



# How does ownership structure affect the profitability of Turkish banks? A comparative analysis of determinants

AHSEN EMIR BULUT, Ph.D. candidate, Res. Asst.\*  
NILGUN ACAR BALAYLAR, Prof. Dr.\*  
TURAN KARIMLI, Ph.D. candidate\*

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Ahsen Emir BULUT

Dokuz Eylül University, Graduate School of Social Sciences, Department of Economics, Kuruçeşme,

Doğuş Cd. 207V, Buca, 35160 İzmir, Türkiye

e-mail: [ahsenemir.bulut@deu.edu.tr](mailto:ahsenemir.bulut@deu.edu.tr)

ORCID: 0000-0003-3475-9456

Nilgün Acar BALAYLAR

Dokuz Eylül University, Faculty of Business Administration and Economics, Department of Economics,

Dokuzçeşmeler Kampüsü 24 Sokak No:2, Buca, 35160 İzmir, Türkiye

e-mail: [nilgun.balaylar@deu.edu.tr](mailto:nilgun.balaylar@deu.edu.tr)

ORCID: 0000-0002-7024-5279

Turan KARIMLI

Azerbaijan State Economic University, Hasan Aliyev 135, Narimanov, Baku, AZ1007, Azerbaijan

Western Caspian University, 31 Istiglaliyyat, 1001 Baku, Azerbaijan

e-mail: [turan.karimli@ogr.iu.edu.tr](mailto:turan.karimli@ogr.iu.edu.tr)

ORCID: 0000-0001-7023-0854



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## Abstract

*This study examines the determinants of profitability of deposit banks in Türkiye taking into account differences in the ownership structures of public, private domestic and foreign-owned banks. The aim of the study is to analyse whether the factors determining profitability change depending on the managerial differences that the ownership structure may entail. A seemingly unrelated regression method with monthly data from 2010 to 2022 is used for this purpose. Our findings suggest that the real effective exchange rate, inflation, and non-interest income variables have common effects on profitability regardless of bank ownership. However, the bank capital ratio, bank size, loan to deposit ratio, and economic activity affect profitability differently across bank ownership types.*

*Keywords: ownership structure, Türkiye, bank profitability, seemingly unrelated regression*

## 1 INTRODUCTION

Historically, public banks have often been established in crisis times to support economic developments or respond to the effects of financial, social, and now, for example, climate crises. Operating in the public sphere can lead public banks to operate differently from private banks. Public banks are not subject to the same competitive pressures as private banks due to the policy framework in the public sector and political will (Barrowclough and Marois, 2022). Public and private banks can thus operate in different institutional environments (Karas, Schoors and Weill, 2010). Public banks may perform functions that are not necessarily fulfilled by private banks, such as providing finance for projects with high social but relatively low private returns (Coelho, de Mello and Rezende, 2013), or continuing to provide finance during cyclical downturns. Public banks usually respond to the needs of governments due to the presence of state officials in their management. Extensive state participation in the banking system could thus undermine fiscal discipline by providing access to quasi-fiscal in addition to any regular public sector budget financing (Garcia and Grigoli, 2014).

Foreign banks generally differ from local banks through better access to superior technology and international capital markets, more sophisticated risk management techniques, and often a more experienced workforce (Wanke et al., 2021). There has been a remarkable increase in foreign bank participation worldwide in the past thirty years. The literature generally evaluates this trend as beneficial, as foreign banks make the banking sector more competitive, provide easier access to cross-border funds, increase the efficiency of local banking markets, and stabilise lending conditions during local crisis periods (Jeon and Miller, 2005; Albertazzi and Bottero, 2014). Moreover, there is strong evidence that foreign banks are more efficient (Berger, Hasan and Zhou, 2009; Berger et al., 2005; Liu et al., 2020; Chen and Hsu, 2022). Therefore, governments in developing countries have adopted policies to privatise public banks and reduce entry barriers for foreign banks.

The assets of public and private banks increased in tandem until the 2008 Global Financial Crisis (GFC). During the GFC, foreign banks typically reduced their lending to a greater extent than domestic banks (Caparusso and Hardy, 2022; Cull, Peria and Verrier, 2017), even though domestic banks' access to cross-border financing was often more restricted than that of foreign banks. Although the GFC did not lead to a significant change in the ownership structure of banks in developing countries, foreign banks adjusted their balance sheets more rapidly in developing countries with a high share of foreign banks (Mihaljek, 2014).

On the other hand, the importance of publicly owned banks has increased since the GFC. One reason noted in the literature is that they finance their assets largely with deposits, which tend to be sticky – including in crisis periods. Another is that in many countries public banks receive allocations from government budgets to finance targeted programmes in the real economy. By rapidly expanding their assets and branches after the GFC, public banks thus became stronger competitors in many countries' local markets (EBRD, 2020).

The resilience of public banks during the GFC revived the debate on the economic costs and benefits of state-owned banks (Borsuk, Kowalewski and Pisany, 2022). One aspect of this debate has been the influence of ownership and management structures on bank profitability. Numerous studies found that public banks tend to be less profitable than either private domestic or foreign banks (Flamini, McDonald and Schumacher, 2009; Micco, Panizza and Yanez, 2007; Bonin, Hasan and Wachtel, 2005; Gupta and Mahakud, 2020). As banks become more profitable and develop a more robust financial structure, they contribute to both financial development and financial stability (Ozili and Ndah, 2021). Therefore, it is crucial to analyse the variables that determine profitability, specifically in relation to bank ownership.

