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Araştırma Makalesi / Research Article

The Effects of Global Financial Crisis, Covid-19 Pandemic, and Bank Ownership Structure on Non-Performing Loans in Turkey

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Abstract

Using System Generalized Method of Moments and data for 23 deposit banks over the period 2002-2020 this study aims to investigate the bank-specific and macroeconomic determinants of non-performing loans in Turkey. For a well-functioning banking system, it is important to understand the empirical determinants of non-performing loans. In this context, we particularly focus on the effects of global financial crisis, Covid-19 pandemic, and bank ownership structure on non-performing loans. To provide additional insights, we divide our sample into two as the pre-crisis and post-crisis periods. Our results indicate that both bank-specific and macroeconomic factors play a significant role in explaining the non-performing loans. Moreover, we find a negative impact of Covid-19 pandemic while there is no evidence for any significant impact of the last global financial crisis. More interesting is to note that bank ownership structure does not exert any significant effect on non-performing loans. Furthermore, the determinants of non-performing loans greatly differ in pre-crisis and post-crisis periods. We think that a sound banking and financial system would play a decisive role for allocating financial resources and thus supporting macroeconomic stability.

Keywords: *Non-Performing Loans, Financial Institutions, Panel Data Analysis, Covid-19 Pandemic, Ownership Structure, Global Financial Crisis.*

Küresel Finansal Kriz, Covid-19 Pandemisi ve Banka Sahiplik Yapısının Türkiye'deki Takipteki Krediler Üzerindeki Etkileri

Öz

Sistem Genelleştirilmiş Momentler Yöntemi ile 2002-2020 dönemi için 23 mevduat bankasının verilerini kullanan bu çalışma, Türkiye'deki takipteki kredilerin bankaya özgü ve makroekonomik belirleyicilerini incelemeyi amaçlamaktadır. İyi çalısan bir bankacılık sistemi için takipteki kredilerin ampirik belirleyicilerini tespit etmek önemlidir. Bu kapsamda özellikle küresel finansal krizin, Covid-19 salgınının ve banka sahiplik yapısının takipteki krediler üzerindeki etkilerine odaklanılmaktadır. Ek bilgi sağlamak için, incelenen periyot kriz öncesi ve kriz sonrası dönemler olarak ikiye ayrılmıştır. Sonuçlar, takipteki kredilerin açıklanmasında hem bankaya özgü hem de makroekonomik faktörlerin önemli bir rol oynadığını göstermektedir. Ayrıca, son küresel mali krizin önemli bir etkisi olduğuna dair herhangi bir kanıt bulunmazken, Covid-19 pandemisinin olumsuz etkisi gözlemlenmiştir. Daha da ilginci, banka sahiplik yapısının takipteki krediler üzerinde önemli bir etkisi olmadığıdır. Ayrıca, takipteki kredilerin belirleyicileri kriz öncesi ve kriz sonrası dönemlerde büyük farklılıklar göstermektedir. Güçlü bir bankacılık ve finansal sistemin finansal kaynakların etkin dağılımı ve böylece makroekonomik istikrar konusunda önemli bir rol oynayabileceği düşünülmektedir.

Anahtar Kelimeler: *Takipteki Krediler, Finans Kurumlar, Panel Veri Analizi, Covid-19 Pandemisi, Sahiplik Yapısı, Küresel Finansal Kriz.*

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INTRODUCTION

The vital role of banks could not be overstated for a well-functioning financial sector. In essence, playing an intermediary role, banks bring borrowers and lenders together, thereby increasing the stability and efficiency in the economies. Doubtlessly, banks face several risks when performing their roles. One of the most important risks is to deal with the credit risk. Because some borrowers default on their debts. In general, a loan is classified as non-performing one when borrowers don't pay the agreed instalments or interest. As a measure of credit risk and quality, non-performing loans (NPL hereafter) point out potential problems and send warning signals. Therefore, we should note that NPLs are crucially important especially in economies that mainly rely on banking systems (Ghosh, 2015). In this context, an increase in NPLs (non-performing loans) in banks' loan portfolios seriously affects the liquidity, profitability, and quality of the financial system (Ayaydin et al., 2021; Barseghyan, 2010).

Additionally, NPLs might signal the crises and contractions (Reinhart and Rogoff, 2011). The deterioration in the assets of the banks first affects the banking system, then reduces financial efficiency, and eventually causes economic problems. In this way, NPLs would threaten the financial system if it is not controlled by risk management mechanisms (Michael, 2006). Similarly, in a comparative analysis, Balgova et al. (2016) suggest that if countries effectively manage and reduce their NPLs, they can have better macroeconomic results compared to others. There is no doubt that NPLs gain even more importance in times of increased uncertainty such as the current pandemic and affect the stability, profitability and liquidity of banking systems.

After the millennium, the quality of the loan portfolios, which did not fluctuate much especially until 2007, experienced a serious decline during the global financial crisis and the general asset quality was damaged. In conjunction with increasing competition in the financial sector and the development of information technologies, a remarkable expansion is observed in loans (Panopoulou, 2005). However, this increase in loans brought by competition has increased the risky credits of banks and adversely affected their profitability and loan portfolios (Beck et al., 2015). As a result of banks' lending policies to their high-risk customers, an escalating effect has also been determined in NPLs (Afşar, 2011).

