer price index in logs.[25] EXCHANGE is the quarter-on-quarter change in the USD/TL exchange rate in logs.[26] POLICYRATE is the CBRT policy rate.[27,28] TLRESERVES/ASSETS is the ratio of Turkish lira reserves to total assets and FXRESERVES/ASSETS is the ratio of FX reserves to total assets.[29,30]

18 Dietrich and Wanzenried (2011) and Alper et al. (2001a) measure bank size by categorizing banks according to their asset size. However, as in Ganioğlu and Us (2014), this paper measures bank size using total assets to GDP ratio in order to truly represent some banks that increased in size due to intensive mergers and acquisitions that took place during the analyzed period.

19 Smirlock (1985) finds strong evidence that bank size is positively related to profitability, while Lin and Zhang (2009), Stiroh and Rumble (2006) and Pasiouras and Kosmidou (2007) show that extremely large banks might display a negative relationship between their size and profitability.

20 The number of currently listed commercial banks at the Borsa Istanbul is 12, where 9 of these banks are listed at the stock exchange over the entire analyzed period, while the initial public offerings of the other 3 banks took place in 2004Q3, 2005Q4 and 2007Q2, respectively.

21 Listed banks face greater pressure from shareholders, financial analysts and market participants for profitability. Yet, Dietrich and Wanzenried (2011) discuss that listed banks are also subject to higher costs due to reporting requirements, which reduce profitability.

22 Dietrich and Wanzenried (2011) state that older banks are expected to be more profitable due to their longer period of service.

23 D1800s is selected as the reference dummy variable for bank age given that the number of banks founded in 1800s is the lowest in this category. Hence, the coefficients of the dummy variables for bank age should be interpreted relative to the oldest bank. Due to multicollinearity problem with the DBIST term, the regression equations for state banks do not include bank age. Likewise, the regression equations exclude D1990s for private banks and D1980s for foreign banks.

24 Demirgüç-Kunt and Huizinga (1999), Bikker and Hu (2002) and Athanasoglou et al. (2008) report a positive link between growth and profitability.

25 Hanson and Rocha (1986) and Demirgüç-Kunt and Huizinga (1999) observe that higher inflation is associated with higher interest margins and profitability.

26 Demirgüç-Kunt and Detragiache (1998), Choi et al. (1992) and Chamberlain et al. (1997) find strong negative correlation between profitability and exchange rate.

27 Kashyap and Stein (1995), Bernanke and Blinder (1988) and Mishkin (1996) assert that policy rate influences banking sector via lending channel.

28 As part of the normalization process during the exit from the global crisis, the CBRT has implemented a technical adjustment in policy rates starting from May 2010. As discussed in Başçı and Kara (2011), Küçüksaraç and Özel (2012), Kara (2013) and Alper et al. (2013), the CBRT has adopted a new monetary policy mix as of end-2010 that included additional policy tools for pursuing multiple objectives. Accordingly, an interest rate corridor was set for overnight borrowing and lending rates and 1-week repo rate was announced as the policy rate. Moreover, the CBRT conducted an active liquidity management policy, which adjusted market rates without changing the policy rate. In fact, as also stated in CBRT (2012) and Akçelik et al. (2012), the CBRT has delivered an additional monetary tightening as of end-2011 without resorting to a change in the policy rate. The additional monetary tightening was implemented occasionally starting from end-2011 and ended in January 2014 (CBRT, 2014). Hence, in order to account for the additional monetary tightening, the policy rate is substituted by the 1-week repo rate from 2010Q2 to 2011Q4 and replaced by the average funding rate from 2012Q1 and onwards.

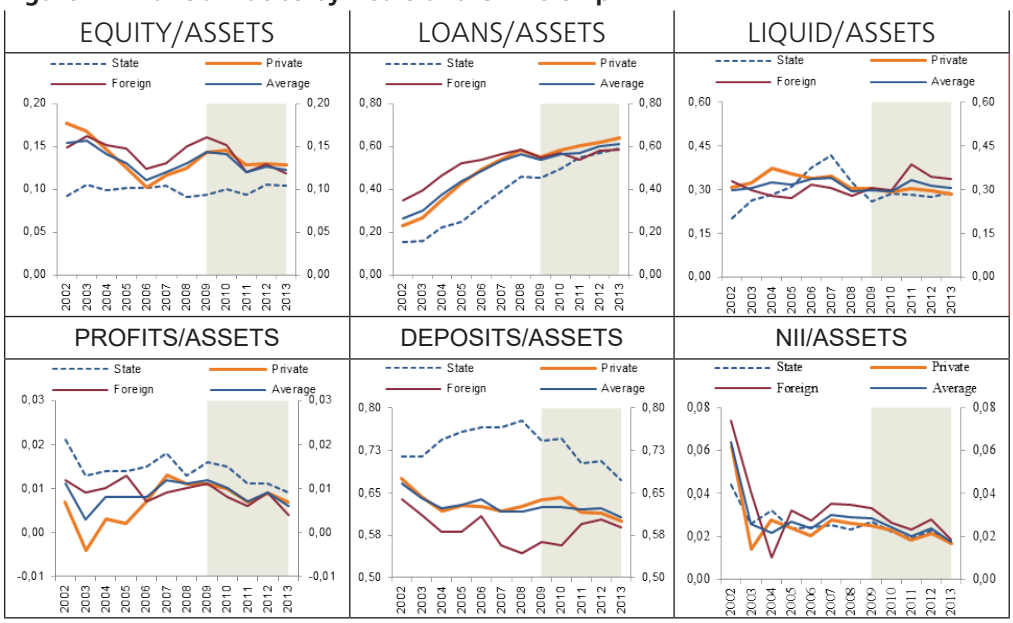
29 Demirgüç-Kunt and Huizinga (1999) state that reserve requirements are an implicit tax on banks if official reserves are remunerated at less than market rates. Rose and Rose (1979) and Gilbert and Rasche (1980) also find that reserve requirements reduce bank profitability.

30 Due to absence of bank-level data, required reserves are approximated by data on cash and balances with the CBRT, which shows the combined effect of required reserves held at the CBRT plus desired reserves held due to unexpected events. It is assumed that cash and balances are not persistently in excess of required reserves, which was historically witnessed in former Soviet states and transitional countries or during wartime as discussed in Gray (2006) and Ganley (2002).

3.2. Stylized Facts

Figure 1 plots the mean values of dependent variables by ownership across time. This enables to view the asymmetric response of banks to the global crisis. The graphical presentation also includes the banking sector's average in order to compare each ownership category with the overall banking sector.

Figure 1. Financial Ratios by Years and Ownership



Notes: Shaded region denotes the post-crisis period.

Accordingly, it can be seen that state banks diverge notably from other banks, while private banks closely reflect the characteristics of the overall banking sector. Meanwhile, foreign banks are also observed to have some unique features, which distinguish them from other banks. Moreover, the global crisis seems to have strong effects on the banking sector structure, which are perceived to be different across ownership categories. More specific facts can be highlighted as follows:

Capital adequacy differs notably by ownership. More specifically, private and foreign banks are relatively prudent, whereas state banks maintain a stable level of regulatory capital merely above the Basel II standards.[31] The capital adequacy of private banks is near and that of foreign banks is slightly above the banking sector's average. On the other hand, the capital adequacy of state banks is remarkably below the average. Despite posting a decline, private and foreign banks continue to

31 According to Basel II, capital adequacy (also known as capital requirement or regulatory capital, which should be held as required by the financial regulator) must be no lower than 8 percent. However, the BRSA sets the target capital adequacy ratio to be minimum 12 percent (BRSA, 2010).

have a higher regulatory capital than state banks after the global crisis, while state banks experience a minor rise.

