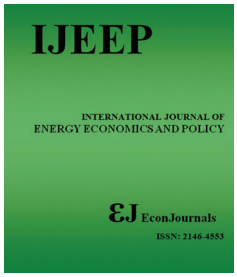

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2024, 14(6), 492-500.

The Impact of Energy Prices on the Performance of Banks in Türkiye

Samet Evci[1]*, Irem Kefe[2], Ilker Kefe[1]

[1]Faculty of Economics and Administrative Sciences, Osmaniye Korkut Ata University, Osmaniye, Türkiye, [2]Faculty of Health Sciences, Osmaniye Korkut Ata University, Osmaniye, Türkiye. *Email: sametevci@osmaniye.edu.tr

Received: 21 August 2024 **Accepted:** 23 October 2024 **DOI:** https://doi.org/10.32479/ijeep.17512

ABSTRACT

The aim of this study is to identify the direct and indirect effects of energy price changes on the financial performance of commercial banks operating in Türkiye. In this context, the impact of energy price changes on the return on assets and return on equity of 21 commercial banks operating between 2003 and 2022 is analyzed using the bias-corrected least-squares dummy variable (LSDVC) estimator. The model includes bank-specific variables such as net interest margin, the capital adequacy ratio, the ratio of total loans and receivables to total assets, the ratio of liquid assets to total assets, and the ratio of non-interest income to total assets. To identify indirect effects, macroeconomic variables such as gross domestic product and inflation rates are also included in the model. The findings reveal that energy prices have a direct and positive effect on the return on assets of banks, while showing no effect on return on equity. Given the limited studies examining the impact of energy price changes on the Turkish banking sector, the findings of this study may be beneficial in formulating measures and regulations regarding the stability of the banking sector.

Keywords: Energy Price Changes, Bank Performance, LSDVC Approach
JEL Classifications: G21, Q41, Q43, C23.

1. INTRODUCTION

Crude oil and natural gas are energy sources that play a key role in production processes and are vital in promoting economic growth (Narayan and Gupta, 2015). Therefore, price changes in these commodities are closely monitored by both real and financial markets (Narayan and Sharma, 2011). While the effects of energy prices on macroeconomic variables such as investment expenditures, production levels, inflation, interest rates, exchange rates, and stock returns have been empirically proven (Hamilton, 1983; Hamilton, 2009; Narayan and Sharma, 2011; Lee and Zeng, 2011; Basher et al., 2016), there exists limited scholarly research examining the relationship between energy prices and the financial performance of banking institutions (Lee and Lee, 2019; Nasim and Dowing, 2023).

It is generally expected that an increase in energy prices would negatively impact bank performance (Lee and Lee, 2019). This effect can be direct, through the value of bank assets, or indirect via macroeconomic variables that affect the banking sector (Ma et al., 2021; Nasim and Dowing, 2023). High energy prices raise input costs, leading to increased inflationary pressures, higher interest rates, decreased real incomes, reduced consumption expenditures, and economic contraction, which may result in unemployment (Hamilton, 1983; Cunado and Gracia, 2005; Kilian, 2008; Brückner and Ciccone, 2010; Kilian and Vigfusson, 2011). Economic contraction and unemployment may lead to an increase in non-performing loans and a contraction in loan volumes for banks (Poghosyan and Hesse, 2009, Idris and Nayan, 2016). Furthermore, high inflation can exacerbate credit market frictions, negatively affecting bank performance (Huybens and Smith, 1999). The direct effect occurs through the lending channel to firms operating in different sectors. An increase in energy prices, which has a negative impact on many firms, raises banks' credit losses, thus adversely affecting their profitability (Nasim et al.,

2023). Additionally, the direct effect may arise from the impact on the value of banks' assets, particularly those with portfolios consisting of energy-related commodities (Ma et al., 2021). Like all other firms, banks require energy for maintaining operational activities, including the maintenance of branches and offices, as well as the powering of large-scale data centers. An increase in energy prices leads to higher costs associated with these activities. This, in turn, raises the cost income ratio, a widespread measure of banks' efficiency, resulting in decreased operational efficiency and negatively impacting banks' profitability (Nasim et al., 2023).

Banks are intermediary institutions that play a key role in ensuring the flow of funds within the financial system. They contribute significantly to the accumulation of capital by economic units, ensure sustainable economic growth and development, and channel scarce resources into productive areas. In this regard, the financial performance of the banking sector is of great importance to all economies. The global financial crisis of 2008 clearly demonstrated the importance of the sector and the widespread impact of issues within it on all economic units (Nasim and Dowing, 2023). The role of banks is particularly vital in countries like Türkiye, where the financial sector constitutes a significant portion of the economy. In Türkiye, the share of banks in the financial sector was 83% based on asset size in 2022 (Bankalarımız, 2022). Given that Türkiye relies on external sources for approximately 74% of its energy needs, determining the effect of fluctuations in energy prices on the performance of banks, which play a pivotal role in the financial system, is crucial for economic units. In this context, this study analyzes both direct and indirect impacts of energy price changes on the financial performance of the Turkish banking sector.

In recent years, although studies examining the impact of changes in energy prices on the banking sector have been conducted, these studies remain limited. From this perspective, the fact that this study is conducted specifically for Türkiye can contribute to the literature by revealing the potential effects of changes in energy prices on the sector, particularly in countries where the banking sector has a significant share in the financial system and is highly dependent on external energy sources. Additionally, instead of oil prices as a representative measure for energy prices, this study utilizes the more comprehensive energy price index developed by the International Monetary Fund. Thus, the effects of not only oil price changes but also other energy sources will be collectively observed. Furthermore, the study analyzes whether the effect of energy prices on the sector is direct or indirect. With these aspects, the findings of the study may contribute to the decision-making processes of policymakers. The banking sector plays an important role in achieving economic growth. Therefore, understanding the factors that affect the stability of the banking sector, which holds a large share within the financial system, can guide macroprudential policy decisions.