It is clear that banking sector is the backbone of Turkish financial system. Capital inadequacy, negative effects of dollarization on loans, deteriorated asset quality, and fractured banking structure almost locked the banking system during the crisis that occurred in Turkey in 2001 (Banking Regulation and Supervision Agency [BRSA], 2009).[1] After this crisis, BRSA had to face the problem of NPLs, which constituted one third of the total loans at the time. However, the capital structure of the Turkish banking system has been strengthened, its asset quality has increased and its NPLs have decreased by complying with BRSA decisions. After the effective implementation of the BRSA decisions contributed to the alleviation the effects of the last global financial crisis. Nonetheless, there has been an increase in NPLs afterwards. As a result, a steady decline was observed in the NPLs of European countries and the USA in the 5-year period after 2011, a 54% increase in NPLs was observed in the Turkish banking system (Partovi and Matousek, 2019).

Using data for 23 deposit banks over the period 2002-2020 this study aims to contribute to the existing literature in some important dimensions. First, to the best of our knowledge, this study is the first investigating the effects of Covid-19 pandemic on NPLs in Turkey. There is no

question that the global financial crisis deeply affected financial and banking sectors in many countries especially in 2009. Similarly, Covid-19 pandemic has exerted a strong effect on the economies around the world. To deal with this pandemic many countries have implemented some drastic measures including lockdowns and other restrictions. Therefore, it would be informative to examine the effects of the global financial crisis and Covid-19 pandemic on NPLs in Turkey. Second, it is possible to argue that NPLs would depend on the bank ownership structure (Micco et al, 2007; Yagli and Topcu, 2023). For example, public banks could allocate funds based on some non-economic factors and hence experience a lower credit quality, causing an increase in NPLs (Hu et al., 2004). In other words, private owned banks might be more successful at minimizing the credit risk. Similarly, foreign owned banks might have higher efficiency and technical or managerial capacity than the domestic ones or vice versa. Since public, private, and foreign owned banks operate in Turkey, it would be critical to test whether bank ownership structure plays a considerable role for the NPLs. Third, the global financial crisis might induce a fundamental change in financial and banking sector (Dietrich & Wanzenried, 2011; Erdas, 2019; Turan, 2022). If this is the case, using a dummy variable for a single year, i.e. 2009, would not be enough to capture the effects. Other than the possible impacts of the global financial crisis, one can argue that the determinants of NPLs change over time. To gain additional insight, like Us (2018) we divide our sample into two as pre-crisis (2002-2008) and post-crisis (2009-2020) periods. To sum up, examining the effects of bank specific and macroeconomic factors, Covid-19, the global financial crisis and ownership structure on the NPLs by means of system Generalized Method of Moments (GMM hereafter) this study contributes to the existing literature and provides empirical findings to better understand the determinants of NPLs in Turkey.

Our empirical results strongly indicate that both bank specific and macroeconomic factors should be considered when examining the NPLs. Interestingly, we find a strong-evidence for a negative impact of Covid-19 pandemic. However, bank ownership structure does not play a significant role in this context. On the other hand, we obtain markedly different results for pre-crisis and post-crisis periods, pointing to a remarkable change in the determinants of NPLs over time. Finally, it is crucially important to employ a dynamic model since the lagged value of dependent variable is significantly important in all regressions. Additionally, GMM is frequently used to tackle endogeneity and autocorrelation problems (Dietrich & Wanzenried, 2011; Garcia et al., 2009; Ullah et al., 2018).

We briefly review the literature in section 2, explain our model and data in section 3, share and discuss empirical results in section 4, and finally conclude in section 5.

1. LITERATURE REVIEW

Using different samples and methods many studies focus on the determinants of NPLs. Some studies examine the determinants of NPL in a single country while others focus on a group or panel of countries (Espinoza & Prasad, 2010; Ozili, 2019). There are two broad sets of determinants: bank-specific and macroeconomic (Louzis et al., 2012). Therefore, many studies investigate the impact of both bank-specific and macroeconomic factros on NPLs in the same framework (Louzis et al., 2012; Salas & Saurina, 2002). Although many variables employed in the literature we briefly touch most important ones included in our empirical specification below. In doing so, we first focus on the bank-specific then macroeconomic determinants of NPLs.

It is a well-established fact that NPLs are mostly affected by bank-specific factors (Berger & DeYoung, 1997). Bank-specific indicators include but not limited to capital adequacy, bank loans, bank size, cost and management efficiency, non-interest income, and profitability. The capital adequacy ratio, which was put forward for the first time in the Basel I Committee held in 1988, is a popular ratio that measures the level of liquidity of financial institutions to meet their liabilities against risks. The importance of the capital requirement ratio as a determinant of NPLs has been extensively covered in the recent literature. For example, in an important study, Berger and DeYoung (1997) suggest that banks with low capital increase their risky loans with a more aggressive credit policy and consequently experience a rise in their NPLs. Similarly, banks with higher capital generally avoid from providing high-risk loans and thus face with low NPLs (Keeton & Morris, 1987). In this context, some studies such as Ersoy (2021), Nugroho et al. (2021), Abdioglu and Aytekin (2016), and Salas and Saurina (2002) also find a negative relationship between NPLs and capital adequacy while some others (Hasan & Wall, 2004; Vatansever & Hepsen, 2013) report a positive impact of capital adequacy on NPLs. On the other hand, Suryanto (2015) concludes that capital adequacy does not have a significant effect on NPLs in Indonesia.