Developments in the Turkish banking sector have followed the global trend. In order to encourage economic growth, especially in the post-2010 period, state-owned banks have been used as an important policy tool for credit expansion. As a result, the weight of public banks in the Turkish banking sector has increased. Economic policies implemented during the GFC and the covid pandemic have made differences in bank management based on ownership even more evident. This study aims to highlight these management factors in explain differences in the profitability of public, domestic and foreign banks operating in Türkiye between 2010 and 2022.

Our study differs from the existing literature in two respects. First, unlike most earlier studies, which focused on the link between the ownership structure and efficiency of banks, we focus on the link between differences in managerial structure and profitability of banks. Second, we analyse factors affecting bank profitability on a bank-by-bank basis by using a seemingly unrelated regression (SUR) framework. We argue that the SUR framework is appropriate due to the oligopolistic structure of the Turkish banking sector. To support and complement the

findings of the SUR estimation, we also include in the model dummy variables to represent different bank types, and use panel data analysis to capture relative differences in profitability. In this way we can more robustly examine the heterogeneity of the determinants of bank profitability.

The remainder of this paper is organised as follows. Section 2 describes some stylised facts on the Turkish banking sector and its ownership structure. Section 3 reviews the relevant empirical literature. Section 4 describes the data and the empirical framework. Section 5 presents and discusses the estimation results. Section 6 concludes.

## 2 STYLISTED FACTS ON THE BANKING SECTOR IN TURKIYE

The financial sector in Turkiye is bank-based (BAT, 2021) and the most important source of external finance for the private sector is bank loans. Restrictions on foreign entry in the pre-1980 period allowed domestic commercial banks to operate in an oligopolistic structure with almost no competition. In the post-1980 period, liberalisation and deregulation aimed at integrating domestic banks with the global financial system, and providing greater diversity in money and capital market instruments, resulted in greater competition, as new domestic and foreign banks entered the market (BAT, 2019: 21).

The financial fragility of the banking sector increased during the 1990s. Public banks were exposed to high interest rate risk due to the large holdings of public debt instruments in their portfolios. Private banks were more exposed to exchange rate risk due to their open foreign exchange position (Akçay, 2011). The sudden increase in interest rates and a sharp depreciation of the exchange rate in 2001 weakened the financial structure of both public and private banks, resulting in a banking crisis (Akyüz and Boratav, 2003). A significant part of the stand-by agreement signed with the IMF consisted of banking sector restructuring (Özatay and Sak, 2002). Regulation of foreign currency positions, connected lending practices, and capital adequacy criteria were considerably strengthened. Basel II was taken as an international benchmark to determine the regulatory framework. Foreign bank participation increased as a result, including in domestic majority-owned banks. Although the number of public banks remained constant, their relative share in the sector decreased until the GFC.

In the aftermath of the GFC, quantitative easing policies of major central banks and falling global interest rates led to a decrease in interest rates and rapid credit expansion in Turkiye. Government policies contributed to the expansion in 2018, for example, a state-backed Credit Guarantee Fund was established to support credit to small and medium-sized enterprises (Orhangazi and Yeldan, 2021). In 2020, public banks played a leading role in credit expansion aimed at alleviating the damage caused by the covid pandemic. These developments increased the weight of public banks in the banking sector. Separately, the central bank and the Banking Regulation and Supervision Agency (BRSA) implemented a set of

regulations that compelled domestic private banks to lend more (BAT, 2020). These generally increased the operational costs and the complexity of risk management for domestic private banks, making it easier for public banks to attract deposits. As a result, the share of assets, loans and deposits of publicly owned banks increased further, to over 40% of the banking sector total in 2021.

Table 1 presents the main indicators of performance for deposit banks operating in Türkiye. Public banks differ from domestic private and foreign banks in several respects. Although they expanded strongly in terms of asset, loan and deposit shares in the sector after the GFC, they had the lowest equity, asset and branch profitability in the sector. In terms of foreign currency net general position, public banks and domestic and foreign banks were similar in the 2000s, but after 2010 private domestic and foreign banks showed much higher foreign net currency surplus.

Although the banking sector as a whole strengthened considerably after the 2001 restructuring programme, public banks were unable to increase their profitability and efficiency sufficiently. In addition, their capital adequacy ratio, which reached 50% after recapitalisation in 2002, decreased in the following years and was below the sector average as of 2021.

Public banks use deposits as a source of funding to a greater extent than private domestic and foreign banks. Similarly, the share of domestic currency deposits in total deposits, and the share of domestic currency loans given in total loans were higher for public than private banks.

The ratio of non-performing loans (NPL) to total loans in public banks increased well above that in private banks after the 2001 crisis, decreasing gradually in the following years. During the downturn in 2018, many public bank loans were restructured, so by 2021 the NPL ratio was lower in public than in private banks.

The liquidity ratio of public banks was below the sector average in 2021, and their interest expenses were higher as a share of total expenses than those of domestic and foreign private banks. Interest income as a share of total revenue was higher for public banks as private banks generated much more non-interest income. Private domestic and foreign banks thus had much higher interest margins than public banks.

Finally, the number of employees and branches per bank was much higher for public than private banks. Foreign banks operated with the smallest number of branches and employees per bank.