The following sections of the study are structured as follows. The second section provides a review of the relevant literature on the subject. The third section provides information about the methodology and dataset used. The fourth section discusses the findings of the study, while the fifth section offers the concluding remarks.

2. LITERATURE REVIEW

Empirical studies have focused on identifying the effects of bank-specific factors and macroeconomic factors on the financial performance of the banking sector. These studies demonstrate that sector-specific factors such as capital adequacy, asset quality, interest income, non-interest income, personnel expenses, bank size, liquidity, and credit risk (Antwi, 2019; Akkaynak, 2022) as well as macroeconomic or external factors such as national income, exchange rates, interest rates, unemployment rates, and inflation (Jokipii and Monnim, 2013; Iriani and Yuliadi, 2015; Fakhrunnas, 2019; Abaidoo et al., 2023) impact the financial performance of the sector. However, there is a limited number of studies examining the impact of energy prices on the financial performance of the sector (Khandelwal et al., 2016; Miyajima, 2017).

The banking sector is expected to be affected by changes in energy prices through factors that are influenced by energy prices. Recent studies have revealed a negative relationship between energy prices and economic growth (Hamilton, 1983; Hamilton, 1996; Lee and Lee, 2019; Nasim and Dowing, 2023). The reason for this effect caused by rising energy prices is a decrease in purchasing power. High energy prices increase input costs, leading to higher inflation, reduced output, and declining incomes (Du and He, 2015; Lee and Lee, 2019). In addition, rising energy prices cause economic contraction and increase unemployment. Fluctuations in energy prices are indirectly reflected in the banking sector through macroeconomic variables. In addition, energy price changes directly affect the sector through banks' assets. Existing studies support the presence of this effect. These studies have generally used oil prices as a representative measure for energy prices.

Lee and Lee (2019) examine the topic through the banking sector of China, which is the largest energy importer. The study analyzes the impact of oil prices on banks using CAMEL indicators during the period 2000-2014. The findings reveal the presence of this effect. The study emphasizes that an increase in oil prices improves the asset quality of banks, with a stable economic and political system playing a crucial role in this. On the other hand, it concludes that the rise in oil prices negatively impacts management efficiency and the profitability of banks. Since oil is a significant input in production, the increase in prices raises production costs, leading to higher prices, lower demand, and reduced investments. This is expected to result in a decline in both banks' balance sheet and off-balance sheet activities. The weakening of economic activity and the inability of borrowers to fulfill their obligations weakens the banks' balance sheets, while the decrease in demand and investments negatively affects banks' fee income, leading to a reduction in off-balance sheet activities. However, the study states that these adverse effects would diminish if economic and political stability is maintained. Another study on China by Ma et al. (2021) analyzes the impact of oil shocks on the risk of stock returns for Chinese banks during the 2011-2019 period. The findings reveal that oil shocks do not affect the risk levels of public banks but do influence the risk levels of private banks.

Studies examining the issue from the perspective of oil-exporting countries reveal a strong relationship between oil prices and the

banking sector. Poghosyan and Hesse (2009) analyze the effects of oil price fluctuations on the profitability of banks in oil-exporting countries within the Middle East and North Africa (MENA) region from 1994 to 2008. The findings of the study show that oil price shocks indirectly influence bank profitability through country-specific macroeconomic and institutional factors, while the direct impact is found to be insignificant. The study also indicates that investment banks are more affected by oil price shocks compared to Islamic and commercial banks. Al-Khazali and Mirzaei (2017) examine the impact of oil shocks on non-performing loans of banks operating in 30 oil-exporting countries. The findings of the study reveal that, during the 2000-2014 period, oil shocks have an asymmetric effect on banks' non-performing loans, with negative oil price shocks having a greater impact than positive shocks. Al-Khazali and Mirzaei (2017) suggest that the decline in oil prices can adversely affect the operations of companies in oil-exporting countries, leading to difficulties in meeting financial obligations such as bank loans. They state that this situation will increase credit default rates, increase the non-performing loans of banks and negatively affect the financial stability of banks. Another study examining the impact of changes in energy prices on non-performing loans of banks was conducted by Saif-Alyousfi et al. (2018a). The study, covering the period from 2000 to 2016, found that changes in oil and gas prices did not directly affect the non-performing loans of banks operating in Qatar, but had indirect effects through the country's macroeconomic and institutional factors. Furthermore, Saif-Alyousfi et al. (2018a) emphasized that Islamic banks benefited more from the cash flow generated by the rise in oil and gas prices compared to commercial banks, leading to lower non-performing loan ratios for Islamic banks. In another study conducted by Saif-Alyousfi et al. (2018b) on the same country, the impact of changes in oil and gas prices on the deposits of commercial and Islamic banks was investigated. The results of this study indicate that changes in oil and gas prices directly affected the deposits of commercial banks in Qatar. This effect was related to the banks' increased lending activities and, consequently, the rise in economic business activities. On the other hand, the findings reveal that the impact on the deposits of Islamic banks in Qatar was indirect. In other words, this effect was transmitted through the country's macroeconomic and institutional characteristics, reinforced by rising expectations and the overall business climate. Saif-Alyousfi et al. (2021), in their study on Gulf Cooperation Council (GCC) member countries, emphasized that the increase in oil and gas prices had a direct effect on banks' deposits and loans during the period 2000-2017. The study's findings revealed that the negative impact of a decline in oil and gas prices was greater than the positive impact of a rise for GCC countries. It was noted that the negative effect was more significant on Islamic banks, while the positive effect was more pronounced on conventional banks. This was explained by the different business models of the two banking groups. While the traditional banking model is based on lending, the Islamic banking model is founded on investment. The lending operations of conventional banks expand rapidly in parallel with the increase in oil and gas prices, and during this process, banks often engage in excessive lending activities. When oil and gas prices decrease and the economy contracts, this negatively affects the performance of companies and leads to a high proportion of underperforming loans on the balance sheets of conventional banks. This negative development impacts the performance of Islamic banks, which focus more on investment activities, to a greater extent. Nasim and Downing (2023) reveal that the financial performance of 62 banks operating in G7 countries is affected by changes in energy prices. The study, covering the years 2001-2020, finds that increases in energy prices have a negative and direct impact on banks' return on assets and return on equity. Nasim et al. (2023) reach similar conclusions. Nasim et al. (2023), in their study on 48 banks operating in developing countries between 2001 and 2020, find that operational and investment performance of banks and changes in energy prices are negatively correlated. It is stated that energy price changes have a direct relationship with the performance of banks.