Bank loans, which can be defined as the credits given by financial institutions to their customers, play a vital role in explaining the credit risk (Kishan & Opiela, 2000). In an influential study Keeton and Morris (1987) suggest that aggressively lending banks have a higher increase in their NPLs. This idea is confirmed by many studies thereafter, such as Salas and Saurina (2002), Messai and Jouini (2013), Staehr and Uusküla (2020), and Zheng et al., (2020). In a study examining the determinants of NPLs in the Turkish financial sector, a positive and significant relationship was found between NPLs and the ratio of loans in GDP (Yuksel, 2011). On the other hand, Vithessonthi (2016) reports a negative relationship between lending and NPLs in Japan. According to a study based on 75 European banks, NPLs put a burden on bank lending, and consequently effect loan performances of the finance sector negatively in the long run (Serrano, 2021). A similar result is reported for the Guana as well (Khemraj & Pasha, 2009). In addition, the lending activities with higher interest rates in the market could create a herd behavior and affect the financial system in general (Dash and Kabra, 2010).

There is no doubt that the cost efficiency or productivity of banks would affect the NPLs (Berger and DeYoung, 1997). An analysis conducted on Italian banks found a negative relationship between efficiency and NPLs (Girardone et. al., 2004). Some other studies also point to a negative association between the efficiency and NPLs (Espinoza and Prasad, 2010; Suryanto, 2015). This negative relationship is also confirmed for Turkish banks as well (Vatansever & Hepsen, 2013). Similarly, Abdioglu and Aytekin (2016) confirms the existence of a positive relationship between inefficiency and NPLs.

Banks with higher profits might have less motivation to fill their loan portfolios with risky credits. In this context, numerous studies show that there is a negative relationship between the profitability and NPLs (Berger & DeYoung, 1997; Louzis et al., 2012; Isik & Bolat, 2016; Yagli and Topcu, 2023; Zheng et al., 2020). On the other hand, in times of aggressive competition, banks may give risky loans in order to increase their profitability in the finance sector, at the expense of increasing their NPLs. In this case, a positive relationship can be observed between bank profitability and NPLs. Indeed, García-Marco and Robles-Fernández (2008) observe a positive association between higher profitability and higher NPLs in Spain. A research on the Turkish

banking sector also indicates a positive relationship between NPLs and the return on equity ratio (Vatansever & Hepsen, 2013).

Bank size, as measured by the total asset of banks, is another bank-specific determinant used frequently in NPL analyses. A recent study shows that since major banks have a wide range of customer portfolios, these banks can issue more high-risk loans and increase their NPLs (Rezina et al., 2020). It is not a secret that certain large-scale banks have an extremely risky lending policy and self-confidence, with the expectation of bailout by governments, due to their power of affecting the economy altogether when they go bankrupt. To illustrate, Bank of America, the second largest bank in USA, which was particularly affected by subprime mortgages during the global financial crisis, received $45 billion as an aid from government programs (Webel and Labonte, 2010). On the other hand, it is possible to argue that as asset size increases, banks can make better use of loans and give higher quality loans, i.e. economies of scale, resulting in a negative relationship between bank size and NPLs (Fernandez de Lis et al., 2000; Hu et al., 2004; ; Louzis et al., 2012; Salas and Saurina, 2002; Us,2017; Yagli and Topcu, 2023).

Banks earn additional income not only from lending activities, but also from non-interest activities such as asset management, insurance and brokerage services, and derivatives transactions. Banks have increased their non-interest income compared to previous periods, in line with the increase in the use of the internet and mobile applications. Banks that earn more from non-interest income would try to develop an effective risk management policy by reducing their level of high-risk lending. There would exist a negative relationship between income diversification and NPLs (Isik & Bolat, 2016; Ghosh, 2015). On the other hand, Ersoy (2021), Abdioglu and Aytekin (2016) for Turkish banks, and Louzis et al. (2012) for Greek banks report that non-interest incomes have a positive effect on NPLs. However, in some studies, no relationship is reported between NPLs and non-interest incomes (Hu, 2002).

As for macroeconomic determinants of NPLs, some studies clearly highlight the role of macroeconomic environment (Berger & DeYoung, 1997; Us, 2017). There is no question that changes in the macroeconomic conjuncture affect and transform the behavior of banks and other economic agents. In this context, several macroeconomic indicators such as GDP growth, inflation, and exchange rates are frequently employed in explaining the determinants of NPLs.