**TABLE 1**  
*Selected indicators of commercial banks in Türkiye*

	Public banks			Domestic private banks			Foreign banks			All deposit banks		
	2002	2010	2021	2002	2010	2021	2002	2010	2021	2002	2010	2021
Average return on equity (%)	50	17	15	20	18	20	33	17	19	23	18	18
Foreign currency net general position / Equity (%)	2*	1	1	1*	0	10	4*	-1	9	0*	0	7
Average return on equity (%)	16	23	6	16	18	18	6	11	17	8	18	14
Average return on assets	2	2	0	2	2	2	1	1	2	1	2	1
Turkish lira deposits / Total deposits (%)	63	78	41	31	64	34	18	67	32	42	70	37
Turkish lira loans / Total loans (%)	75	79	69	34	65	62	44	82	58	43	72	64
Loans/Deposits (L/D) (%)	22	70	88	43	90	89	73	106	89	35	80	89
Non-performing loans (NPL) / Total loans (%)	13	0	3	4	0	4	1	1	4	7	1	4
Interest income / Interest expenses (%)	131	184	147	144	200	186	234	252	209	137	202	170
Interest expenses / Total assets (%)	23	4	5	11	4	4	8	4	3	15	4	4
Interest income / Total revenue (%)	91	86	98	82	75	86	75	87	80	87	80	89
Interest expenses / Total expenses (%)	85	71	90	72	59	80	51	47	78	77	61	84
Liquid assets / Short-term liabilities (%)	56	45	24	80	57	34	80	62	42	74	54	32
Total loans / Total assets (%)	14*	48	58	32*	52	54	39*	58	56	54*	48	56
Total deposits / Total assets	72	77	66	70	62	61	52	58	58	70	66	64
Net profit per branch (million TL)	1	3	3	1	3	11	0	1	11	0	2	8
Employment ('000)	40	47	62	67	84	66	5	42	52	118	173	180
Number of branches per bank	673	915	1,238	183	417	446	464	123	115	152	294	306

\*The data are for 2003.

Sources: The Banks Association of Türkiye 2002, 2010, 2021; Banking Regulation and Supervision Agency (BRSA); Banking Sector Data; Banking System in Türkiye (from 1958 to 2021).

### 3 LITERATURE REVIEW

#### 3.1 BANK-RELATED DETERMINANTS OF PROFITABILITY

The bank-related factors that determine the profitability of banks consist of the active and passive items of the bank's balance sheet. Banks' efforts to achieve high returns with the least risk by utilizing their various resources in alternative investment areas constitute asset management, and their efforts to raise funds with the least cost constitute liabilities management. Equity is an endogenous variable that determines the profitability of banks. It is considered a tool that guarantees the bank's ability to protect itself against risk (Demirgüç-Kunt, Detragiache and Merrouche, 2013). The relationship between equity and profitability is controversial, as previous empirical findings have shown. For instance, Iannotta, Nocera and Sironi (2007) analysed 180 banks from 15 European countries and found that equity increases profitability in both public and private banks. In their study of Pakistani banks from 2011-2014, Waleed, Shah and Mughal (2015) found that the variable of equity/total assets has a greater impact on the profitability of private banks than that of public banks. Chortareas, Girardone and Ventouri (2012) found that equity has a positive effect on profitability. In contrast, Bitar, Pukthuanthong and Walker (2018) discovered a negative effect of high levels of equity on the profitability of public and private banks with high liquidity in their study of European banks from 1999-2013. In a study with comparable results, Goddard et al. (2013) concluded that the capital ratio negatively affects profitability. This indicates that banks with higher capital have lower risk levels and therefore earn lower returns.

Results regarding the relationship between non interest income (NNI) and profitability vary in the literature. NNI activities can have a positive impact on bank profitability by being less sensitive to changes in interest rates and the economic conjuncture and by allowing banks to benefit from scope economies through diversification (Hsieh, Chen and Lee, 2013; Berger, Hasan and Zhou, 2010). Expanding NNI activities, on the other hand, may entail an increase in fixed expenses (for example, new employees), which increases banks' operating leverage (Stiroh, 2004). Diversification may cause managers to work beyond their areas of competence and banks to abandon sectors where they have a comparative advantage (Adesina, 2021; Vidyarthi, 2020; Abedifar, Molyneux and Tara, 2018). There are studies in the literature showing that the relationship between non-interest income and bank performance differs according to the ownership structure of the bank. It is seen that public banks benefit less from non-interest income than domestic and foreign banks (Ahamed, 2017; Tan, 2020). Additionally, Abugri, Osah and Andoh (2016) found that non-interest income does not differ on bank performance in terms of domestic and foreign banks.

The credit-deposit ratio is the ratio of bank loans created from deposits, in other words, the lending capacity of banks. A high ratio indicates that banks generate more loans from their deposits. This ratio reflects a bank's ability to use its existing resources optimally (Ramchandani and Jethwani, 2017). Since loans are the

primary source of income for banks, a high credit-deposit ratio means that deposits are used better and generate higher earnings (Biswal and Gopalakrishna, 2014; Gurung and Gurung, 2022). However, it can lead to significant credit misallocation when politicians use state bank loans to secure political patronage (Carvalho, 2014; Laidroo, 2016). Therefore, for public banks, there may be an inverse relationship between the loan-to-deposit ratio and bank performance. Domestic banks have more precise information about the market in which they operate than foreign banks. Foreign banks may be reluctant to lend to small and medium-sized firms due to an information disadvantage. However, the global advantages hypothesis suggests that foreign banks may have better risk management and operational techniques (Garcia and Trindade, 2019; Rosalina and Nugraha, 2019). For this reason, the ownership structure can affect banks' lending decisions and thus their risk management. Athanasoglou, Brissimis and Delis (2008) reported that loan/deposit ratio increases the profitability of private banks. Aydemir, Övenç and Koyuncu (2018) reported an inverted U-shaped relationship between loan/deposit ratio and profitability.