Asset quality also varies remarkably by ownership. In particular, before the global crisis, foreign banks lead the asset quality, while private banks are close to the banking sector's average. On the other hand, state banks notably lag behind other banks. However, after the global crisis, state banks raise their asset quality and catch up foreign banks, while private banks take the lead. Yet, all banks devote higher percentage of their assets to loans across time.

Profitability changes dramatically by ownership as well. Particularly, state banks are more profitable, while private banks register even negative values before the crisis. After a significant slump at the onset, all banks experience a rebound. This is followed by state and foreign banks' maintaining a stable profitability level, while private banks increase their returns. However, after the global crisis, all banks experience a notable fall. Consequently, private and foreign banks become fairly comparable by nearing the sector's average, while state banks continue to lead profitability.

Balance sheet structure also differs significantly by ownership. More specifically, state banks have a considerably higher, but foreign banks have a lower ratio of deposits to total assets than the overall banking sector. In the meantime, private banks are close to the average. Before the global crisis, state banks experience a rise, while other banks witness a fall. However, after the global crisis, both state and private banks see a sharp decline; whereas foreign banks observe a surge, which enables them to near private banks and the banking sector's average.

On the other hand, liquidity varies slightly by ownership. In general, all banks are relatively stable in terms of their liquidity except for state banks, which have a gradually increasing ratio of liquid assets to total assets in the beginning of the analyzed period. After the global crisis, the liquidity remains virtually unchanged except for foreign banks, which experience a rise. Accordingly, in the post-crisis period, foreign banks are more liquid in relative terms.

Besides liquidity, the income-expenditure structure is also similar across ownership categories. More specifically, foreign banks have a merely higher net interest margin than other banks. Having experienced a dramatic fall in the beginning of the analysis, all banks see a mild recovery in their net interest income to total assets. The global crisis instigates another decline in the net interest margin, which is experienced almost equally by all ownership categories.

3.3. Econometric Methodology

In order to test whether the changing structure of the Turkish banking sector in the aftermath of the global crisis is asymmetric with respect to ownership, a general regression is estimated by the following specification:

$$Y_{it}=\alpha+\beta_1\ Bank_{it}+\beta_2\ \ Macro_t+U_i+\varepsilon_{it}$$

Where Y_{it} is the dependent variable of bank i at time t; $Bank_{it}$ is the matrix of bank-specific variables for bank i at time t; $Macro_t$ is the matrix of macroeconomic and policy-related variables at time t; α is the intercept term; and β_1 and β_2 are the corresponding coefficient vectors. U_i is the unobserved bank-specific effect and ε_{it} is the idiosyncratic error term, both following i.i.d. processes with mean 0 and variances σ_u and σ_ε, respectively. The subscripts i and t range from 1 to N and 1 to T, correspondingly, where N is the number of banks and T is the number of periods in the dataset.

The above model is estimated using panel data estimation techniques. Accordingly, Hsiao (2003) argues that ordinary least squares estimators may be inconsistent and/or meaningless if heterogeneity exists across firms. Meanwhile, De Haas and van Lelyveld (2006) also discuss that treating banks as homogeneous entities is a too strong restriction. Conversely, the fixed effects and random effects models take into account the heterogeneity across firms by allowing variable intercepts. Hence, the above models are estimated using fixed effects[32] and random effects model[33,34,] where model selection is based on the corresponding Hausman specification test.[35] Estimation results are reported for the selected model.

4. Empirical Results

Tables 1-3 present the estimation results. Accordingly, in each column, the determinants of capital adequacy, asset quality, liquidity, profitability, balance sheet and income-expenditure structure are reported by ownership for the overall period and also for the pre-crisis and the post-crisis periods, which cover 2002Q4-2008Q3 and 2008Q4-2013Q3, respectively. The fixed effects model estimations omit the time-

32 The fixed effects model eliminates the unobserved bank-specific effect in the above equation.
33 The analysis may alternatively be performed using generalized method of moments (GMM). Yet, Wooldridge (2001) and Ahn et al. (2001) discuss that GMM may result in a finite sample bias in small samples.
34 In the random effects model, the individual effects are treated as random unobservable variables, which are uncorrelated with all of the regressors. As stated by Balestra and Nerlove (1966), the coefficients can be consistently and efficiently estimated by GLS under this assumption. In contrast, when the equation constant is treated as a nuisance parameter, the regression equation reduces to the fixed effects model. A simple treatment of the fixed effects model is to remove the effects by the (within) transformation of the model to deviations from individual means.
35 Hausman test (Hausman, 1978) is used to test the validity of the null hypothesis that the random effects model is preferred due to higher efficiency versus the alternative hypothesis that the fixed effects model is consistent, despite being less efficient.

invariant dummy variables due to multicollinearity. Key findings are summarized as follows:

4.1. Capital Adequacy

Both state and private banks are affected positively by overdue loans to total loans and receivables with regard to their capital adequacy. The effect is significant in both periods as well as over the entire period of analysis. This finding on the positive link between capital adequacy and the ratio of overdue loans to total loans and receivables may be due to compliance with the regulatory standards for well-capitalization of banks. This necessitates higher capital adequacy for higher overdue loans to total loans and receivables.

Private and foreign banks are influenced positively by overhead costs with respect to their capital requirement in the overall analysis and also in the pre-crisis period. However, the effect of overhead costs is significant only for private banks in the post-crisis period. The positive link between capital adequacy and the operating efficiency may also be owed to the impact of regulatory capital standards.

Capital adequacy of state banks is affected favorably by the ratio of FX assets to FX liabilities in both sub-periods and in the overall analysis. The ratio is also positively significant for private banks in the entire period and before the crisis, while foreign banks are influenced favorably by this ratio in the whole period. The significance of the ratio can be owed to the fact that a lower FX open position indicates a relatively lower risk of currency mismatch, which feeds into higher capital adequacy for banks. On the other hand, the ratio is ineffective for private and foreign banks after the global crisis and also insignificant for foreign banks in the pre-crisis period.

Bank size has an impact on the capital adequacy of both state and foreign banks before the global crisis and also throughout the analyzed period; while only private and foreign banks are affected by bank size after the crisis. The effect is negative for foreign banks, implying that smaller banks in this ownership category are induced to have higher capital adequacy. As for state banks, the effect is also negative in the overall period but positive before the crisis, whereas for private banks, the impact is positive.