In recent years, one of the driving forces that directly affect the financial sector, along with the exchange and interest rates, is GDP (Beck et al., 2015). The economic situation in the country can affect the banking system and NPLs, as it has the potential to change the ability of borrowers to pay their debts on time. The increase in welfare during economic development will reduce NPLs by enabling debt stocks to be paid more easily and effectively, and in case of economic contractions debt repayment will become relatively difficult with an increase in risky debts and then a rise in NPLs will be observed (Vazquez et al., 2012). Mohaddes et al. (2017) find that if the growth is stable and 1% faster than expected, there is a decrease between 6.5% and 9.5% in NPLs per year in Italy. Along these lines, many studies report a negative relationship between GDP growth and NPLs (Dash & Kabra, 2010; Ersoy, 2021; Fernandez de Lis et al., 2000; Jiménez & Saurina, 2006; Khemraj & Pasha, 2009; Louzis et al., 2012; Messai & Jouini, 2013; Salas & Saurina, 2002; Staehr & Uusküla, 2020; Us, 2017; Yagli & Topcu, 2023; Zheng et al., 2020).

The pressure of the exchange rate will be inevitable for companies and individuals when the local currency is depreciated. The depreciation of the local currency against the globally popular currencies creates a domino effect that makes it difficult to pay foreign loans within the

country (Hausmann et al., 2001), sometimes called “original sin”. This indicates the existence of a negative relationship between exchange rate and NPLs. This negative relationship is observed more if banks give large amounts of foreign currency credits to their customers in the risky groups (Beck et al., 2013; Moinescu & Codirlaşu, 2012). On the other hand, in heavily exporting countries, NPLs may decrease if the private sector’s financial situation improves, even if the local currency is weak against foreign exchange rates. In this context, a positive relationship would be observed between exchange rates and NPLs (Khemraj & Pasha, 2009). In addition, studies on the Turkish banking sector don’t find a significant relationship between the exchange rate and NPLs (Us, 2017; Vatansever & Hepsen, 2013). Thus, we conclude that the exchange rate affects NPLs in both directions.

Inflation is a proxy for macroeconomic stability and monetary policy. Therefore, inflation rate would affect the NPLs. On the one hand, an increase in inflation can create a mechanism for easier debt repayment by reducing the purchasing power of money (Khemraj & Pasha, 2009; Yuksel, 2011). On the other hand, as the income of borrowers decrease with rising inflation, debt repayments may become gradually difficult and NPLs may increase as a result (Ersoy, 2021; Staehr & Uusküla; 2020; Us, 2017).

Ownership structure would matter (Yagli & Topcu, 2023). A decrease in NPLs is observed when some of the bank's capital is government-owned (Hu et al., 2004). On the other hand, some studies argue that non-performing loans are higher in public banks than those of private sector banks due to the fact that public banks are self-confident to support more risky projects, because they have a low default probability (Iannotta et al., 2007).

Finally, we would like to briefly highlight some studies that solely focus on the determinants of credit risk or non-performing loans in Turkey (Ayayadin et al., 2021; Bolat; 2016; ; Erdas, 2019; Ersoy, 2021; Isik et al. , 2016; Kartal et al., 2020; Us, 2017; Vatansever & Hepsen, 2013; Yagli & Topcu, 2023). Regarding macroeconomic factors many studies find a strong negative relationship between economic growth and NPLs (Ersoy, 2021; Yagli & Topcu, 2013) in Turkey while there is no consensus on the impact of inflation rate and exchange rate (Ersoy, 2021; Kartal et al, 2020; Us, 2017; Yagli & Topcu, 2023). As explained above we can conclude that empirical findings largely differ. This is not surprising as studies utilize different samples, variables, and estimation methods.

2. MODEL AND DATA

To investigate the determinants of NPLs many studies such as (Beck et al., 2015; Louzis et al., 2012; Us, 2017) include not only bank specific indicators but also macroeconomic variables. Based on the literature we can specify our empirical model as follows:

$$NPL_{it}=c+ \alpha NPL_{it-1} + \beta BS_{it} + \theta MV_{t} + \Omega D2009 + \gamma D2020 + \mu OWN_{it} + \varepsilon_{it} \quad (1)$$

Our dependent variable is the NPLs (NPL, as % of total loans) and ε is the error term. Since there would be a persistence or inertia in NPLs we use the lagged value of dependent variable as a regressor in the equation (1). BS and MV stand for the bank specific and macroeconomic variables, respectively. As bank specific variables we include bank size (SZE), capital adequacy (CAP), non-interest income (NII), other operating expenses (EXP), loans (LNS), and profitability (ROA). Bank size is measured as total assets in log while capital adequacy (the equity), non-interest income, other operating expenses, profitability, and loans are defined as percent of total assets. Following the literature, we employ GDP growth rate (GRW), inflation rate (INF),

and exchange rate (EXC) to capture the effects of macroeconomic conditions or environment. GDP growth rate (inflation rate) refers to the percentage change in the real GDP (consumer price index) while the exchange rate is defined as Turkish Lira (TRY) for per US$ (in log). Therefore, an increase in the exchange rate shows the deprecation of TRY. Additionally, our baseline model includes two dummies, D2009 and D2020, to grasp the effects of the global financial crisis and Covid-19 pandemic on the NPLs, respectively. More precisely, D2009 (D2020) takes value 1 if 2009 (2020), otherwise equals 0. Finally, to test whether bank ownership structure affects the NPLs we add dummy variables for public owned (POWN), private owned (ROWN) and foreign owned (FOWN) banks. In this way, we could detect the existence of any difference among public, private, and foreign owned banks regarding the NPLs.