A negative or positive relationship between bank size and profitability can be expected. Large banks can benefit from scale economies by keeping their costs low and also earn very high profits by using their market power in pricing their products if they have well-differentiated products. However, small banks can increase their profitability by serving more risky customers and applying higher rates to loans, thus earning higher interest income (Liu and Wilson, 2010; Afanasiyeff, Lhacer and Nakane, 2002; Ejoh and Sackey, 2014).

In their study of six Eastern European countries, Kořak and Āok (2008) discovered that market share had a positive impact on profitability for the entire sample of banks. However, a negative relationship was statistically significant for a subsample of foreign banks. This outcome has been attributed to the above-average growth of foreign-owned banks, usually immediately after entering the market. Pasiouras and Kosmidou (2007) found that the profitability of European banks is positively affected by their size. This is because larger banks tend to have a higher level of product and loan classification than smaller banks, which enables them to benefit from economies of scale. Micco, Panizza and Yanez (2007) state that the size of the bank does not affect the return on assets, as the estimated coefficient is not statistically significant. Empirical evidence suggests that whether a bank is privately or state-owned impacts its financial outcomes. Similarly, some studies report an insignificant relationship between bank profitability and bank size (Goddard, Molyneux and Wilson, 2004; Athanasoglou, Brissimis and Delis, 2008).

### 3.2 MACROECONOMIC DETERMINANTS OF PROFITABILITY

The relationship between economic growth and bank profitability is inconclusive. A rise in the rate of growth will result in an increase in the sector's activities, which will benefit profitability (Hasan, Manurung and Usman, 2020). When the economy is doing well, both the rise in client deposits and loans and the increase



in interest margins benefit bank profitability (Petria, Capraru and Ihnatov, 2015). Another key reason that bank profits rise in tandem with economic expansion is that fewer loans default during periods of rapid growth (Vejzagic and Zarafat, 2014). Bertay, Demirgüç-Kunt and Huizinga (2012) examined state-owned banks in 111 countries in the period 1999-2010 and found that the loans given by public banks were less cyclical than those of private banks. Moreover, loans issued by state-owned banks in high-income countries are counter-cyclical. Numerous studies have found a negative correlation between economic growth and the performance of public banks (Laidroo, 2016; Ferri, Kalmi and Kerola, 2014).

The exchange rate and bank profitability are related in both direct and indirect ways. A direct negative effect on the bank balance sheet occurs when the bank has more foreign currency liabilities than foreign currency assets and the local currency depreciates unexpectedly. On the other hand, even if the bank is not in a foreign exchange open position, banks are indirectly exposed to exchange rate risk in the case of default of bank loans because real sector firms carry large amounts of net foreign currency debt, especially in developing countries (Hahm, 2004). Kořak and Āok (2008) found that the depreciation of the national currency positively affects the profitability of the entire banking sector, while the exchange rate variable is insignificant for domestic banks. Acaravcı and Calım (2013) found that the effect of real exchange rate on bank profitability in Türkiye for the period 1998-2011 was positive for public and foreign banks and insignificant for domestic private banks.

There are different views on the effect of inflation on bank profitability. The dominant view is that the relationship is positive. This argument relies on the assumption that bank income grows faster than bank costs in an inflationary environment. High inflation rates are often linked to high interest rates on loans and consequently high income. However, when inflation is unforeseen and banks are slow to adjust interest rates, there is a risk that bank costs will rise faster than income and thus negatively affect profitability. Unexpected inflation may also cause debtors to have difficulty in paying, resulting in credit losses. At the same time, bank costs tend to increase with inflation. More transactions can lead to higher labour costs (Demirgüç-Kunt and Huizinga, 1999; Vong and Chan, 2009). High inflation can weaken the domestic currency, so that profits of banks with open foreign exchange positions may decrease due to exchange rate losses. Inflation may also lead to slower output growth, weaker growth of deposits and loan demand, and a decrease in profitability. Empirical studies have found both negative (Rahman, Hamid and Khan, 2015; Aftab, Samad and Husain, 2015; Supriyono and Herdhayinta, 2019) and positive effects of inflation on bank profitability (Sufian, 2009; Rose and Wieladek, 2012; Al-Jafari and Alchami, 2014).

## 4.1 DATA

This study aims to examine the internal and macroeconomic determinants of profitability in the banking sector in Türkiye according to ownership structure by using seemingly unrelated regression analysis. Monthly data covering the period from 2010M1 to 2022M12 are used for this purpose. The variables and their abbreviations are shown in table 2.