Studies on Türkiye reveal that the performance of the banking sector is positively influenced by factors such as the capital adequacy ratio, industrial production index, asset size, non-interest income, net interest margin, the use of derivative instruments, total liquid assets, and inflation rate. On the other hand, it is negatively affected by factors such as the size of the credit portfolio, non-performing loans, inflation rate, and economic growth (Taşkın, 2011; Anbar and Alper, 2011; Acaravcı and Çalım, 2013; Sarıtaş et al. 2016; Erdoğan and Acar, 2020; Kayran and Kıyılar, 2021). However, studies examining the impact of energy prices on the sector's performance are limited. Gülcemal (2022) investigates the effects of changes in oil prices on the performance of banks listed on the Borsa Istanbul Banking Index between 2008 and 2020. According to the analysis results, oil prices have a positive impact on banks' management efficiency and earnings. Additionally, oil prices are found to have a positive effect on asset quality, but the country risk reduces this positive effect. It is suggested that the reason for this effect could be capital injections by the government and interventions in the banking sector.

3. DATA AND METHODOLOGY

3.1. Data

To analyze the impact of energy prices on the financial performance of banks operating in Türkiye between 2003 and 2022, the study focuses on the top 21 commercial banks by asset size in 2022. Information related to these banks is presented in Table 1, while descriptive information on the variables used in the analysis is provided in Table 2. Banking variables were obtained from reports published by the Banking Regulation and Supervision Agency, while the energy price index was sourced from the Federal Reserve Bank of St. Louis database. Macroeconomic variables were obtained from the Türkiye Statistical Institute and World Bank database.

In the study, return on assets (ROA) and return on equity (ROE) which are widely used in the literature to measure the financial performance of banks, are employed as dependent variables. ROA indicates the profitability generated by banks based on their assets, while ROE reflects the profit earned on the capital provided by shareholders.

As an independent variable, the percentage change in the global energy price index (EIN), developed by the International Monetary

Fund, is used to represent energy prices. The energy price index is composed of benchmark prices in US dollars that represent the global market, including various energy sources. Although many studies use oil prices as a proxy for energy prices, in this study the index is preferred due to its more comprehensive nature (Nasim and Downing, 2023; Nasim et al. 2023).

Bank-specific variables and macroeconomic variables are used as control variables. The bank-specific variables include net interest margin (NIM), the capital adequacy ratio (CAR), the ratio of total loans and receivables to total assets (AQR), the ratio of liquid assets to total assets (LIQ), and the ratio of non-interest income to total assets (INS). NIM represents the cost of intermediation in the banking system and the efficiency of the banking sector (Demirgüç-Kunt and Huizinga, 1999). This ratio focuses on the earnings derived from interest-based activities (Acaravcı and Çalım, 2013). CAR reflects the amount of capital banks are required to hold as a percentage of their risk-weighted assets, in line with the Basel criteria. A high capital adequacy ratio enhances confidence in banks and positively impacts their performance. Another bank-specific variable is AQR. Since loans are the primary assets from which banks generate interest income, an increase in loans is expected to positively influence banks' financial performance. Other variables being constant, as deposits are converted into loans, net interest margin and profitability will increase further. However, if banks are meeting their financing needs at higher costs while increasing their loan portfolios and taking on more risk, a decline in profitability may be expected (Vong and Chan, 2009). LIQ is used as a liquidity measure. It is an important ratio for banks to fulfill their short-term obligations and evaluate earning opportunities. The final bank-specific variable is INS. While a high ratio reduces the risk of banks going into default, not taking advantage of alternative earning opportunities can negatively affect profitability. Non-interest income is derived from fees and commission income, dividend income, other operating income, and trading profits. A high level of non-interest income is expected to positively influence financial performance.

Table 1: List of banks by asset size (Million Turkish Lira)

Banks	Total Assets	Banks	Total Assets
Ziraat Bank	2.311.665	Fibabank	74.109
VakıfBank	1.681.061	Şekerbank	63.244
İşbank	1.408.323	ICBC Turkey Bank	60.712
Halkbank	1.392.140	Burgan Bank	57.807
Garanti BBVA	1.152.172	Alternatifbank	57.447
Yapı Kredi Bank	1.108.094	Citibank	39.925
Akbank	1.075.186	Anadolubank	39.295
QNB Finansbank	601.755	A&T Bank	11.442
Denizbank	526.295	Turkland Bank	7.439
TEB Bank	275.147		
ING Bank	98.853		
HSBC Bank	88.040		

Macroeconomic variables used in the study include gross domestic product (GDP) and inflation (INF) rates. GDP growth rate is an indicator of economic development. GDP affect the financial performance of banks through services such as loans and deposits offered by the banking sector. Banks are inclined to extend more credit in pursuit of increasing their profits. Therefore, the relationship between GDP growth and bank performance is expected to be positive. (Lee and Lee, 2019). Inflationary pressures lead to higher interest rates and reduce disposable income, thereby increasing the risk of loan defaults and raising non-performing loans (NPLs) for banks (Idris and Nayan, 2016). While this