After a serious economic crisis became a reality, an IMF-supported stabilization program adopted and took place in early 2001. This stabilization program unsurprisingly included some important regulations and policy measures aiming to restructure and restore the finance and banking sector. Because of this reason and data quality concerns as well our sample period starts from 2002. We collect the bank specific and ownership data from Turkish Banking Association and macroeconomic variables from Turkish Central Bank databases. Our sample covers 23 deposit banks for the 2002-2020 period in Turkey. [2] We present descriptive statistics in Table 1 and correlation matrix in Table 2. Table 2 indicates that NPLs have a negative (positive) correlation with ROA, LNS, GRW, CAP and SZE (NNI, EXP, INF, EXC).

Table 1: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
ROA	1.199922	1.858898	-17.61114	6.462274
NNI	1.9242	1.71807	-1.579275	13.91235
LNS	54.40954	16.56148	.4541584	84.71611
NPL	5.352767	7.481588	0	94.62025
EXP	3.274284	1.845521	.5033297	14.38878
GRW	5.229763	3.720606	-4.823154	11.20011
EXC	.7554172	.5194511	.2568936	1.947199
INF	11.42842	5.678819	6.16	29.7
CAP	12.40339	5.440651	2.881049	84.97628
SZE	16.61843	1.942666	10.11298	20.66415

Table 2: Correlation Matrix

	ROA	NNI	LNS	NPL	EXP	GRW	INF	CAP	SZE	EXC
ROA	1	0.17	-0.03	-0.20	-0.14	-0.01	-0.05	0.01	0.25	-0.09
NNI	0.17	1	-0.33	0.12	0.59	0.11	0.23	0.28	-0.23	-0.34
LNS	-0.03	-0.33	1	-0.23	-0.14	-0.09	-0.19	-0.33	0.31	0.35
NPL	-0.20	0.12	-0.23	1	0.04	-0.10	0.27	-0.04	-0.01	0.12
EXP	-0.14	0.59	-0.14	0.04	1	0.13	-0.06	0.34	-0.53	-0.54
GRW	-0.01	0.11	-0.09	-0.10	0.13	1	-0.01	-0.02	-0.10	-0.24
INF	-0.05	0.2	-0.19	0.27	-0.06	-0.01	1	-0.02	0.01	0.40
CAP	0.01	0.28	-0.33	-0.04	0.34	-0.02	-0.02	1	-0.43	-0.26
SZE	0.25	-0.23	0.31	-0.01	-0.53	-0.10	0.01	-0.43	1	0.39
EXC	-0.09	-0.34	0.35	0.12	-0.54	-0.24	0.40	-0.26	0.39	1

Since we have a dynamic model, i.e. the lagged dependent variable is employed as a regressor, and the group number (N) is greater than the time dimension (T) we use the system GMM method developed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). We think that it is important to include the lagged value of dependent variable in our model as it would have a significant impact. Otherwise estimates would be subject to omitted-variable bias problem. In other words, NPLs in the previous year should be controlled in the model. Fixed effect models have a well-known bias in dynamic models (Nickell, 1981). It is worth highlighting that especially endogeneity might be a serious problem or concern for our specification. For example, reverse causality problem would exist between the dependent and some independent variables. Similarly, some regressors might be related to the error term. Ignoring endogeneity problem would lead to misleading results. Therefore, like many studies in the literature, to account the persistence of NPLs and endogeneity problem we employ System GMM to investigate the determinants of NPLs (Dietrich and Wanzenried, 2011; García-Herrero et al., 2009; Hasanov et al., 2018). If the endogenous variable is persistent then the System GMM (Blundell and Bond, 1998) is better suited than the difference GMM (Arellano and Bover, 1995). System GMM approach exploits differences and levels simultaneously, yields consistent estimators, controls for unobserved heterogeneity and has some well-known advantages to deal with some econometric problems such as serial correlation, and heteroscedasticity (Dietrich & Wanzenried, 2011; García-Herrero et al., 2009; Ullah et al., 2018;). To ensure the reliability of our empirical estimations, we perform Hansen test for the validity of our instruments and AR2 test for serial correlation. Additionally, we use the two-step estimates and robust standard errors since typically statistical tests based on the two-step estimator are expected to be asymptotically more powerful compared to those based on the one-step estimator (Hwang & Sun, 2018).