TABLE 2

*Variable definitions*

Notation	Definition	Source
ROE	Return on equity (Net income / Total equity)*100	TBA
EQUITY	The ratio of equity to total assets (Equity / Total assets)	TBA
NNI	Non-interest income (Fees and commission income / Total assets)*100	TBA
CUR	Rate of capacity utilisation (%) (proxy for economic growth on a monthly basis)	CBRT
RER	Real effective exchange rate (2003=100)	CBRT
INF	Inflation rate (%)	CBRT
SIZE	Logarithm of the ratio of assets by ownership to total assets (%)	TBA
CREDIT/DEPOSIT	Loan-to-deposit ratio (Total loans / Total deposits)	TBA

Return on equity is used as the dependent variable and the bank-related variables are the ratio of equity to total assets, the ratio of fee and commission income to total assets and the ratio of total loans to total deposits. In addition, the logarithm of the share of assets of public, domestic private and foreign banks in sector assets is used as an indicator of bank size. These variables are obtained from the Turkish Banks Association database in an aggregated form. Macroeconomic variables are the industrial sector capacity utilization rate as a proxy for economic growth, real effective exchange rate (RER), and inflation rate. These variables are taken from the CBRT database. Table 3 presents the descriptive statistics of the variables used in this study.

TABLE 3

*Descriptive statistics*

Variable	N	Mean	Std. dev.	Min.	Max.
ROE	468	8.4	5.7	0.003	36.5
EQUITY	468	0.1	0.02	0.1	0.15
NNI	468	12.2	3.1	6.1	18.8
CUR	468	75.3	3.7	67.8	81.9
RER	468	95.1	18.4	53.5	126.5
INF	468	15.2	16.9	3.9	85.5
SIZE	468	13.3	0.8	11.5	14.9
CREDIT/DEPOSIT	468	1.1	0.2	0.5	1.2

#### 4.2 EMPIRICAL FRAMEWORK

Regression analysis is used to determine the cause-effect relationship between two or more variables and to make predictions based on this relationship. Some problems encountered in daily life can be solved by using linear regression models and obtaining statistical results. Sometimes, multiple models can be encountered and there can be individual relationships between these models. These models, although they may seem unrelated to each other, can contain different dependent variables in the system of linear regression models and have error terms that are correlated with each other. Especially, situations related to models that use the same data set or models that have some independent variables in common with other models can be encountered. Such situations are called seemingly unrelated regression (SUR) models. SUR models are models that allow for correlated errors between equations. In other words, as much as possible, SUR models take into account the interactions between statistical data that are difficult to perceive. These models were first proposed by Zellner (1962). A general approach to SUR models is to combine these models as a system instead of treating them separately. According to this approach, the models are combined using block matrices. Therefore, it is important to present the results related to the SUR model and the parameter estimates under this model clearly (Zellner, 1962). The SUR model is a system of equations that contains multiple multivariate equations. Each equation is a linear and multivariate regression equation and there is usually no connection between the equations. If there is a neglected variable in any equation, the effect of this variable appears in the error term. If this variable is highly correlated with one of the explanatory variables of the other equations, a connection between the error terms or an existing connection is strengthened (Elhorst, 2003).

Such regression equations with associated error terms are frequently encountered in economic models. Equations related to error terms can be seen in the demand functions of various goods or the production functions of various industries. For example, the error term of the demand function for good A can be associated with the error terms of the demand functions for goods B and C. In addition, the SUR model can be encountered when the dependent and independent variable data are time series or survey data (Youssef, Abonazel and Kamel, 2022).

The SUR model can be defined as follows using  $n$  regression models:

$$\left. \begin{aligned} y_{1t} &= \beta_{10} + \beta_{11}X_{1t,1} + \beta_{12}X_{1t,2} + \dots + \beta_{1k}X_{1t,k} + u_{1t} \\ y_{2t} &= \beta_{20} + \beta_{21}X_{2t,1} + \beta_{22}X_{2t,2} + \dots + \beta_{2k}X_{2t,k} + u_{2t} \\ y_{nt} &= \beta_{n0} + \beta_{n1}X_{nt,1} + \beta_{n2}X_{nt,2} + \dots + \beta_{nk}X_{nt,kn} + u_{nt} \end{aligned} \right\} t = 1, 2, \dots, n \quad (1)$$

The regression equations given above can be expressed in matrix form as follows:

$$\begin{bmatrix} Y_1 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ Y_N \end{bmatrix} = \begin{bmatrix} x_1 & 0 & \cdot & \cdot & \cdot & 0 \\ 0 & x_2 & \cdot & \cdot & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & \cdot & \cdot & \cdot & x_N \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \cdot \\ \cdot \\ \cdot \\ \beta_N \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \\ \cdot \\ \cdot \\ \cdot \\ u_N \end{bmatrix}$$

In the matrix, the dimension of the  $yn$  matrix is  $(TN \times 1)$ , the dimension of the  $xn$  matrix is  $(TN \times K)$ , the dimension of the  $\beta n$  matrix is  $(K \times 1)$  and the dimension of the  $un$  matrix is  $(TN \times 1)$  (Wang and Kockelman, 2007). There are five basic assumptions of the SUR model. These assumptions can be expressed as follows.

$$\text{Cov}(u_{it}, u_{jt}) = E(u_{it}u_{jt}) = \sigma_{ij}, \quad i \neq j, \quad t = 1, 2, \dots, n, \quad i, j = 1, 2, \dots, N \quad (2)$$

According to this assumption, there is a relationship between the error terms of the equations in the same period.

$$\text{Cov}(u_{it}, u_{jt}) = \text{Var}(u_{it}) = \sigma_{ij} \quad (3)$$

According to this assumption, the constant variance condition is valid for the equations in the model.

$$\text{Cov}(u_{it}, u_{js}) = E(u_{it}u_{js}) = 0, \quad t \neq s \quad (4)$$

There is no relationship between the error terms of the equations in different periods.