Table 1. Estimation Results for the Overall Period

		EQUITY/ ASSETS	LOANS/ ASSETS	LIQUID/ ASSETS	PROFITS/ ASSETS	DEPOSITS/ ASSETS	NII/ ASSETS
	State	0.0821*** (0.012)	-0.5657*** (0.053)	-0.4510*** (0.076)	0.0006 (0.005)	-0.2376*** (0.035)	0.0136 (0.009)
ODL/LOANS	Private	0.4791*** (0.078)	-0.8354*** (0.140)	0.2002 (0.171)	-0.0374* (0.020)	-0.3739*** (0.120)	-0.0326 (0.024)
	Foreign	-0.0031 (0.054)	-0.8623*** (0.099)	-0.1233 (0.097)	-0.0148* (0.009)	-0.3843*** (0.109)	-0.0220 (0.036)
	State	-0.2410 (0.163)	0.3123 (0.707)	-0.4761 (0.903)	0.7917*** (0.057)	0.1488 (0.413)	1.2728*** (0.107)
OTHEREXP/ ASSETS	Private	1.3663*** (0.108)	-0.8122*** (0.195)	-0.5610** (0.239)	-0.5102*** (0.028)	-1.1171*** (0.166)	0.3688*** (0.033)
	Foreign	0.3000*** (0.075)	-0.3742*** (0.142)	0.0347 (0.137)	0.0803*** (0.012)	-0.1492 (0.155)	0.2383*** (0.051)
	State	0.0320*** (0.012)	0.3154*** (0.054)	-0.0876 (0.080)	0.0181*** (0.005)	-0.1116*** (0.037)	0.0402*** (0.010)
FXASSETS/ FXLIABILITIES	Private	0.0621*** (0.017)	-0.2314*** (0.027)	0.1803*** (0.032)	0.0035 (0.004)	-0.1161*** (0.027)	0.0070 (0.005)
	Foreign	0.0490*** (0.018)	-0.3566** (0.036)	0.1944*** (0.035)	0.0051* (0.003)	0.2014*** (0.040)	-0.0350*** (0.012)
	State	-0.0764** (0.038)	0.5993*** (0.166)	-0.3768* (0.211)	-0.0195 (0.013)	-0.0293 (0.096)	-0.0372 (0.025)
ASSETS/GDP	Private	0.0168 (0.056)	-0.2102*** (0.055)	0.2272*** (0.067)	-0.0187*** (0.008)	-0.3209*** (0.086)	-0.0193 (0.017)
	Foreign	-0.4286*** (0.105)	-0.4689* (0.280)	0.4254 (0.271)	-0.0119 (0.017)	-0.8393*** (0.307)	-0.1466** (0.071)
	State	-0.0099 (0.009)	0.2801*** (0.039)	-	-	-	-
DBIST	Private	-	0.1462*** (0.015)	-0.1419*** (0.018)	0.0040* (0.002)	-	-
	Foreign	-0.0210** (0.008)	-	-	0.0040*** (0.001)	-	0.0084 (0.006)
	State	-	-	-	-	-	-
DEARLY1900s	Private	-	-0.0397* (0.021)	0.0855*** (0.025)	0.0026 (0.003)	-	-
	Foreign	-0.0555*** (0.013)	-	-	-0.0076*** (0.002)	-	-0.0015 (0.009)

	State	-	-	-	-	-	-
D1980s	Private	-	-0.0613*** (0.014)	0.1823*** (0.017)	-0.0104*** (0.002)	-	-
	Foreign	-	-	-	-	-	-
	State	-	-	-	-	-	-
D1990s	Private	-	-	-	-	-	-
	Foreign	-0.0091 (0.006)	-	-	-0.0026*** (0.001)	-	-0.0061 (0.004)
	State	0.0053 (0.023)	-0.1699* (0.102)	0.2063 (0.130)	-0.0172** (0.008)	-0.0148 (0.060)	-0.0117 (0.015)
GDP	Private	-0.0777 (0.052)	-0.2072** (0.098)	0.0213 (0.120)	-0.0167 (0.014)	0.0594 (0.080)	-0.0007 (0.016)
	Foreign	-0.1055** (0.051)	-0.0369 (0.087)	-0.0813 (0.084)	-0.0078 (0.008)	0.0705 (0.096)	-0.0702** (0.034)
	State	-0.0765 (0.065)	1.2463*** (0.284)	-0.2539 (0.360)	-0.0290 (0.023)	-0.0418 (0.165)	-0.0686 (0.042)
INFLATION	Private	0.0310 (0.125)	1.5694*** (0.231)	-1.4015*** (0.283)	0.0299 (0.033)	0.6610*** (0.193)	0.0159 (0.038)
	Foreign	-0.1145 (0.125)	0.4969** (0.217)	0.2414 (0.210)	-0.0124 (0.020)	0.6602*** (0.238)	0.1525* (0.085)
	State	-0.0559*** (0.019)	-0.0409 (0.081)	-0.2187** (0.102)	-0.0148** (0.007)	-0.0169 (0.047)	-0.0075 (0.012)
EXCHANGE	Private	-0.1099*** (0.041)	0.0134 (0.080)	-0.0289 (0.097)	-0.0088 (0.011)	0.0296 (0.064)	0.0113 (0.013)
	Foreign	-0.0704* (0.042)	-0.0185 (0.071)	0.0363 (0.069)	-0.0173*** (0.007)	0.0455 (0.078)	-0.0103 (0.028)
	State	-0.1568*** (0.055)	-0.6850*** (0.238)	0.7762** (0.303)	0.0073 (0.019)	0.3439** (0.139)	-0.0619* (0.036)
POLICYRATE	Private	-0.1426* (0.074)	-1.7529*** (0.132)	1.0061*** (0.161)	-0.0018 (0.019)	-0.2274** (0.115)	-0.0335 (0.023)
	Foreign	-0.0359 (0.074)	-0.6574*** (0.136)	0.0293 (0.131)	-0.0139 (0.012)	-0.2956** (0.149)	-0.0266 (0.050)
	State	-0.1992** (0.086)	-2.1762*** (0.375)	-0.5471 (0.474)	0.0417 (0.030)	0.7866*** (0.217)	0.0387 (0.056)
TLRESERVES/ ASSETS	Private	-0.0765 (0.185)	-0.0280 (0.354)	0.0590 (0.433)	-0.0049 (0.050)	0.1584 (0.285)	0.0844 (0.057)
	Foreign	-0.6689*** (0.173)	0.4151 (0.322)	-0.5850* (0.311)	0.0529* (0.027)	0.0642 (0.353)	-0.2328** (0.117)

	State	0.3208** (0.140)	0.1372 (0.610)	-1.4017* (0.772)	-0.1606*** (0.049)	-0.1280 (0.353)	0.1571 (0.091)
FXRESERVES/ ASSETS	Private	0.1827 (0.132)	1.0376*** (0.235)	-1.4398*** (0.287)	0.0093 (0.033)	0.4315** (0.203)	0.0504 (0.040)
	Foreign	0.4938*** (0.109)	0.8165*** (0.202)	-1.4237*** (0.195)	0.0401** (0.017)	-0.2742 (0.221)	-0.0421 (0.074)
	State	0.1196*** (0.021)	-0.1567* (0.092)	0.4974*** (0.102)	-0.0032 (0.007)	0.8112*** (0.047)	-0.0110 (0.012)
CONSTANT	Private	0.0432** (0.018)	0.7918*** (0.027)	0.1927*** (0.033)	0.0188*** (0.004)	0.7532*** (0.028)	0.0120*** (0.006)
	Foreign	0.1446*** (0.017)	0.8849*** (0.032)	0.2023*** (0.030)	0.0053** (0.003)	0.4818*** (0.035)	0.0543*** (0.012)
	State	132	132	132	132	132	132
No of Obs.	Private	440	440	440	440	440	440
	Foreign	352	352	352	352	352	352
	State	137.46	1269.78	-	-	-	-
Wald chi2	Private	-	1004.00	402.48	530.65	-	-
	Foreign	226.82	-	-	77.76	-	52.00
	State	0.000	0.000	-	-	-	-
Prob>chi2	Private	-	0.000	0.000	0.000	-	-
	Foreign	0.000	-	-	0.000	-	0.000
	State	-	-	10.23	26.20	15.46	22.18
F-stat	Private	29.74	-	-	-	11.97	14.27
	Foreign	-	36.03	11.95	-	6.83	-
	State	-	-	0.000	0.000	0.000	0.000
Prob>F	Private	0.000	-	-	-	0.000	0.000
	Foreign	-	0.000	0.000	-	0.000	-
	State	0.11(1) (1.000)	0.53(1) (1.000)	615.05(2) (0.000)	102.01(2) (0.000)	149.48(2) (0.000)	53.61(2) (0.000)
Hausman Test	Private	164.46(2) (0.000)	-1797.53(3) chi2<0	-260.66(3) chi2<0	15.77(1) (0.106)	45.75(2) (0.000)	31.25(2) (0.000)
	Foreign	-394.97(3) chi2<0	98.14(2) (0.000)	466.71(2) (0.000)	-67.38(3) chi2<0	271.27(2) (0.000)	4.83(1) (0.903)

*significant at p<0.1;** significant at p<0.05;*** significant at p<0.01.
(1) random effects; (2) fixed effects; (3) model fitted on these data fails to meet the asymptotic assumptions of the Hausman test.
Standard errors are in parenthesis.