Table 2: Variables and calculation methods

Dependent Variable	Abbreviation	Calculation Method	References
Return on Assets	ROA	Net Income/Total Assets	Poghosyan and Hesse, 2009; Acaravcı and Çalım 2013; Lee and Lee, 2019; Nasim and Dowing, 2023.
Return on Equity	ROE	Net Income/Total Equity	Taşkın, 2011; Acaravcı and Çalım 2013; Nasim and Dowing, 2023.
Independent Variable			
Energy Index	EIN	Percentage change in the global energy price index	Nasim and Dowing, 2023; Nasim et al. 2023
Bank Specific Control Variables			
Capital Adequacy	CAR	Equity/(Credit Risk+Market Risk+Operational Risk)	Ogboi and Unuafe, 2013; Gharaibeh, 2015; Dizgil, 2017; Çelik and Kaya, 2021; Nasim and Dowing, 2023,
Net Interest Margin	NIM	Net Interest Income After Specific Provisions/Total Assets	Taşkın, 2011; Atik, 2019.
Asset Quality	AQR	Total Loans and Receivables/Total Assets	Vong and Chan, 2009; Taşkın, 2011; Acaravcı and Çalım, 2013.
Liquidity	LIQ	Liquid Assets/Total Assets	Acaravcı and Çalım 2013; Dizgil, 2017; Saif-Alyousfi et al. 2018b; Akkaya and Torun, 2020; Saif-Alyousfi et al. 2021; Akkaynak, 2022.
Income Structure	INS	Non-Interest Incomes/Total Assets	Acaravcı and Çalım 2013; Samırkaş et al. 2014; Atik, 2019; Akkaynak, 2022.
Macroeconomic Control Variables			
Gross Domestic Product Growth	GDP	Annual economic growth rate	Lee and Lee, 2019; Poghosyan and Hesse, 2009; Acaravcı and Çalım 2013; Saif-Alyousfi et al. 2021; Nasim and Dowing, 2023; Nasim et al., 2023.
Inflation Rate	INF	Annual rate of change of consumer price index	Lee and Lee, 2019; Poghosyan and Hesse, 2009; Acaravcı and Çalım 2013; Saif-Alyousfi et al. 2021; Nasim and Dowing, 2023; Nasim et al. 2023.

negatively impacts profitability, banks can increase their profits if they are able to adjust interest rates in advance to counter the cost increases driven by inflation (Poghosyan and Hesse, 2009).

3.2. Methodology

In this study, the relationship between energy prices and the financial performance of the banks operating in Türkiye's banking sector is investigated using the bias-corrected least-squares dummy variable (LSDVC) estimator. Poghosyan and Hesse (2009), Lee and Lee (2019), Nasim and Dowing (2023) and Nasim et al. (2023) preferred to use the Generalized Method of Moments (GMM) to analyze the relationship between energy prices and the financial performance of banks. However, the application of this method is limited by the fact that the properties of GMM estimators are only valid when the number of cross-sectional units (N) is large. Therefore, in panel data with a small number of cross-sectional units, GMM can produce significantly biased and unreliable results (Bruno, 2005). In this study, the dataset consists of 21 banks operating in Türkiye, indicating a small number of cross-sectional units. For this reason, the estimator employed in the study is the LSDVC estimator, developed by Bun and Kiviet (2003). This approach is consistent with the literature (Dahir et al., 2019). Bun and Kiviet (2003), using Monte Carlo estimation, demonstrate that the LSDVC estimator performs better in small samples compared to other techniques applied to dynamic panel data sets. According to Bun and Kiviet (2001), the estimated asymptotic standard errors can be poor approximations in small samples. Therefore, the statistical significance of the LSDVC coefficients was tested using bootstrap standard errors with 50 iterations (Bogliacino et al., 2012). The bootstrap procedure produces more accurate parameter estimates compared to standard dynamic panel models based on the asymptotic assumption of first-order autoregressive (AR) models. To make reliable predictions, a consistent and efficient dynamic panel estimator must be identified for a valid bias correction (Abdullahı et al., 2023). Therefore, the bias correction model in this study is initialized following the dynamic bias corrected estimators developed by Anderson and Hsiao (1982) (LSDVC (AH)), Arellano and Bond (1991) (LSDVC (AB)), and Blundell and Bond (1998) (LSDVC (BB)).

In this context, to analyze the impact of energy prices on banking performance, the standard panel data model is formulated as shown in Equation 1.

$$Y_{it} = \gamma Y_{it-1} + \beta_1 energy_{it} + \beta_2 bank_{it} + \beta_3 macro_{it} + \mu_i + \varepsilon_{it}\ i = 1....N,\ t=1...T \quad (1)$$

In Equation 1, the dependent variable Y_{it} represents the parameter vector used to measure bank performance, including ROA and ROE. The term Y_{it-1} denotes the lagged value of the dependent variable. $energy_{it}$ represents the energy price index, the explanatory variable vector $bank_{it}$ includes control variables related to banks. Additionally, $macro_{it}$ symbolizes the explanatory variable vector comprising macroeconomic control variables such as GDP and inflation rate. Finally μ_{it} and ε_{it} are an unobserved individual effect and error term respectively.

Equation 1 demonstrates that energy price fluctuations can have both a direct effect, represented by coefficient β_2, and an indirect effect, represented by coefficient β_3, on bank performance. However, due to the inclusion of all variables in the model, distinguishing between the direct and indirect effects becomes challenging. Therefore, following the methodologies used by Poghosyan and Hesse (2009) and Saif-Alyousfi et al. (2018b), the study first constructs bank-specific variables without incorporating macroeconomic variables in Equation 1. If the energy price coefficient is significant in this equation, a direct effect can be inferred. Subsequently, macroeconomic variables are added to the model. If the energy price coefficient remains significant, it can be concluded that energy prices have a direct impact on the bank's financial performance. Otherwise, it is suggested that energy price fluctuations indirectly affect bank performance through macroeconomic variables.