The error terms follow a normal distribution.

$$E(u_i) = 0, \quad i = 1, 2, \dots, n \quad (5)$$

According to this assumption, the expected value of the error term for each equation is zero.

In addition to the five basic assumptions of the SUR model expressed above, it is also necessary to ensure that the time dimension is larger than the unit dimension ( $T > N$ ) in the SUR model (Kmenta and Gilbert, 1968).

Following the theoretical information presented in the methodology section, we will first estimate the model using SUR estimation. This approach is essential because the interdependence between the error terms can lead to biases in the regression results when using common arguments in the models. Additionally, we will predict the model using the panel data approach. By using both panel data models and the SUR model, we aim to facilitate meaningful comparisons and reduce potential biases.

## 5 ESTIMATION RESULTS

The correlation matrix between the error terms obtained from the models for the public, foreign private, and domestic private deposit banks operating in Türkiye and the Breusch-Pagan test results indicating cross-sectional dependence are given in table 4.

**TABLE 4**

*Correlation matrix of error terms obtained from models related to banks*

	ROE <sub>1</sub>	ROE <sub>2</sub>	ROE <sub>3</sub>
ROE <sub>1</sub>	<b>1.000</b>		
ROE <sub>2</sub>	0.668	<b>1.000</b>	
ROE <sub>3</sub>	0.826	0.908	<b>1.000</b>
Breusch-Pagan test of independence: $\chi^2(45) = 337.742$			Pr = 0.000

According to the correlation matrix, there is a very high degree of relationship between the error terms of the three types of banks. There is a 66.83% relationship between the error terms obtained from the model for public banks and the error terms obtained from the model for foreign banks. There is an 82.67% relationship between the error terms obtained from the model for public banks and the error terms obtained from the model for domestic private deposit banks. There is also a very high correlation relationship of about 90.81% between the error terms obtained from the models for foreign private and domestic private deposit banks. The high correlation relationship between the error terms obtained from the models for the banks indicates that the results obtained from the normal regression model are not appropriate. In addition, according to the Breusch-Pagan Cross-Sectional Dependence test results, the null hypothesis that there is no cross-sectional dependence has been rejected. That is, there is a relationship between the error terms obtained from the models for different types of banks. In this context, since the error terms in the equations related to the sample banks in this study are related to each other, that is, there is cross-sectional dependence, the “Seemingly Unrelated Regression (SUR)” estimation method can be used (Tatoğlu, 2012).

**TABLE 5**

*Pesaran and Yamagata (2008) test results*

	Delta	P-value
$\Delta$	4.527	0.000
Adj- $\Delta$	4.665	0.000

The results of the Pesaran and Yamagata test to test the homogeneity of the slope coefficients are summarized in table 5. According to the results obtained, the probability values of the test statistics are less than 0.05. That is, the null hypothesis H<sub>0</sub> which states that the slope coefficients are homogeneous is rejected. As a result, it is appropriate to use the SUR model in this study. This finding supports the correlation matrix and the Breusch-Pagan cross-sectional dependence tests.

TABLE 6

*Overall statistical significance of equations*

Equation	RMSE	R <sup>2</sup>	Chi <sup>2</sup>	Probability
ROE <sub>1</sub>	0.989	0.717	59.07	0.000
ROE <sub>2</sub>	0.735	0.723	62.82	0.000
ROE <sub>3</sub>	0.739	0.716	51.78	0.000

The general model results obtained for each type of bank are shown in the table 6. According to the results, the model results obtained for each type of bank are statistically significant. In addition, the explanatory power of the model results for public banks (71.7%) is higher than the explanatory power of the models for foreign private (72.3%) and domestic private banks (71.6%).

TABLE 7

*Panel SUR estimations for Turkish banks*

Dependent variable	Independent variables	Coefficient		
		Public	Foreign	Domestic private
ROE	EQUITY	8.232 (5.542)	22.443*** (3.715)	9.377** (4.101)
	NNI	0.154** (0.067)	0.029** (0.015)	0.105*** (0.028)
	CUR	0.049 (0.045)	0.077*** (0.018)	0.065*** (0.017)
	RER	-2.159** (1.036)	-3.135*** (1.353)	-3.047*** (1.026)
	INF	-0.027*** (0.007)	-0.004* (0.019)	-0.047** (0.013)
	SIZE	0.536** (0.218)	-0.038 (0.112)	0.017 (0.272)
	CREDIT/DEPOSIT	-2.053*** (0.725)	0.267* (0.128)	-2.349*** (0.539)
	Constant	3.428 (3.572)	14.761*** (4.551)	11.672* (5.852)

Note: \*10% level, \*\*5% level, \*\*\*1% level.

According to our findings, RER, INF and NNI variables have common effects regardless of bank ownership. The NNI variable positively affects profitability in public, domestic, and foreign private banks, while the RER and INF have a negative effect. The high inflationary environment experienced in the Turkish economy in recent years negatively affects the profitability of commercial banks regardless of ownership. These results are consistent with the studies of Rahman, Hamid and Khan (2015); Aftab, Samad and Husain (2015); Supriyono and Herd-hayinta (2019). A decrease in the real exchange rate (i.e. an appreciation of the foreign currency) leads to an increase in bank profitability. This relationship is confirmed by the existence of a surplus in the foreign currency position in the

banking sector in Türkiye, which is a result of regulations on foreign currency position and good management of exchange rate risk in the sector. In the model results, the RER variable is significant at 1% for domestic private and foreign banks, and significant at 10% for public banks. Regarding ownership structure, it is noteworthy that private banks tend to have a higher excess foreign currency position compared to public banks, which has a greater impact on their profitability. In Türkiye, public banks have been conducting foreign exchange sales in recent years to prevent the depreciation of the national currency. This practice has a negative impact on the foreign currency position of state banks.