Table 2. Estimation Results for the Pre-Crisis Period

		EQUITY/ ASSETS	LOANS/ ASSETS	LIQUID/ ASSETS	PROFITS/ ASSETS	DEPOSITS/ ASSETS	NII/ ASSETS
	State	0.0875*** (0.014)	-0.5888*** (0.057)	-0.1706 (0.136)	0.0244*** (0.006)	-0.0412* (0.023)	0.0442*** (0.012)
ODL/LOANS	Private	0.3302*** (0.103)	-0.6011*** (0.135)	0.0456 (0.123)	-0.0033 (0.028)	-0.6315*** (0.132)	-0.0220 (0.035)
	Foreign	0.0562 (0.071)	-0.7862*** (0.101)	-0.3682*** (0.112)	-0.0044 (0.014)	-0.1600 (0.101)	0.0030 (0.058)
	State	0.0015 (0.229)	0.9954 (0.953)	0.6865 (1.392)	0.7956*** (0.094)	0.0360 (0.389)	1.1947*** (0.197)
OTHEREXP/ ASSETS	Private	1.0320*** (0.148)	-0.7117*** (0.179)	0.1876 (0.177)	-0.4510*** (0.040)	-0.9700*** (0.176)	0.3195*** (0.051)
	Foreign	0.2758*** (0.087)	-0.2941** (0.124)	0.3566*** (0.122)	0.0836*** (0.016)	-0.1377 (0.110)	0.1275** (0.072)
	State	0.0337** (0.016)	0.2947*** (0.065)	-0.2760* (0.153)	-0.0043 (0.006)	-0.2918*** (0.026)	0.0052 (0.013)
FXASSETS/ FXLIABILITIES	Private	0.2788*** (0.037)	-0.2408*** (0.033)	0.0050 (0.044)	-0.0349*** (0.010)	-0.2701*** (0.033)	0.0185 (0.013)
	Foreign	0.0455 0.035)	-0.4286*** (0.050)	0.1898*** (0.055)	-0.0049 (0.007)	0.0514 (0.050)	-0.0423 (0.029)
	State	0.1553** (0.077)	1.1674*** (0.321)	0.1244 (0.468)	-0.0086 (0.032)	-0.2160* (0.131)	0.0206 (0.066)
ASSETS/GDP	Private	-0.1442 (0.132)	-0.1048 (0.077)	0.1216 (0.158)	0.0396 (0.036)	-0.4952*** (0.076)	0.0067 (0.045)
	Foreign	-0.8097*** (0.207)	3.3583*** (0.297)	1.8995*** (0.537)	-0.1033 (0.069)	-1.2001** (0.484)	-0.0535 (0.170)
	State	0.0358** (0.016)	0.4248*** (0.068)	-	-0.0069 (0.007)	-0.1468*** (0.028)	-0.0113 (0.014)
DBIST	Private	-	0.1927*** (0.017)	-	-	-0.1248*** (0.017)	-
	Foreign	-0.0272** (0.012)	-0.1040*** (0.018)	-	-	-	-0.0006 (0.010)
	State	-	-	-	-	-	-
DEARLY1900s	Private	-	-0.0730*** (0.025)	-	-	0.2855*** (0.024)	-
	Foreign	-0.0512*** (0.018)	0.0995*** (0.025)	-	-	-	0.0115 (0.014)
	State	-	-	-	-	-	-

D1980s	Private	-	-0.0862*** (0.016)	-	-	-0.0134 (0.016)	-
	Foreign	-	-	-	-	-	-
	State	-	-	-	-	-	-
D1990s	Private	-	-	-	-	-	-
	Foreign	0.0080 (0.010)	0.1321*** (0.015)	-	-	-	-0.0059 (0.008)
	State	0.0372 (0.079)	-1.1910*** (0.331)	-0.6810 (0.500)	-0.0839*** (0.033)	-0.2828** (0.135)	-0.0559 (0.068)
GDP	Private	-0.5154*** (0.186)	-0.9342*** (0.269)	0.2926 (0.223)	0.0652 (0.050)	0.4875** (0.264)	0.1250* (0.064)
	Foreign	-0.2820 (0.175)	0.4121 (0.251)	0.0849 (0.229)	-0.0140 (0.029)	0.5391*** (0.206)	0.0522 (0.144)
	State	-0.0561 (0.097)	0.7139* (0.402)	-0.6068 (0.622)	-0.0688* (0.040)	-0.1090 (0.164)	-0.1167 (0.083)
INFLATION	Private	-0.3249 (0.212)	1.3134*** (0.311)	-0.8804*** (0.254)	0.0574 (0.057)	0.7196** (0.305)	0.0575 (0.073)
	Foreign	-0.1442 (0.201)	0.0880 (0.288)	0.2242 (0.254)	0.0467 (0.032)	0.7592*** (0.229)	0.3382** (0.165)
	State	-0.1148*** (0.035)	0.0347 (0.145)	0.0561 (0.215)	0.0027 (0.014)	0.0983* (0.059)	0.0026 (0.030)
EXCHANGE	Private	-0.1062 (0.081)	0.0176 (0.120)	-0.0222 (0.097)	-0.0383* (0.022)	0.0045 (0.117)	-0.0164 (0.028)
	Foreign	-0.0216 (0.076)	-0.0829 (0.109)	-0.0171 (0.096)	-0.0108 (0.012)	0.0410 (0.087)	-0.0741 (0.063)
	State	-0.2264*** (0.080)	-0.2840 (0.334)	0.9515* (0.492)	0.0263 (0.033)	0.2393* (0.136)	-0.0621 (0.069)
POLICYRATE	Private	0.0741 (0.152)	-1.7278** (0.221)	0.4327** (0.182)	-0.0384 (0.041)	-0.0159 (0.217)	-0.0904* (0.052)
	Foreign	-0.0679 (0.137)	-0.2211 (0.197)	0.1758 (0.183)	-0.0548** (0.023)	-0.4040** (0.165)	-0.1205 (0.113)
	State	-0.2208** (0.109)	-0.7533* (0.453)	-0.8460 (0.665)	-0.0163 (0.045)	0.1027 (0.185)	0.0126 (0.093)
TLRESERVES/ ASSETS	Private	0.1034 (0.245)	0.4098 (0.359)	-0.2826 (0.293)	0.0158 (0.066)	0.3188 (0.353)	0.0955 (0.084)
	Foreign	-0.3958* (0.222)	0.5953* (0.317)	-0.2883 (0.292)	0.0752** (0.037)	-0.0814 (0.263)	-0.3550* (0.182)
	State	0.4116** (0.194)	0.7921 (0.810)	-3.4481*** (1.261)	-0.3127*** (0.080)	-1.1255*** (0.330)	0.0908 (0.167)