3. EMPIRICAL RESULTS AND DISCUSSION

We summarize our full sample results in Table 3.[3] It seems that non-interest income, other operating expenses, GDP growth rate, profitability, and exchange rate have a statistically significant effect on NPLs (Column 1). More precisely, an increase in GDP growth rate leads to a reduction in NPLs, consistent with many studies such as (Ersoy, 2021; Isik & Bolat, 2016; Louzis et al., 2012; Messai & Jouini, 2013; Mohaddes et al, 2017; Us, 2017; , Yagli & Topcu, 2023;) describing the GDP growth rate as the main driving variable for NPLs. For example, a 1 unit increase in GDP growth rate is associated with a 20% decline in NPLs. Similarly, non-interest income as a proxy for income diversification has a negative impact as well (Ersoy, 2021; Ghosh, 2015; Isik & Bolat, 2016). On the other hand, an increase in operating expenses reflecting the operational efficiency is associated with a rise in NPLs (Ersoy, 2021; Espinoza & Prasad, 2010; Suryanto, 2015). Moreover, a deprecation of Turkish Lira is associated with higher NPLs, in line with some studies such as Moinescu & Codirlaşu (2012) and Beck et al. (2015), differing from some previous results (Us, 2017; Vatansever & Hepsen, 2013). As highlighted in some studies (among others, Beck et al., 2015) a change in the exchange rate would have both competitiveness and balance sheet effects in principle, our results suggest that the latter effect dominates the former one. In other words, a depreciation makes more difficult for borrowers to pay their debt or credit and hence worsens the credit quality. However, it is interesting to find that profitability exerts a positive impact. We should note that the lagged value of the dependent variable has a significant impact in all estimates, indicating the importance of a dynamic specification and persistence in NPLs, consistent with some previous studies such as

Yagli and Topcu (2023), Ersoy (2021) and Abdioglu and Aytekin (2016). This particular result casts some doubts over the results reported by previous studies which don't employ a dynamic specification. Other bank-specific and macroeconomic variables don't significantly impact the NPLs. In this context, the effect of inflation on NPLs is not significant, consistent with some previous results (Isik & Bolat, 2016; Yagli & Topcu, 2023).

As for the global financial crisis and Covid-19 pandemic, we find a statistically significant impact for just Covid-19 pandemic. It seems that Covid-19 pandemic is associated with a decline in NPLs. One might expect that Covid-19 pandemic would lead to a rise not a decline in NPLs. However, our results don't lend any evidence for this argument. Given Turkish banking system successfully maintained its operations thanks to their strong technical capacity and infrastructure during the pandemic, this result is not surprising. For example, the ratio of NPLs to total loans (as of %) is 6.95, 8.54, and 6.53 in 2018, 2019 and 2020, respectively. Second, there are some policy regulations. On the other hand, we don't find any direct significant impact of the global financial crisis on NPLs. Nonetheless, it is worth stating that the last global financial crisis might have some indirect effects through other regressors such as GDP.

Doubtlessly, it is more interesting to test the argument that bank ownership structure would matter in explaining the NPLs (Yagli & Topcu, 2023). For example, one can argue that public owned banks would have a higher credit risk or lower loan quality resulting in higher NPLs as they could arguably pay more attention to non-economic factors like political considerations when allocating loans compared to private owned banks. However, our results consistently and robustly demonstrate that there is no evidence for this argument. In other words, bank ownership structure does not play a significant role for NPLs in Turkey during the period examined.

It is clear that the global financial crisis might have a long-lasting effect. If this is the case, then using a dummy variable for 2009 would not be enough to capture the effects spreading over time. Additionally, it would be informative to examine whether a change exists in the determinants of NPLs over time. Therefore, to gain additional insights we re-estimate our model separately for pre-crisis (2002-2008) and post-crisis periods (2009-2020) and report the results in Table 4.

For pre-crisis period, loans, other expenses, non-interest income, exchange rate, and profitability exert a significant effect on NPLs. Similar to the full sample results reported in Table 4, an increase in the other expenses and profitability leads to a rise in NPLs. It seems that non-interest income, loans and exchange rate have a negative impact. This implies that there is no evidence for the argument that higher loans would be necessarily associated with higher credit risk. This result is plausible as we employ the NPLs as a percent of total loans, implying an increase in loans leads to an increase in denominator.

Table 3: The determinants of NPLs (full sample) (Dep. Var.: NPL, as in % of total loans)

L.NPL	0.562***	0.605***	0.591***	0.549***
	(5.120)	(4.331)	(7.977)	(5.671)
LNS	-0.0129	-0.0226	-0.0116	-0.0193
	(-0.269)	(-0.632)	(-0.346)	(-0.443)
EXP	0.761***	0.698**	0.811***	0.806***
	(3.423)	(2.473)	(4.861)	(3.524)
NNI	-0.607**	-0.404	-0.607**	-0.616**
	(-2.464)	(-1.585)	(-2.533)	(-2.576)
CAP	-0.209	-0.231**	-0.178	-0.227
	(-1.274)	(-2.432)	(-1.553)	(-1.657)
SZE	-0.474	0.0882	-0.570	-0.566
	(-1.087)	(0.136)	(-1.171)	(-1.111)
ROA	0.314*	0.282	0.467***	0.393*
	(1.803)	(1.137)	(3.560)	(1.857)
GRW	-0.218***	-0.202*	-0.159**	-0.202**
	(-3.145)	(-1.854)	(-2.257)	(-2.387)
INF	0.0330	0.0146	0.0200	0.0227
	(0.380)	(0.127)	(0.242)	(0.248)
EXC	2.969**	2.491	3.804***	3.531**
	(2.300)	(1.050)	(3.461)	(2.279)
D2009	0.233	0.554	0.521	0.203
	(0.440)	(0.976)	(1.024)	(0.396)
D2020	-3.060**	-2.987**	-3.306***	-3.220**
	(-2.197)	(-2.184)	(-3.019)	(-2.539)
POWN		-1.424		
		(-0.525)		
ROWN			0.617	
			(1.159)	
FOWN				-0.626
				(-0.600)
Constant	9.835	1.514	9.280	11.54
	(1.598)	(0.155)	(1.506)	(1.590)
# of Obs.	403	403	403	403
# of Groups	23	23	23	23
# of Ivs	22	23	23	23
Hansen test	0.121	0.177	0.352	0.147
AR (2) test	0.204	0.173	0.205	0.213