The positive relationship between NNI, which is an internal variable, and bank profitability shows that commercial banks in Türkiye increase their profitability through diversification. These results are consistent with the studies of Hsieh, Lee and Shen (2023) and Berger, Hasan and Zhou (2010). Our finding that NNI increases profitability raises a very important implication for bank managers. In recent years in particular, regulations on the Turkish banking sector by policymakers have been aimed at affecting bank balance sheets. Therefore, commercial banks can take measures against regulations that reduce their profitability and increase their risks by increasing their activities related to NNI.

The effect of capital ratio, bank size, loan-to-deposit ratio, and CUR utilization rate variables on bank profitability varies according to bank ownership. Capital ratio is a significant variable that increases profitability for domestic private and foreign banks, while no significant relationship has been found for public banks. The low asset profitability and high financial leverage ratios of public banks compared to domestic private and foreign banks indicate that public banks in Türkiye cannot benefit from the financial leverage effect. At the same time, it can be said that the prudent attitude of the managements of domestic private and foreign banks on capital adequacy is positively reflected in bank profitability. Moreover, the insignificance of the relationship between equity and profitability for public banks points to an implicit guarantee that the losses of state-owned banks in Türkiye are covered by the state and that public banks do not face a liquidity problem.

The relationship between the Credit/Deposit variable and profitability is negative for public banks and domestic private banks, and positive for foreign banks. In Türkiye, the ratio of foreign sources to total assets of foreign banks is higher than public and domestic private banks (BAT, 2022). Therefore, foreign banks' cost of funds is lower. According to the BRSA data for our analysis period, both the amount of non-performing loans (NPL) and the amount of provisions allocated for NPL is lower in foreign banks than in public and domestic private banks. Our finding shows that foreign banks manage their funding costs and credit risks better than public and domestic private banks. Therefore, public and domestic private banks need to do better risk analysis when they increase the amount of loans they give. Otherwise, their profitability will be negatively affected. Our findings are in line with Garcia and Trindade (2019); Rosalina and Nugraha (2019) and confirm the global advantages hypothesis.

It is seen that as the size of public banks increases, their profitability also increases. No significant relationship has been detected between the bank size and profitability of domestic private and foreign banks. Considering that the three public banks operating in Türkiye are the first three banks in terms of asset size in the market, the existence of a positive relationship between size and profitability for public banks indicates that public banks benefit positively from scale economies. However, public banks have lower asset and equity profitability than domestic, private and foreign banks. In this case, it can be said that public banks cannot reflect the advantage they gain from economies of scale in profitability. Our findings are consistent with Pasiouras and Kosmidou (2007); Goddard, Molyneux and Wilson (2004) and Athanasoglou, Brissimis and Delis (2008).

One of the macroeconomic variables added to the model to represent economic growth, the industrial sector capacity utilization rate (CUR) variable, has been found to have a positive and significant relationship with the profitability of domestic private and foreign banks. No relationship has been detected between CUR and public bank profitability. This finding, which indicates the independence of public bank profits from the business cycle, points to the fact that the government uses public banks as a counter-cyclical policy tool.

**TABLE 8**  
*Panel SUR-MG results*

Variable	Coefficient	Standard error	t-statistic
EQUITY	13.351	1.915	6.972***
NNI	0.096	0.025	3.884**
CUR	0.064	0.017	3.719**
RER	-2.780	0.663	-4.193***
INF	-0.026	0.008	-3.242**
SIZE	0.172	0.122	1.407
CREDIT/DEPOSIT	-1.378	0.304	-4.532***
Constant	9.954	2.743	3.629**

Note: \*10% level, \*\*5% level, \*\*\*1% level.

Table 8 shows the results of Panel SUR-MG estimation, which indicate a positive and significant relationship between profitability and the variables EQUITY, NNI, and CUR. Conversely, a negative and significant relationship was found with the variables INF, RER, and CREDIT/DEPOSIT. No relationship was detected between profitability and the SIZE variable.

This study examines the profitability of banks in Türkiye using the SUR model. The SUR model should theoretically produce similar results to the panel data model. The data in the estimated panel model is divided into clusters, equal to the number of units, for appropriate analysis. In the other hand, the panel model provides common results for general data. In other words, the working mechanism of both the SUR model and the panel data model are similar. Therefore, the



coefficient and significance levels obtained will be close and compatible with each other. Thus, the SUR model results have been supported by the panel data analysis. The econometric model examined in the study is discussed below within the scope of panel data analysis.