FXRESERVES/ ASSETS	Private	0.4938* (0.296)	1.7373*** (0.394)	-0.4122 (0.354)	0.1226 (0.080)	-0.3065 (0.387)	0.2216** (0.102)
	Foreign	0.7205*** (0.201)	0.7896*** (0.288)	-1.1159*** (0.317)	0.0331 (0.041)	0.2048 (0.286)	-0.2260 0.166)
	State	0.0357 (0.034)	-0.4062*** (0.140)	0.6384*** (0.194)	0.0278** (0.014)	1.1954*** (0.057)	0.0230 (0.029)
CONSTANT	Private	-0.0936*** (0.034)	0.7895*** (0.037)	0.3311*** (0.041)	0.0327*** (0.009)	0.7987*** (0.036)	-0.0093 (0.012)
	Foreign	0.1526*** (0.031)	0.6919*** (0.044)	0.0885 (0.054)	0.0171** (0.007)	0.5543*** (0.049)	0.0663*** (0.025)
	State	72	72	72	72	72	72
No of Obs.	Private	240	240	240	240	240	240
	Foreign	192	192	192	192	192	192
	State	122.05	421.24	-	112.21	410.10	79.82
Wald chi2	Private	287.84	834.42	-	-	239.87	-
	Foreign	169.02	759.98	-	-	-	23.96
	State	0.000	0.000	-	0.000	0.000	0.000
Prob>chi2	Private	-	0.000	-	-	0.000	-
	Foreign	0.000	0.000	-	-	-	0.021
	State	-	-	5.71	-	-	-
F-stat	Private	26.86	-	3.07	25.05	-	7.34
	Foreign	-	-	5.40	4.99	4.82	-
	State	-	-	0.000	-	-	-
Prob>F	Private	0.000	-	0.000	0.000	-	0.000
	Foreign	-	-	0.000	0.000	0.000	-
	State	9.50(1) (0.485)	0.43(1) (1.000)	41.35(2) (0.000)	8.64(1) (0.567)	9.09(1) (0.524)	17.25(1) (0.069)
Hausman Test	Private	21.11(2) (0.020)	-3612.43(3) chi2<0	83.03(2) (0.000)	20.67(2) (0.024)	19.40(1) (0.035)	66.21(2) (0.000)
	Foreign	-14.56(3) chi2<0	-221.63(3) chi2<0	33.33(2) (0.000)	29.30(2) (0.001)	318.33(2) (0.000)	1.46(1) 0.9991

*significant at p<0.1;** significant at p<0.05;*** significant at p<0.01.
(1) random effects; (2) fixed effects; (3) model fitted on these data fails to meet the asymptotic assumptions of the Hausman test.
Standard errors are in parenthesis.

Table 3. Estimation Results for the Post-Crisis Period

		EQUITY/ ASSETS	LOANS/ ASSETS	LIQUID/ ASSETS	PROFITS/ ASSETS	DEPOSITS/ ASSETS	NII/ ASSETS
	State	0.3114** (0.143)	-3.1136*** (0.564)	1.3346 (0.833)	0.0619 (0.062)	1.5778** (0.624)	0.0774 (0.080)
ODL/LOANS	Private	0.6376*** (0.155)	-4.4105*** (0.531)	3.1669*** (0.621)	0.0250 (0.032)	1.1597*** (0.337)	0.0480 (0.041)
	Foreign	0.0528 (0.131)	-2.2646*** (0.326)	-0.5016* (0.296)	-0.0088 (0.019)	0.4873 (0.358)	-0.1144*** (0.029)
	State	0.1011 (0.214)	-0.8404 (0.699)	1.0326 (1.033)	0.9771*** (0.077)	1.6930** (0.773)	1.7460*** (0.099)
OTHEREXP/ ASSETS	Private	0.3474* (0.194)	-0.1647 (0.663)	0.0668 (0.777)	0.2977*** (0.040)	0.8650** (0.356)	0.8924*** (0.044)
	Foreign	0.1136 (0.186)	0.0959 (0.404)	-1.2628*** (0.422)	0.0850*** (0.027)	2.2438*** (0.509)	0.9401*** (0.041)
	State	0.0568** (0.025)	-0.0546 (0.098)	-0.0866 (0.144)	0.0205* (0.011)	-0.0151 (0.108)	0.0095 (0.014)
FXASSETS/ FXLIABILITIES	Private	0.0119 (0.011)	-0.1700*** (0.038)	0.1567*** (0.045)	0.0147*** (0.002)	-0.0283 (0.023)	0.0069** (0.003)
	Foreign	0.0241 (0.027)	-0.1748*** (0.064)	0.3269*** (0.061)	0.0087* (0.004)	-0.2380*** (0.074)	-0.0089 (0.006)
	State	0.0001 (0.051)	-0.5762*** (0.180)	0.3301 (0.267)	0.0144 (0.020)	0.8641*** (0.199)	0.0024 (0.025)
ASSETS/GDP	Private	0.0513** (0.027)	-0.3011*** (0.092)	0.2961*** (0.108)	0.0109** (0.005)	-0.3118 (0.227)	-0.0266 (0.028)
	Foreign	-0.5299*** (0.171)	-1.8541*** (0.532)	0.5341 (0.386)	0.0053 (0.025)	0.2192 (0.466)	-0.0247 (0.038)
	State	-0.0010 (0.011)	-	-	-	-	-
DBIST	Private	-0.0194*** (0.007)	0.1896*** (0.025)	-0.1715*** (0.029)	0.0012 (0.001)	-	-
	Foreign	0.0097 (0.0162)	-	-0.0498 (0.037)	0.0027 (0.002)	0.0995** (0.044)	0.0012 (0.004)
	State	-	-	-	-	-	-
DEARLY1900s	Private	-0.0065 (0.010)	-0.0772** (0.034)	0.0820** (0.040)	-0.0052*** (0.002)	-	-
	Foreign	-0.0835*** (0.020)	-	0.0980** (0.045)	-0.0034 (0.003)	0.1234** (0.055)	-0.0131*** (0.004)
	State	-	-	-	-	-	-

D1980s	Private	0.0282*** (0.006)	-0.0178 (0.019)	0.1163*** (0.023)	-0.0118*** (0.001)	-	-
	Foreign	-	-	-	-	-	-
	State	-	-	-	-	-	-
D1990s	Private	-	-	-	-	-	-
	Foreign	-0.0319*** (0.008)	-	0.0567*** (0.017)	-0.0023** (0.001)	0.0703*** (0.021)	-0.0068*** (0.002)
	State	-0.0298 (0.033)	-0.3161*** (0.106)	0.0864 (0.156)	0.0169 (0.012)	0.3234*** (0.117)	-0.0102 (0.015)
GDP	Private	0.0444 (0.052)	0.0597 (0.179)	-0.1596 (0.210)	0.0087 (0.011)	0.0390 (0.098)	-0.0041 (0.012)
	Foreign	0.0765 (0.083)	-0.1445 (0.154)	0.0006 (0.187)	0.0081 (0.012)	-0.5142** (0.226)	-0.0021 (0.018)
	State	0.1578** (0.076)	0.4733* (0.244)	-0.0658 (0.360)	-0.0196 (0.027)	-0.1217 (0.270)	-0.0181 (0.034)
INFLATION	Private	-0.1392 (0.140)	0.9391** (0.478)	-0.5209 (0.559)	-0.0113 (0.028)	0.3440 (0.256)	0.0009 (0.031)
	Foreign	-0.1396 (0.217)	0.9404** (0.392)	-1.0495** (0.490)	-0.0562* (0.032)	0.3556 (0.592)	-0.0372 (0.048)
	State	-0.0153 (0.023)	0.1393*** (0.075)	-0.0283 (0.110)	-0.0213** (0.008)	-0.1735** (0.082)	-0.0169 (0.011)
EXCHANGE	Private	-0.0787** (0.041)	-0.0712 (0.140)	0.1239 (0.164)	-0.0172** (0.008)	0.0087 (0.075)	-0.0040 (0.009)
	Foreign	-0.2023*** (0.064)	-0.1232 (0.117)	0.0922 (0.145)	-0.0324*** (0.009)	0.3808** (0.175)	-0.0071 (0.014)
	State	-0.1604 (0.100)	-1.2896*** (0.322)	-0.1958 (0.474)	0.0310 (0.035)	1.5750*** (0.354)	-0.0181 (0.045)
POLICYRATE	Private	0.1691 (0.166)	-1.2879** (0.569)	0.3235 (0.667)	0.0451 (0.034)	-0.1248 (0.318)	0.0138 (0.039)
	Foreign	0.7332*** (0.263)	-0.7983 (0.485)	0.2203 (0.594)	0.0933** (0.038)	-2.0638*** (0.718)	0.0978* (0.058)
	State	-0.3998** (0.178)	-3.7718*** (0.596)	-1.1939 (0.880)	0.1776*** (0.065)	1.6017** (0.659)	0.1467* (0.084)
TLRESERVES/ ASSETS	Private	-0.2906 (0.262)	2.5813*** (0.896)	-2.4788** (1.050)	0.0184 (0.053)	-0.0338 (0.491)	0.0043 (0.060)
	Foreign	-1.4049*** (0.325)	-1.3558 (0.831)	-1.3316* (0.735)	-0.0257 (0.047)	2.0740** (0.888)	0.0910 (0.071)
	State	-0.0376 (0.226)	0.7069 (0.729)	-0.0345 (1.077)	-0.0358 (0.080)	-0.8687 (0.806)	-0.0565 (0.103)