After each model is constructed, Equation 1 is concisely expressed as follows to estimate the parameters (Bun and Kiviet, 2003):

$$Y = W\delta + D\eta + \varepsilon \quad (2)$$

In equation 2, where $\delta=(\gamma,\beta')'$, W represents the matrix of lagged dependent variables and explanatory variables. D denotes the NTxN matrix of individual dummy variables, ε is the NT * 1 vector of disturbances. The Least Squares Dummy Variable (LSDV) estimator of δ is,

$$\hat{\delta}_{lsdv} = \left(W'AW\right)^{-1} W'AY \quad (3)$$

In equation 3, A is NTxNT symmetric and idempotent matrix which eliminate individual effects. Kiviet (1999) suggested the equation 4 for the bias of the LSDV estimator,

$$E\left(\hat{\delta}_{lsdv} - \delta\right) = c_1\left(T^{-1}\right) + c_2\left(N^{-1}T^{-1}\right) + c_3\left(N^{-1}T^{-2}\right) + O\left(N^{-2}T^{-2}\right) \quad (4)$$

In their study, Bun and Kiviet (2003) analyse the three bias approximations in the equation 5 by comparing the true bias with that obtained from Monte Carlo simulations and state that B_3 is closest to the true bias.

$$B_1 = c_1\ (T^{-1}),\ B_2 = B_1 + c_2\ (N^{-1}\ T^{-1}),\ B_3 = B_2 + c_3\ (N^{-1}\ T^{-2}) \quad (5)$$

4. EMPIRICAL RESULTS

The descriptive statistics of the variables used in the study are presented in Table 3. During the sample period, the average ROA and ROE of the banks were 1.4% and 12.9%, respectively. It is observed that the financial performance of the banks remains below the inflation rate, which averaged 13.7% during the period. CAR, which is expected to be at least 8% according to international standards, is quite high, with an average of 18.8%. The average GDP during the relevant period is 5.4%.

The correlation matrix for the variables is presented in Table 4. The highest correlation is observed between the dependent variables. However, the dependent variables are not included in the model simultaneously. Since the correlation between the other variables

is below 0.90, multicollinearity will not be an issue (Saif-Alyousfi et al. 2018b).

To assess the impact of changes in energy prices on the performance of banks, the first step is to estimate Equation 1 without incorporating macroeconomic variables. In other words, the regression is performed using only bank-specific variables, applying LSDVC (AH), LSDVC (AB), and LSDVC (BB) estimation methods. The findings are presented in Tables 5 and 6 under Model I. The estimation results in Table 5 show that for all three LSDVC estimations, the coefficient for EIN is statistically significant at the 10% level for ROA. This indicates that changes in energy prices have a positive impact on banks' ROA. On the other hand, the results of Model I in Table 6 show that the coefficient for EIN is statistically insignificant for ROE, indicating that changes in energy prices do not affect ROE.

To identify direct and indirect effects, Equation 1 is estimated by including both bank-specific variables and macroeconomic variables in the model. The results, presented under Model II in Table 5, show that the EIN parameter remains statistically significant for ROA. This indicates that changes in energy prices have a direct and positive impact on banks' ROA. Additionally, among the macroeconomic variables included in the model, the INF variable positively affects bank profitability, while GDP shows no effect. All bank-specific variables have a positive and statistically significant impact on banks' ROA. However, this is not the case for ROE. The estimation results under Model II in Table 6 reveal that even when macroeconomic variables are included in the model, the EIN coefficient remains statistically insignificant, indicating that changes in energy prices have neither a direct nor an indirect impact on ROE. On the other hand, among the bank-specific variables, NIM, AQR, LIQ, and INS positively influence banks' ROE, while among the macroeconomic variables, only INF affects ROE.

The statistical significance of the lagged dependent variables (ROA and ROE) in the models presented in Table 5 and Table 6 supports the validity of using the LSDVC model. Additionally, the fact that the lagged values of profitability fall between 0 and 1 indicates the persistence of profitability, while being close to 0 suggests a highly competitive market structure (Poghosyan and Hesse, 2009; Saif-Alyousfi et al., 2021).

Table 3: Descriptive statistics of variables

Variables	Observations	Mean	Median	Maximum	Minimum	Standard Deviation
ROA	420	0.014183	0.015271	0.064288	−0.265785	0.021064
ROE	420	0.129590	0.130104	0.582589	−1688276	0.156871
EIN	420	0.112765	0.109180	1025344	−0.406040	0.325101
CAR	420	0.188901	0.168617	0.993136	0.072393	0.085963
NIM	420	0.033631	0.031781	0.102582	−0.065310	0.016939
AQR	420	0.561286	0.602529	0.847161	0.033077	0.141703
LIQ	420	0.281406	0.257987	0.666435	0.058281	0.117070
INS	420	0.019321	0.015636	0.139124	−0.015793	0.015748
GDP	420	0.054985	0.056319	0.117968	−0.048396	0.038970
INF	420	0.137995	0.088731	0.723088	0.062510	0.140680

Table 4: Correlation matrix for the variables

	ROA	ROE	CAR	EIN	NIM	AQR	LIQ	INS	INF	GDP
ROA	1									
ROE	0.8068*	1								
CAR	0.0244	0.0841***	1							
EIN	0.0600	0.0705	0.1056**	1						
NIM	0.3803*	0.4132*	0.2623*	0.0157	1					
AQR	−0.0492	−0.1388*	−0.6080*	−0.1898*	−0.1861*	1				
LIQ	0.0737	0.0575	0.1416*	0.0570	0.2684*	−0.575*	1			
INS	0.1766*	0.1650*	0.1751*	0.1177**	0.1618*	−0.3789*	0.2277*	1		
INF	0.1965*	0.3396*	0.1313*	0.0379	−0.0154	−0.121**	−0.151*	0.1476*	1	
GDP	0.0051	0.0363	0.0263	0.3526*	0.0035	−0.120**	0.1455*	0.0955*	0.005	1