$$\begin{aligned} \text{ROE} = & \alpha_0 + \alpha_1 \text{EQUITY} + \alpha_2 \text{NNI} + \alpha_3 \text{CUR} - \alpha_4 \text{RER} - \alpha_5 \text{INF} + \alpha_6 \text{SIZE} \\ & - \alpha_7 \text{CREDIT/DEPOSIT} + \beta_0 \text{FOREIGN} + \beta_1 \text{EQUITY*FOREIGN} - \\ & \beta_2 \text{NNI*FOREIGN} - \beta_3 \text{CUR*FOREIGN} - \beta_4 \text{RER*FOREIGN} - \\ & \beta_5 \text{INF*FOREIGN} - \beta_6 \text{SIZE*FOREIGN} + \beta_7 \text{CREDIT/} \\ & \text{DEPOSIT*FOREIGN} + \gamma_0 \text{DOMESTIC} + \gamma_1 \text{EQUITY*DOMESTIC} - \\ & \gamma_2 \text{NNI*DOMESTIC} + \gamma_3 \text{CUR*DOMESTIC} - \gamma_4 \text{RER*DOMESTIC} - \\ & \gamma_5 \text{INF*DOMESTIC} - \gamma_6 \text{SIZE*DOMESTIC} - \gamma_7 \text{CREDIT/} \\ & \text{DEPOSIT*DOMESTIC} \end{aligned}$$

The model includes the variable “FOREIGN”, which is a dummy variable that takes the value “1” if the bank is foreign. Similarly, the variable “DOMESTIC” is a dummy variable that takes the value “1” if the bank is a domestic private bank. The  $\alpha$  coefficients in the model represent the results for public banks when the dummy variables “FOREIGN” and “DOMESTIC” are “0”. The model results for foreign and domestic private banks vary depending on the value of the dummy variables. Table 9 presents the results of the panel model for all banks.

**TABLE 9**  
*Results of panel model estimation*

Dependent variable: ROE	Fixed effects model	
	Coefficient	Standard error
EQUITY	8.404	(7.357)
NNI	0.163*	(0.063)
CUR	0.052	(0.047)
RER	-1.003**	(0.312)
INF	-0.021***	(0.002)
SIZE	0.423*	(0.218)
CREDIT/DEPOSIT	-0.631**	(0.211)
<b>Foreign</b>	9.193*	(4.582)
EQUITY*FOREIGN	22.630***	(3.722)
NNI*FOREIGN	0.021*	(0.063)
CUR*FOREIGN	0.051**	(0.147)
RER*FOREIGN	-3.045*	(1.027)
INF*FOREIGN	0.044**	(0.003)
SIZE*FOREIGN	0.219	(0.372)
CREDIT/DEPOSIT*FOREIGN	0.234*	(0.382)
<b>Domestic</b>	8.705*	(4.168)
EQUITY*DOMESTIC	9.412*	(0.482)
NNI*DOMESTIC	0.150	(0.081)
CUR*DOMESTIC	0.087*	(0.013)
RER*DOMESTIC	-3.025**	(0.947)

Fixed effects model		
Dependent variable: ROE	Coefficient	Standard error
INF*DOMESTIC	-0.039*	(0.005)
SIZE*DOMESTIC	0.940	(0.958)
CREDIT/DEPOSIT*DOMESTIC	-2.969**	(1.358)
Constant	4.791*	(2.268)
Model specification		
R <sup>2</sup>	71%	
Overall F-stat/Wald	6.48***	

Note: \*10% level, \*\*5% level, \*\*\*1% level.

Table 9 presents the relevant equations for public, foreign, and domestic private banks respectively. This allows for a comparison with the SUR estimation results in table 7. The equations for all three bank types are provided, taking into account the values of the dummy variables.

## 6 CONCLUSION

This paper examined the determinants of Turkiye's banking sector profitability in 2010-20 depending on ownership structure of banks. The seemingly uncorrelated regression method was used with aggregate monthly data. Our results showed that bank-related and macroeconomic variables generally affected bank profitability differently depending on ownership structure and management practices. Only the real effective exchange rate, inflation, and non-interest income had similar effects on profitability irrespective of bank ownership. This suggests that exchange rate risk was well managed in the banking sector, and that all banks benefited from asset diversification.

Other macroeconomic and bank-specific factors – the capital ratio, the loan-to-deposit ratio, and macroeconomic conditions (proxied by the capacity utilisation rate) – affected profitability differently across public, domestic private, and foreign banks.

The capital ratio was a significant determinant of profitability of domestic private and foreign banks, but had no statistically significant effect on the profitability of public banks. One reason could be that public banks in Turkiye collected deposits at rates above and extended loans at rates below the sector average in order to support government policies. This gradually weakened their capital, requiring intermittent capital injections from the Ministry of Treasury and Finance, financed by domestic borrowing. Using public banks in pursuit of government policy goals not only led to additional interest burden on government budget, but also narrowed the room for manoeuvre of fiscal policy in the fight against inflation.

Another notable finding related to government policies is that the loan-to-deposit ratio was negatively correlated with profitability of public and domestic private banks, but positively correlated with profitability of foreign banks. This suggests

that government regulations forcing public and domestic private banks to lend placed them at a competitive disadvantage relative to foreign banks. This had not only weakened the domestic banking sector but may have also affected macroeconomic stability through second-round effects of credit expansion on inflation. It would therefore be important to adjust government policies and banking regulation in a way that provided incentives for banks to strengthen their management of funding costs and credit risk, rather than forced them to lend more to the private sector.

Macroeconomic conditions, proxied by the capacity utilisation rate in the economy, had a positive and statistically significant effect on the profitability of domestic private and foreign banks, but no discernible effect on that of public banks. This finding clearly points to the use of public banks as a counter-cyclical policy tool.

### **Disclosure statement**

The authors have no potential conflict of interest to report.

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