FXRESERVES/ ASSETS	Private	0.1068 (0.076)	0.5474** (0.261)	-0.6026** (0.306)	0.0402*** (0.016)	0.2991** (0.148)	0.0091 (0.018)
	Foreign	0.5640*** (0.143)	0.9127*** (0.282)	-0.9468*** (0.324)	-0.0014 (0.021)	-1.1939*** (0.391)	0.0467 (0.032)
	State	0.0406 (0.035)	1.0020*** (0.137)	0.2199 (0.203)	-0.0285** (0.015)	0.2367 (0.152)	-0.0100 (0.019)
CONSTANT	Private	0.0918 (0.017)	0.8505*** (0.058)	0.0998 (0.068)	-0.0094*** (0.003)	0.6108*** (0.061)	0.0000 (0.008)
	Foreign	0.1219*** 0.036)	0.8834*** (0.075)	0.2022** (0.081)	-0.0021 (0.005)	0.7260*** (0.098)	0.0125 (0.008)
	State	60	60	60	60	60	60
No of Obs.	Private	200	200	200	200	200	200
	Foreign	160	160	160	160	160	160
	State	99.17	-	-	-	-	-
Wald chi2	Private	103.79	215.42	156.61	272.55	-	-
	Foreign	135.35	-	102.50	51.21	141.14	805.05
	State	0.000	-	-	-	-	-
Prob>chi2	Private	0.000	0.000	0.000	0.000	-	-
	Foreign	0.000	-	0.000	0.000	0.000	0.000
	State	-	25.53	1.97	25.21	8.01	45.25
F-stat	Private	-	-	-	-	4.48	50.63
	Foreign	-	9.23	-	-	-	-
	State	-	0.000	0.059	0.000	0.000	0.000
Prob>F	Private	-	-	-	-	0.000	0.000
	Foreign	-	0.000	-	-	-	-
	State	5.29(1) (0.870)	33.19(2) (0.000)	75.46(2) (0.000)	261.86(2) (0.000)	183.55(2) (0.000)	51.96(2) (0.000)
Hausman Test	Private	-55.99(3) chi2<0	-94.23(3) chi2<0	-55.28(3) chi2<0	-8.253) chi2<0	155.03(2) (0.000)	33.92(2) (0.000)
	Foreign	-59.27(3) chi2<0	136.05(2) (0.000)	-30.38(3) chi2<0	12.98(1) (0.225)	-0.43(3) chi2<0	5.77(1) (0.834)

*significant at p<0.1;** significant at p<0.05;*** significant at p<0.01.
(1) random effects; (2) fixed effects; (3) model fitted on these data fails to meet the asymptotic assumptions of the Hausman test.
Standard errors are in parenthesis.

Bank listing has a positive effect on the regulatory capital of state banks before the crisis; although it has a negative effect on foreign banks in the pre-crisis period and also over the entire analysis. Private banks are affected adversely by bank listing in the post-crisis period. This suggests that listed state banks hold more shareholders' equity in proportion to their assets. On the other hand, listing of private and foreign banks at the stock exchange inversely affects their capital adequacy.

In the meantime, the impact of bank age is viewed to be significant for both private and foreign banks. More specifically, the regulatory capital of private banks founded in 1980s is affected favorably after the global crisis. On the other hand, bank age has a negative effect on the capital adequacy of foreign banks founded during early 1900s in both sub-periods and in the overall analysis, while foreign banks founded in 1990s have lower capital adequacy after the crisis.

Private banks are affected negatively by GDP growth regarding their capital adequacy prior to the global crisis, while capital requirement of foreign banks is influenced adversely by GDP growth over the entire period. This implies a counter-cyclical equity holding behavior for these ownership categories.

As for inflation, the effect is positive for state banks in the post-crisis period. This suggests that state banks' regulatory capital is favorably affected by the post-crisis inflation. On the other hand, estimation results yield no significant coefficient for other ownership categories.

Meanwhile, exchange rate has an adverse effect on the capital adequacy of state banks before the crisis and also in the entire period of analysis. In addition, exchange rate has a negative effect on the regulatory capital of private and foreign banks after the global crisis and throughout the analyzed period as well. This suggests that depreciation of the Turkish lira leads to lower regulatory capital for all ownership categories.

Capital adequacy of state banks is affected adversely by policy rate before the crisis and throughout the overall period of analysis. Policy rate has a negative effect on private banks in the overall period, while foreign banks are affected positively by the policy rate after the crisis.

As for required reserves, the ratio of TL reserves to total assets has a negative effect on state and foreign banks during both sub-periods and over the entire analysis. In the meantime, the impact of FX reserves to total assets is significantly positive for all ownership categories before the crisis, while the ratio has a favorable impact

on only foreign banks after the global crisis. However, state and foreign banks are positively affected by FX reserves to total assets in the whole period.

4.2. Asset Quality

Asset quality of all banks is affected negatively by the ratio of overdue loans to total loans and receivables in both sub-periods and also throughout the overall analysis. Meanwhile, overhead costs reduce the asset quality of private and foreign banks before the crisis as well as over the entire analyzed period.

Moreover, private and foreign banks are negatively affected by the ratio of FX assets to FX liabilities both before and after the global crisis and also during the overall analysis. On the other hand, the asset quality of state banks is also sensitive to this ratio. Yet, the effect is positive and observed only before the crisis and in the overall period. This implies that private and foreign banks are more willing to lend amid a widened FX open position, but state banks are more likely to grant loans if the FX open position narrows.

Both state and foreign banks are affected favorably by bank size with respect to their asset quality before the global crisis. However, after the crisis, bank size has an adverse effect on the asset quality of all ownership categories. In addition, estimation results for the entire analysis yield significantly negative coefficients for private and foreign banks, while state banks are affected positively by bank size during this period.

Private banks are affected positively by bank listing in all sub-periods and also in the overall analysis. State banks are also sensitive to bank listing in the entire analyzed period and before the global crisis. However, bank listing has an adverse impact on the asset quality of foreign banks in the pre-crisis period.

Meanwhile, bank age has a negative effect on private banks both before and after the global crisis and also throughout the analyzed period. However, the asset quality of foreign banks is favorably affected by bank age before the crisis. In particular, asset quality of private banks founded in early 1900s and 1980s is lower in the pre-crisis period and also in the overall analysis, while that of private banks in the former age category is also lower after the global crisis. On the other hand, the asset quality of foreign banks founded in early 1900s is higher compared to other foreign banks prior to the global crisis.