Table 5: LSDVC estimation results for ROA

Variables	MODEL I			MODEL II		
	LSDVC (AH)	LSDVC (AB)	LSDVC (BB)	LSDVC (AH)	LSDVC (AB)	LSDVC (BB)
ROA (-1)	0.3709144*	0.3791052*	0.4238009*	0.3658674*	0.3671531*	0.4135828*
EIN	0.0032324***	0.003093***	0.0031083***	0.004346**	0.0043049**	0.0040952**
CAR	0.0379517*	0.0341405*	0.0354924*	0.0387269*	0.0355726*	0.0381739*
NIM	0.3808885*	0.3876737*	0.3747017*	0.3959857*	0.4044108*	0.3918701*
AQR	0.0164996***	0.0153317***	0.0161552***	0.031577*	0.0296836*	0.0319803*
LIQ	0.0011753	0.0035333	0.0039811	0.0265003*	0.0273207*	0.0291145*
INS	0.2188421*	0.2181305*	0.2203119*	0.1727465*	0.1778244*	0.1796915*
GDP				−0.0171423	−0.0177916	−0.0155644
INF				0.0365985*	0.035507*	0.0358723*

ROA (−1) is the lagged dependent variable of ROA. *, **, *** are significance level P<0.01, P<0.05, P<0.1 respectively

Table 6: LSDVC estimation results for ROEy

Variables	MODEL I			MODEL II		
	LSDVC (AH)	LSDVC (AB)	LSDVC (BB)	LSDVC (AH)	LSDVC (AB)	LSDVC (BB)
ROE (-1)	0.3131586*	0.320277*	0.3436581*	0.3037713*	0.3113963*	0.3367417*
EIN	0.0214459	0.0213029	0.0214697	0.0265305	0.0268751	0.0264023
CAR	0.0809565	0.0691165	0.0633429	0.097915	0.090371	0.0907583
NIM	4.408132*	4.422176*	4.37321*	4.577406*	4.587323*	4.541827*
AQR	−0.0202713	−0.0226338	−0.0276755	0.1521586	0.1460954***	0.1500239**
LIQ	−0.0752964	−0.0686669	−0.0669595	0.2006301**	0.2014618*	0.2109382*
INS	1.294219**	1.275217**	1.273039**	0.7216591	0.7258104	0.7233681
GDP				−0.0162143	−0.0190168	−0.0121437
INF				0.4248477*	0.4211925*	0.4225759*

ROE (−1) is the lagged dependent variable of ROE. *, **, *** are significance level P<0.01, P<0.05, P<0.1 respectively

Typically, a positive relationship is expected between energy price changes and bank profitability in oil-exporting countries. However, contrary to expectations, the findings of this study show that energy price changes have a direct and positive effect on ROA of commercial banks operating in Türkiye. Poghosyan and Hesse (2009) highlight the positive impact of rising oil prices on bank profitability in MENA countries, while Saif-Alyousfi et al. (2021) emphasize a similar effect in the GCC member states. Conversely, Lee and Lee (2019) state that the profitability of the banking sector in China, the largest energy exporter, is negatively affected by energy price fluctuations. Although studies on Türkiye are limited, the study findings are consistent with Gülcemal (2022). Gülcemal (2022) states that oil price changes have a positive effect on banks' earnings. However, Gülcemal (2022) does not clarify whether the effect is direct or indirect. While the coefficient of the EIN variable is relatively small compared to other variables, indicating a weaker effect, the changes in energy prices directly affect bank profitability through bank assets. The unexpected positive relationship could be attributed to the strong capital structure of the Turkish banking sector, which may have shielded it from the adverse effects of energy price shocks, likely due to the policies implemented in the sector. This is also supported by Saif-Alyousfi et al. (2021), who argue that banks with high capital adequacy tend to be more cautious in monitoring and supervising their credit portfolios and adopt superior risk management practices during periods of instability.

The impact of bank-specific variables on bank profitability is consistent with expectations and previous studies. It is observed that the CAR ratio has a positive effect on the ROA of banks due to the fact that the high ratio increases trust in banks, the risk of bankruptcy is low and the funding cost is lower. The existence of this effect is consistent with Dizgil (2017). There is a positive relationship between NIM and the financial performance of banks. The increase in NIM can contribute to the increase in the profit margins of banks. The positive effect of AQR on the profitability of banks shows that the financial performance of banks increases with the expansion of the credit volume, which is the main source of income of banks. There is a positive relationship between LIQ and the profitability of banks. The increase in LIQ positively affects bank profitability. Akkaynak (2022) reached similar results. It is observed that the ROA of banks is positively affected as the INS ratio increases depending on the operating performance of banks. This situation is supported by the studies of Atik (2019). Atik (2019) states that the majority of the non-interest income of commercial banks in Türkiye originates from interest-based activities, and that non-interest income increases due to the increase in these activities.

The findings of the study indicate that, unlike GDP, the inflation rate has a positive effect on bank profitability. The results are consistent with the studies of Poghosyan and Hesse (2009) and Lee and Lee (2019). Banks' ability to quickly adjust interest rates in response to changes in inflation, based on their forecasting capabilities, can positively influence their profitability.

5. CONCLUSION

Undoubtedly, changes in energy prices affect the financial performance of many sectors. It is inevitable that banks, which play a key role in facilitating the transfer of funds in financial markets, are also impacted by the effects that energy price changes have on other sectors. Previous studies suggest that energy prices can influence the banking sector both directly and indirectly. Fluctuations in energy prices reflect indirectly on the banking sector through macroeconomic variables and directly through the banks' asset portfolios. An increase in energy prices can raise the risk of loan defaults, thereby weakening banks' balance sheets. Additionally, the indirect effects of rising energy prices, such as reduced demand and a decline in investment expenditures, can decrease banks' non-interest income, negatively impacting their off-balance-sheet activities. These effects may vary from country to country, depending on whether a nation is an energy exporter or importer. Türkiye is among the countries with a high dependence on energy imports. There are very few studies examining the impact of energy price fluctuations on the Turkish banking sector. This study aims to contribute to the literature by analyzing both the direct and indirect effects of energy price changes on the financial performance of commercial banks operating in Türkiye.