Note: t statistics are given in parentheses and ***, **, * show significance at the 0.01, 0.05 and 0.10 level. We use robust standard errors. We present p-values for the Hansen test and AR2 test. GMM results are two-step estimates. The two-step standard errors are based on the Windmeijer (2005) finite-sample correction.

Unlike full sample results, a deprecation of Turkish Lira leads to a reduction in NPLs. This suggests that competitiveness effect dominates the balance sheet or budget effects in this sub-period. On the other hand, bank size, loans, exchange rate, and profitability have a significant effect on NPLs while other bank specific and macroeconomic variables don't exert any significant effect for 2009-2020 period.

Table 4: The Determinants of NPLs (Pre-Crisis and Post-Crisis Periods)

	Pre-crisis Period				Post-crisis Period			
L.NPL	0.500***	0.513***	0.503***	0.487***	0.464***	0.514***	0.469***	0.462***
	(13.60)	(7.499)	(10.89)	(13.68)	(4.165)	(4.382)	(4.499)	(4.128)
LNS	-0.0745**	-0.0702	-0.0761*	-0.083***	-0.170**	-0.154**	-0.180**	-0.171**
	(-2.097)	(-1.184)	(-1.920)	(-2.884)	(-2.639)	(-2.193)	(-2.424)	(-2.391)
EXP	0.633*	0.646**	0.624**	0.667*	0.600	0.480	0.509	0.505
	(1.751)	(2.201)	(2.453)	(1.865)	(0.742)	(0.747)	(0.503)	(0.485)
NNI	-0.516**	-0.480**	-0.455**	-0.461*	0.595	0.703	0.543	0.568
	(-2.096)	(-2.383)	(-2.132)	(-2.003)	(1.234)	(1.423)	(1.200)	(1.286)
CAP	-0.0249	-0.0722	-0.0550	-0.0120	0.218	0.288	0.250	0.241
	(-0.248)	(-0.421)	(-0.393)	(-0.135)	(1.297)	(1.617)	(1.217)	(1.124)
SZE	0.622	0.216	0.502	1.080	0.886*	1.429*	0.913	0.847
	(0.604)	(0.247)	(0.434)	(1.074)	(1.870)	(1.911)	(1.626)	(1.689)
ROA	0.419***	0.399**	0.407***	0.411***	-2.137***	-2.215***	-2.168***	-2.163***
	(5.155)	(2.800)	(4.509)	(6.008)	(-4.747)	(-5.242)	(-5.035)	(-5.131)
GRW	-0.0645	-0.119	-0.0826	-0.00337	-0.0570	-0.0649	-0.0571	-0.0530
	(-0.499)	(-1.333)	(-0.633)	(-0.0238)	(-0.658)	(-0.760)	(-0.596)	(-0.550)
INF	0.128	0.0709	0.0981	0.142	0.0794	0.101	0.0866	0.0849
	(0.584)	(0.548)	(0.538)	(0.727)	(1.068)	(1.427)	(1.117)	(1.137)
EXC	-9.366**	-7.701	-9.239*	-8.650	2.358*	1.413	2.119	2.158
	(-2.452)	(-1.170)	(-1.819)	(-1.091)	(1.815)	(0.761)	(1.171)	(1.047)
D2009					1.633	1.812	1.582	1.603
					(1.204)	(0.966)	(1.137)	(1.207)
D2020					-2.835***	-3.000***	-2.692**	-2.660**
					(-2.891)	(-3.304)	(-2.185)	(-2.090)
POWN		-0.436				-1.156		
		(-0.246)				(-0.570)		
ROWN			-0.136				-0.106	
			(-0.192)				(-0.0938)	
FOWN				1.063				0.182
				(1.348)				(0.137)
Constant	-4.466	2.652	-1.747	-12.69	-7.877	-18.00	-7.502	-6.968
	(-0.225)	(0.139)	(-0.0767)	(-0.635)	(-0.827)	(-1.265)	(-0.685)	(-0.672)
#Obs	132	132	132	132	271	271	271	271
#groups	22	22	22	22	23	23	23	23
#IVs	22	23	23	23	23	24	24	24
Hansen test	0.464	0.547	0.596	0.688	0.175	0.253	0.150	0.146
AR (2) test	0.1865	0.162	0.210	0.1873	0.744	0.692	0.732	0.740

Note: See the Note in Table 3.