Both state and private banks are affected adversely by GDP growth regarding

their asset quality in the pre-crisis period and also in the overall analysis. However, the effect of GDP growth is only significant for state banks after the global crisis. In the meantime, all ownership categories are influenced positively by inflation after the global crisis and also over the entire period. Yet, the favorable effect of inflation on the asset quality is significant only for state and private banks before the crisis.

Exchange rate has a positive effect on the asset quality of state banks, while it has no impact on other banks. The effect of exchange rate is observed after the crisis. In the meantime, all banks are affected adversely by the policy rate in the overall period, while policy rate is negatively significant for private banks in sub-periods as well. Also, policy rate has a negative effect on state banks in the post-crisis period.

The ratio of TL reserves to total assets has a negative effect on the asset quality of state banks in both sub-periods and also in the overall analysis. The ratio has a positive effect on the asset quality of private banks after the crisis and it has a favorable impact on foreign banks before the crisis. Meanwhile, the ratio of FX reserves to total assets contributes positively to the asset quality of private and foreign banks both before and after the global crisis and also in the entire period of analysis.

4.3. Liquidity

The ratio of overdue loans to total loans and receivables has a negative effect on the liquidity of state banks in the overall analysis; whereas it has a positive effect on private banks after the crisis. The liquidity of foreign banks is affected adversely by this ratio and the effect is observed in both sub-periods. This suggests that higher overdue loans to total loans and receivables disable both state and foreign banks from being more liquid. Conversely, private banks are urged to hold more liquid assets against their increasing share of overdue loans.

The liquidity of private banks is affected negatively by overhead costs in the overall analysis. On the other hand, overhead costs have an impact on foreign banks, which is positive before the crisis and negative after the crisis. Also, private banks are favorably affected by FX assets to FX liabilities ratio after the crisis and over the entire analysis, while the ratio has a positive effect on foreign banks in both sub-periods and in the overall analysis despite its negative impact on state banks before the crisis.

State banks are affected adversely by bank size in the entire analyzed period. On the other hand, bank size has a positive effect on the liquidity of private banks in the post-crisis period and in the overall analysis. This indicates that relatively larger

private banks are more liquid in this period. Meanwhile, foreign banks are affected favorably by bank size before the global crisis.

Bank listing at the stock exchange negatively affects the liquidity of private banks in the overall period of analysis and also after the global crisis. Meanwhile, bank age has a positive impact on the liquidity of private banks after the global crisis and also over the entire analysis. In addition, bank age has a favorable effect on foreign banks as well after the global crisis.

The GDP growth has no impact on liquidity, while inflation has a negative effect on the liquidity of private banks before the global crisis and throughout the analyzed period. In addition, inflation also has a negative effect on the liquidity of foreign banks after the global crisis. This suggests that higher inflation reduces the liquid holdings of non-state banks.

Exchange rate has a negative impact on the liquidity of state banks in the overall period. Meanwhile, private banks are affected positively by the policy rate before the global crisis and over the entire period, indicating that policy rates, which follow a rather downward course prior to the crisis, reduce their liquidity. The liquidity of state banks is also affected positively by the policy rate in the overall analysis and before the crisis.

The ratio of TL reserves to total assets has a negative impact on the liquidity of both private and foreign banks after the global crisis; whereas the ratio is insignificant in the pre-crisis period. On the other hand, the estimation results for the overall analyzed period imply a significantly negative coefficient for foreign banks.

Meanwhile, FX reserves to total assets ratio contributes negatively to the liquidity of all ownership categories in the entire analysis. In addition, the ratio has an adverse effect on state and foreign banks in the pre-crisis period and it is significantly negative for both private and foreign banks after the global crisis.

4.4. Profitability

State banks are affected positively by the ratio of overdue loans to total loans and receivables with respect to their profitability before the global crisis. However, the ratio has a negative effect on private and foreign banks over the analyzed period. Meanwhile, all banks are affected significantly by their overhead costs in both sub-periods and also during the entire analysis, but the sign of the coefficient is negative for private banks before the global crisis and throughout the overall period,

while it is positive otherwise.

The ratio of FX assets to FX liabilities has a significantly positive impact on all banks after the crisis. This implies that a lower currency mismatch due to narrowing FX open position increases the profitability of all ownership categories. The estimation results suggest a positive coefficient for both state and foreign banks for the overall period, but a negative coefficient for private banks before the crisis.

Private banks are affected negatively by bank size in the overall analysis, but positively after the crisis. Bank listing has a positive effect on private and foreign banks in the entire period. Meanwhile, these ownership categories are adversely affected by bank age in the whole period and after the crisis.

The impact of GDP growth on the profitability is observed to be negatively significant for state banks before the global crisis and in the overall analysis. As for inflation, it has an adverse effect on state banks before the crisis, while it has a negative impact on foreign banks after the crisis.

Exchange rate appears to have a negative effect on the profitability of all ownership categories after the global crisis, while it has an adverse impact on state and foreign banks in the overall analyzed period, implying that depreciation of the TL reduces the profitability of all banks in the post-crisis period. Meanwhile, private banks are affected negatively by exchange rate before the global crisis.

Foreign banks are influenced inversely by the policy rate before the crisis; but the effect is positively significant after the crisis. This implies that relatively tighter monetary policy in the post-crisis period increases the profitability of foreign banks and declining policy rates in the pre-crisis period also lead to higher return for foreign banks.

TL required reserves favorably affect foreign banks before the crisis and in the overall analysis, while state banks are positively affected by TL reserves to total assets after the crisis. FX reserves to total assets ratio has a positive impact on foreign banks in the overall period, while it has an adverse effect on state banks prior to the crisis and also in the entire analysis. Meanwhile, private banks are affected positively by FX required reserves after the crisis.

4.5. Balance Sheet Structure

The ratio of overdue loans to total loans and receivables has a negative effect on the balance sheet structure of all ownership categories in the overall analysis, while

the ratio is significant for only state and private banks before and after the crisis. However, the sign of the coefficient is positive in the post-crisis period.

Meanwhile, overhead costs have a negative effect on private banks before the global crisis and also in the overall analysis. However, the effect turns to positive afterwards. In addition, overhead costs also have a positive impact on state and foreign banks after the global crisis.

The balance sheet structure of both state and private banks is affected negatively by their FX assets to FX liabilities ratio before the global crisis and in the entire analyzed period. In addition, the FX open position has an adverse effect on foreign banks in the post-crisis period. Also, foreign banks are sensitive to this ratio in the overall analysis. However, the effect is positive in this period.

All banks are affected negatively by bank size before the global crisis. This negative link is observed for private and foreign banks also in the overall period. However, the relationship is statistically significant with a positive sign only for state banks after the global crisis.

Bank listing has a negative effect on state and private banks before the crisis, while it has a positive impact on foreign banks after the crisis. Meanwhile, bank age is positively significant for private banks prior to the crisis; whereas the balance sheet structure of foreign banks is influenced positively by bank age in the post-crisis period.

Private and foreign banks are affected favorably by GDP growth before the crisis. On the other hand, GDP has a negative effect on state banks during this time. However, after the crisis, the GDP growth has no impact on private banks, while state and foreign banks are affected positively and negatively by GDP growth, respectively.

As for inflation, it has a favorable effect on both private and foreign banks before the global crisis and also in the entire analyzed period. In the meantime, exchange rate has a positive impact on the balance sheet structure of state banks before the global crisis. Yet, the effect turns negative in the post-crisis period. On the other hand, exchange rate has a positive impact on foreign banks after the crisis.