The sample of this study consists of 21 commercial banks operating between 2003 and 2022. Energy price changes are represented by EIN, and banks' financial performance is measured by ROA and ROE. CAR, NIM, AQR, LIQ, and INS are included in the model as bank-specific variables, while GDP and INF are added to the model to identify indirect effects as macroeconomic variables. The study first estimates a model with only bank-specific variables using LSDVC estimators, and then a new model is constructed by including macroeconomic variables to capture direct and indirect effects. The findings reveal that energy prices have a direct and

positive effect on banks' ROA, but no effect on ROE. In other words, an increase in energy prices positively impacts banks' asset profitability through their commercial activities or lending channels. Additionally, it is found that CAR, NIM, AQR, LIQ, INS, and INF have a positive effect on banks' ROA, while NIM, AQR, LIQ, and INF positively affect ROE.

The findings reveal that, contrary to expectations, the banking sector in Türkiye has benefited positively from energy prices. Generally, in countries with high energy dependence, it is anticipated that changes in energy prices will negatively impact banking performance. However, measures taken in the Turkish banking sector to increase efficiency and maintain the sector's strength against risks, along with a strong capital structure, may have helped it withstand potential negative impacts from changes in energy prices. Banks with high capital adequacy ratios can implement effective risk management practices, closely monitor their on-balance sheet and off-balance sheet activities, and take necessary precautions. These factors may have prevented banks from being adversely affected by fluctuations in energy prices. In this regard, the results of the study are expected to be beneficial for regulatory and supervisory authorities and policymakers concerning the banking sector in countries with high energy dependence.

REFERENCES

Abaidoo, R., Agyapong, E.K., Boateng, K.F. (2023), Stability in the banking industry and commodity price volatility: Perspective from developing economies. Journal of Economic and Administrative Sciences, 39(4), 988-1012.

Abdullahı, A., Ibrahım, S., Azman-Saın, W., Hook, L.S. (2023), Foreign direct investment and its impact on CO_2 emissions at various levels of economic development. International Journal of Economics and Management, 17 (3), 293-303.

Acaravcı, S.K., Çalım, A.E. (2013), Turkish banking sector's profitability factors. International Journal of Economics and Financial Issues, 3(1), 27-41.

Akkaya, M., Torun, S. (2020), Türk bankacılık sektöründe türev ürünlerin kullanımı ve etkileri. Bankacılar Dergisi, 31(115), 38-49.

Akkaynak, B. (2022), Internal variables affecting the profitability of the Turkish banking sector. Karadeniz Sosyal Bilimler Dergisi, 14(27), 769-784.

Al-Khazali, O.M., Mirzaei, A. (2017), The impact of oil price movements on bank non-performing loans: Global evidence from oil-exporting countries. Emerging Markets Review, 31, 193-208.

Anbar, A., Alper, D. (2011), Bank specific and macroeconomic determinants of commercial bank profitability: Empirical evidence from Turkey. Business and Economics Research Journal, 2(2), 139-152.

Anderson, T.W., Hsiao, C. (1982), Formulation and estimation of dynamic models using panel data. Journal of Econometrics, 18(1), 47e82.

Antwi, F. (2019), Capital adequacy, cost income ratio and performance of banks in Ghana. International Journal of Academic Research in Business and Social Sciences, 9(10), 168-184.

Arellano, M., Bond, S. (1991), Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The Review of Economic Studies, 58(2), 277-297.

Atik, M. (2019), Measuring the impact of non-interest income on bank income and risk in the Turkish banking sector. Muhasebe ve Finansman Dergisi, 81(1), 271-292.

Basher, S.A., Haug, A.A., Sadorsky, P. (2016), The impact of oil shocks on exchange rates: A Markov-switching approach. Energy Economics, 54, 11-23.

Blundell, R., Bond, S. (1998), Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 87(1), 115-143.

Bogliacino, F., Piva, M., Vivarelli, M. (2012), R&D and employment: An application of the LSDVC estimator using European microdata. Economics Letters, 116(1), 56-59.

Brückner, M., Ciccone, A. (2010), International commodity prices, growth and the outbreak of civil war in Sub-Saharan Africa. The Economic Journal, 120(544), 519-534.

Bruno, G.S. (2005), Approximating the bias of the LSDV estimator for dynamic unbalanced panel data models. Economics Letters, 87(3), 361-366.

Bun, M.J., Kiviet, J.F. (2001), The Accuracy of Inference in Small Samples of Dynamic Panel Data Models (No. 01-006/4). Tinbergen Institute Discussion Paper, 1-45.

Bun, M.J.G. Kiviet, J.F. (2003), On the diminishing returns of higher order terms in asymptotic expansions of bias. Economics Letters, 79, 145-152.

Çelik, S., Kaya, F. (2021), Micro variables affecting bank profitability: A study on local and foreign banks in the Turkish banking sector. İşletme Araştırmaları Dergisi, 13(1), 719-738.

Cunado, J., Gracia, F.P.D. (2005), Oil prices, economic activity and inflation: Evidence for some Asian countries. Quarterly Review of Economics and Finance, 45(1), 65-83.

Dahir, A.M., Mahat, F., Razak, N.H.A., Bany-Ariffin, A.N. (2019), Capital, funding liquidity, and bank lending in emerging economies: An application of the LSDVC approach. Borsa Istanbul Review, 19(2), 139-148.

Demirgüç-Kunt, A., Huizinga, H. (1999), Determinants of commercial bank interest margins and profitability: Some international evidence. The World Bank Economic Review, 13(2), 379-408.

Dizgil, E. (2017), Türkiye'deki mevduat bankalarının kârlılığını etkileyen mikro düzeyli faktörler üzerine ampirik bir araştırma. BDDK Bankacılık ve Finansal Piyasalar Dergisi, 11(2), 31-52.

Du, L., He, Y. (2015), Extreme risk spillovers between crude oil and stock markets. Energy Economics, 51, 455-465.

Erdoğan, A., Acar, E. (2020), Bank specific factors affecting profitability in the banking sector: A study on private capital deposit banks operating in Turkey. Finans Politik and Ekonomik Yorumlar, 57(654), 77-98.