It is crucial to note that now profitability has a negative impact on NPLs, as expected (Yagli & Topcu, 2023). Additionally, it seems that unlike the pre-crisis period the coefficient on the exchange rate is positive for this period. It seems that non-interest income, loans and exchange rate have a negative impact. This implies that there is no evidence for the argument that higher loans would be necessarily associated with higher credit risk. This result is plausible as we employ the NPLs as a percent of total loans, implying an increase in loans leads to an increase in denominator. Unlike full sample results, a deprecation of Turkish Lira leads to a reduction in NPLs. This suggests that competitiveness effect dominates the balance sheet or budget effects in this sub-period. On the other hand, bank size, loans, exchange rate, and profitability have a significant effect on NPLs while other bank specific and macroeconomic variables don't exert any significant effect for 2009-2020 period. Note that now profitability has a negative impact on NPLs, as expected. Additionally, it seems that unlike the pre-crisis period the coefficient on the exchange rate is positive for this period.

Moreover, bank size has a positive impact, pointing to the absence of economies of scale. Somewhat interestingly, non-interest income and other expenses don't exert a significant impact for the post-crisis period. Similar to our full sample results there is no evidence for the argument that bank ownership matters in explaining NPLs in Turkey in pre-crisis and post-crisis periods. In other words, the ratio of NPLs to total loans does not depend on the ownership structure. These results strongly demonstrate that the determinants of NPLs change over time, confirming the results reported by Erdas (2019).

4. CONCLUSION

Using data for 23 deposit banks over the period 2002-2020 and GMM method this study examines the bank-specific and macroeconomic determinants of NPLs in Turkey. For full sample period, our results suggest that an increase in GDP growth rate (other operating expenses and profitability) and non-interest income (exchange rate) leads to a reduction (rise) in NPLs. Moreover, we find a negative impact of Covid-19 pandemic while the global financial crisis doesn't have any significant effect. On the other hand, there is no evidence for the argument that bank ownership structure matters in explaining the NPLs during the period examined.

To gain additional insights, we make a distinction between the pre-crisis (2002-2008) and post-crisis (2009-2020) periods. For the pre-crisis period an increase in the other expenses and profitability leads to a rise in NPLs. We find that non-interest income, loans and exchange rate negatively impact the NPLs. Unlike full sample results, a deprecation of Turkish Lira leads to a reduction in NPLs in this sub-period. On the other hand, bank size, loans, exchange rate, and profitability have a significant effect on NPLs while other bank specific and macroeconomic variables don't exert any significant effect for 2009-2020 period. We should note that profitability has a negative impact on NPLs, as expected, in the post-crisis period. Additionally, it seems that unlike the pre-crisis period the coefficient on the exchange rate is positive. However, similar to our full sample results there is no evidence for the argument that bank ownership matters in explaining NPLs in Turkey in pre-crisis and post-crisis periods.

We would like to highlight some important points based on our empirical results. First, macroeconomic factors should be considered in explaining the NPLs, lending further evidence for the importance of macroeconomic variables and stability for banking sector (Athanasoglou et al., 2008; Hasanov et al., 2018; Mohaddes et al., 2017; Us, 2017;). Second, Covid-19 pandemic has a negative impact, implying a successful performance of banks during the pandemic. Third,

bank ownership structure does not have any significant effect on the NPLs. In other words, there is no relationship between NPLs and ownership structure. This finding does not support the argument that public banks would be more inefficient compared to private banks (Hu et al., 2004; Micco et al., 2007) in terms of NPLs. Fourth, determinants of NPLs greatly change over time. Our results show that it would be misleading to model those determinants as fixed or unchanged before and after the global financial crisis, as shown in some studies including Erdas (2019), Dietrich and Wanzenried (2011). Therefore, the literature should pay more attention to this point. Fifth, since the lagged value of dependent variables have a significant impact on NPLs in all estimations, employing a dynamic model is crucially important (Ersoy, 2021; Yagli & Topcu, 2023). This particular result casts doubts over the results of some previous studies based on static models. Because adding the lagged dependent variable to model would require different estimation methods and would result in different estimates hence policy proposals. We conclude that banking sector in Turkey is relatively resilient during the global financial crisis and Covid-19. Maybe surprisingly our findings don't lend any evidence that bank ownership structure matters in terms of NPLs. Finally, since the global financial crisis clearly showed the importance of financial sector for macroeconomic stability, it would be a worthwhile effort to focus more on the determinants of banking sector performance by incorporating macroeconomic factors and also utilizing time-varying estimation methods. Policymakers should keep in mind that a sound and well-functioning banking system would play a decisive role for allocating financial resources and thus supporting macroeconomic stability.

FOOTNOTES

[1] Taken from the BRSA 2009 report.

[2] The list of banks is available from the authors.

[3] Although it is not common to carry out unit root tests in GMM method, we find that our variables don't have unit roots. These results are available from the authors.

AUTHOR STATEMENT

Statement of Research and Publication Ethics

This study has been prepared in accordance with scientific research and publication ethics.

Author Contributions

The authors contributed equally to the study.

Conflict of Interest

There is no conflict of interest for the authors or third parties arising from the study.

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