Meanwhile, policy rate affects all banks in the overall analyzed period. However the effect is positive for state banks, but negative for private and foreign banks. State banks are affected positively by the policy rate in both sub-periods; whereas

policy rate also affects foreign banks both before and after the global crisis, but negatively.

The ratio of TL reserves to total assets favorably affects the balance sheet structure of state banks after the crisis and in the entire analyzed period. TL required reserves are positively significant for also foreign banks in the post-crisis period. State banks are affected adversely by their FX required reserves before the global crisis. Meanwhile, FX required reserves have a positive effect on the balance sheet structure of private banks after the global crisis and in the entire analysis, while the ratio has a negative impact on foreign banks in the post-crisis period.

4.6. Income-Expenditure Structure

State banks are affected positively by the ratio of overdue loans to total loans and receivables with respect to their income-expenditure structure before the global crisis, while the ratio has an adverse impact on the income-expenditure structure of foreign banks after the global crisis. In the meantime, overhead costs have a positive impact on all banks in both sub-periods and also during the entire analysis.

The ratio of FX assets to FX liabilities has a positive effect on state banks in the overall analysis. Yet, it has a negative impact on foreign banks during the same time period. Meanwhile, private banks are favorably affected by FX assets to FX liabilities ratio in the post-crisis period.

Bank size has an adverse impact on the income-expenditure structure of foreign banks in the entire analyzed period. Yet, it has no significance otherwise. Meanwhile, bank listing is also insignificant. Bank age affects only foreign banks and the effect is observed after the global crisis with a negative sign.

Meanwhile, GDP growth has a positive impact on private banks before the crisis, though it has an adverse effect on foreign banks in the entire analysis. As for inflation, it has a positively significant effect on foreign banks in the pre-crisis period and also in the overall analysis.

Exchange rate is insignificant for all ownership categories regarding their income-expenditure structure, while policy rate has an adverse effect on state banks in the overall analyzed period and it also has a negative impact on private banks before the global crisis. Yet, policy rate positively affects foreign banks in the post-crisis period.

State banks are affected favorably by their TL required reserves after the global crisis, while the ratio of TL reserves to total assets has an adverse effect on the

income-expenditure structure of foreign banks before the crisis and also throughout the overall analyzed period. In the meantime, the ratio of FX reserves to total assets is observed to have a favorable impact on private banks in the pre-crisis period.

5. Conclusion

This paper attempts to assess whether Turkish banks respond asymmetrically to the global crisis. The analysis shows that the crisis seems to have major effects on the structure of Turkish banks, which vary greatly by ownership. Empirical findings indicate that the determinants of capital adequacy, asset quality, liquidity, profitability, balance sheet and income-expenditure structure of the Turkish banking sector differ largely depending on the ownership and also by the period of analysis.

In particular, prior to the crisis, the ratio of overdue loans to total loans and receivables is significant for state banks by affecting their capital adequacy, asset quality, profitability, balance sheet and income-expenditure structure, while private and foreign banks are less influenced by this ratio. However, the ratio is more significant for private and foreign banks, while it is less effective on state banks after the global crisis.

Furthermore, the effect of overhead costs also differs with respect to ownership and by the period of analysis. To be more specific, private banks are substantially influenced by overhead costs, which act as a significant determinant of their capital adequacy, asset quality, profitability, balance sheet and income-expenditure structure before the global crisis. On the other hand, overhead costs are relatively less influential on private banks in the post-crisis period. Meanwhile, overhead costs also have a reduced significance for foreign banks after the global crisis. As for state banks, the effect of overhead costs is limited both before and after the crisis.

FX open position of banks is also another important determinant, which has a varying effect on the changing structure of Turkish banks by ownership. Accordingly, private banks are considerably influenced by the ratio of their FX assets to FX liabilities in both sub-periods. On the other hand, FX open position has a lower significance for state banks after the global crisis. Meanwhile, foreign banks are relatively less influenced by FX assets to FX liabilities prior to the global crisis. However, after the global crisis, FX open position has an increased effectiveness on foreign banks.

Bank size also affects the structure of the Turkish banking sector, which changes asymmetrically with respect to ownership status and by the period of analysis. Accordingly, private banks are relatively less affected by bank size in the pre-crisis

period, while foreign banks are more significantly influenced by their size in the same period. Bank size has a notable effect on private banks after the global crisis. On the other hand, it has a lesser degree of influence on foreign banks during the same period. As for state banks, the effect of bank size is relatively constant in both sub-periods.

Meanwhile, bank listing is also an important determinant of the asymmetric response of Turkish banks to the global crisis. Consequently, state banks are relatively more affected by bank listing before the crisis; whereas bank listing is significant for only private banks after the crisis. Similarly, bank age is an important variable that can explain the asymmetric response of banks to the global crisis. Accordingly, after the global crisis, bank age has an increased effectiveness on private and foreign banks.

Macroeconomic variables are also key determinants of the changing structure of the Turkish banking sector, which have a varying effect by ownership. In this respect, GDP growth is highly influential for private banks, but relatively less significant for state and foreign banks before the global crisis. In contrast, GDP growth is more crucial for foreign banks in the aftermath of the crisis, while it is relatively less important for state banks during the same period. As for private banks, the GDP growth loses its explanatory power after the global crisis.

Among the macroeconomic variables, inflation is another determinant that can account for the asymmetric response of Turkish banks to the global crisis. In other words, before the global crisis, inflation is more significant for private banks and notably less important for state and foreign banks; whereas after the crisis, inflation has a higher effect on foreign banks while continuing to affect state banks, albeit to a lesser extent. The effect on private banks, on the other hand, is substantially lower after the crisis.

Similarly, exchange rate is another determinant that can explain the asymmetric response of Turkish banks to the global crisis. More specifically, exchange rate has an increased significance in the post-crisis period. Accordingly, after the global crisis, exchange rate affects all ownership categories on contrary to the pre-crisis period, where it has only a minor effect on state and private banks.

Policy-related variables are also important determinants of the asymmetric response of Turkish banks to the global crisis. In this respect, policy rates are equally significant for all ownership categories before the global crisis. On the other hand,

after the global crisis, the effect of policy rates on state banks remains almost unchanged, while that on foreign banks is markedly higher. As for private banks, the impact of policy rates is comparatively lower in the post-crisis period.

The ratio of TL reserves to total assets is another determinant that can explain the asymmetric response of Turkish banks to the global crisis. Accordingly, TL required reserves are more influential on foreign banks, while they are relatively less effective on state banks and insignificant for private banks in the pre-crisis period. However, TL required reserves are highly significant for state banks and also effective on private banks in the post-crisis period. As for foreign banks, the effect of TL reserves to total assets declines slightly during the same period.

The impact of FX required reserves on the changing structure of Turkish banks is also asymmetric with respect to ownership. In this respect, the ratio of FX reserves to total assets has an increased significance for private and foreign banks after the global crisis; whereas the ratio loses its explanatory power for state banks in the aftermath of the crisis.

To summarize, this study concludes that Turkish banks respond asymmetrically to the global crisis. Obviously, bank-specific as well as policy-related factors and other macroeconomic variables are key factors to account for this imbalance. In other words, the analysis by sub-periods shows that the determinants of the banking sector structure change before and after the global crisis and this change is unevenly experienced by each ownership category.

These findings are in compliance with earlier works reporting major differences across different ownership categories. Obviously, further research may elaborate on structural, institutional and historical factors that are likely to underlie these ownership-based discrepancies. Future studies may also analyze whether foreign entry affects the Turkish banking sector as it constitutes an important aspect of the changing ownership structure.

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