Fakhrunnas, F. (2019), The effect of macroeconomic and bank-specific variables to risk-taking of Islamic bank in Indonesia. International Journal of Islamic Economics and Finance (IJIEF), 1(2), 165-186.

Gharaibeh, A.M.O. (2015), Empirical evidence of the determinants of commercial banks profitability in Bahrain. Journal of Emerging Trends in Economics and Management Sciences, 6(5), 299-314.

Gülcemal, T. (2022), Ham petrol fiyatlari ve Türkiye bankacilik performansi arasindaki ilişki. Sosyal, Beşeri ve İdari Bilimler Dergisi, 5(3), 258-268.

Hamilton, J.D. (1983), Oil and the macroeconomy since World War II. Journal of Political Economy, 91(2), 228-248.

Hamilton, J.D. (1996), This is what happened to the oil price-macroeconomy relationship. Journal of Monetary Economics, 38(2), 215-220.

Hamilton, J.D. (2009), Causes and consequences of the oil shock of 2007-08. National Bureau of Economic Research, 5, 215-283.

Huybens, E., Smith, B.D. (1999), Inflation, financial markets and long-run real activity. Journal of Monetary Economics, 43(2), 283-315.

Idris, I.T., Nayan, S. (2016), The joint effects of oil price volatility and environmental risks on non-performing loans: Evidence from panel data of organisation of the petroleum exporting countries. International Journal of Energy Economics and Policy, 6(3), 522-528.

Iriani, L.D., Yuliadi, I. (2015), The effect of macroeconomic variables on non-performance financing of Islamic Banks in Indonesia. Economic Journal of Emerging Markets, 7, 120-134.
Jokipii, T., Monnin, P. (2013), The impact of banking sector stability on the real economy. Journal of International Money and Finance, 32, 1-16.
Kayran, O., Kıyılar, M. (2021), Türkiye'deki mevduat bankalarına yönelik bir araştırma: Bankalarda gelir çeşitlendirmesinin performans üzerine etkileri. Gümüşhane Üniversitesi Sosyal Bilimler Dergisi, 12(2), 419-439.
Khandelwal, P., Miyajima, M.K., Santos, M.A.O. (2016), The Impact of Oil Prices on the Banking System in the GCC. United States: International Monetary Fund.
Kilian, L. (2008), The economic effects of energy price shocks. Journal of Economic Literature, 46(4), 871-909.
Kilian, L., Vigfusson, R.J. (2011), Are the responses of the US economy asymmetric in energy price increases and decreases? Quantitative Economics, 2(3), 419-453.
Kiviet, J.F., (1999), Expectation of expansions for estimators in a dynamic panel data model: Some results for weakly exogenous regressors. In: Hsiao, C., Lahiri, K., Lee, L.F., Pesaran, M.H. (Editors). Analysis of Panel Data and Limited Dependent Variables. Cambridge University Press, Cambridge.
Lee, C.C., Lee, C.C. (2019), Oil price shocks and Chinese banking performance: Do country risks matter? Energy Economics, 77, 46-53.
Lee, C.C., Zeng, J.H. (2011), The impact of oil price shocks on stock market activities: Asymmetric effect with quantile regression. Mathematics and Computers in Simulation, 81(9), 1910-1920.
Ma, Y., Zhang, Y., Ji, Q. (2021), Do oil shocks affect Chinese bank risk? Energy Economics, 96, 1-8.
Miyajima, K. (2017), An empirical investigation of oil-macro-financial linkages in Saudi Arabia. Review of Middle East Economics and Finance, 13(2), 20170018.
Narayan, P.K., Gupta, R. (2015), Has oil price predicted stock returns for over a century? Energy Economics, 48, 18-23.
Narayan, P.K., Sharma, S.S. (2011), New evidence on oil price and firm returns. Journal of Bank and Finance, 35(12), 3253-3262.
Nasim, A., Downing, G. (2023), Energy shocks and bank performance in the advanced economies. Energy Economics, 118, 1-9.
Nasim, A., Ullah, S., Kim, J.R., Hameed, A. (2023), Energy shocks and bank efficiency in emerging economies. Energy Economics, 126, 1-12.
Ogboi, C., Unuafe, O.K. (2013), Impact of credit risk management and capital adequacy on the financial performance of commercial banks in Nigeria. Journal of Emerging Issues in Economics, Finance and Banking, 2(3), 703-717.
Poghosyan, T., Hesse, H. (2009), Oil prices and bank profitability: Evidence from major oil-exporting countries in the Middle East and North Africa. IMF Working Papers, 9(220), 1-23.
Saif-Alyousfi, A.Y., Saha, A., Md-Rus, R., Taufil-Mohd, K.N. (2021), Do oil and gas price shocks have an impact on bank performance? Journal of Commodity Markets, 22, 1-20.
Saif-Alyousfi, A.Y.H., Saha, A., Md-Rus, R. (2018a), Impact of oil and gas price shocks on the non-performing loans of banks in an oil and gas-rich economy: Evidence from Qatar. International Journal of Bank Marketing, 36(3), 529-556.
Saif-Alyousfi, A.Y.H., Saha, A., Md-Rus, R. (2018b), Impact of oil and gas prices shocks on banks' deposits in an oil and gas-rich economy: Evidence from Qatar. International Journal of Emerging Markets, 13(5), 875-901.
Samırkaş, M.C., Evci, S., Ergün, B. (2014), Determinants of profitability in the Turkish banking sector. Kafkas Üniversitesi Iktisadi ve Idari Bilimler Fakültesi Dergisi, 5(8), 117-134.
Sarıtaş, H., Kangallı Uyar, S.G., Gökçe, A. (2016), Analysis of the relationships between bank profitability, financial ratios and macroeconomic variables using system dynamic panel data model: A study on Türkiye. Eskişehir Osmangazi Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 11(1), 87-108.
Taşkın, F.D. (2011), Türkiye'de ticari bankaların performansını etkileyen faktörler. Ege Akademik Bakış, 11(2), 289-298.
Türkiye Bankalar Birliği. (2022), Bankalarımız. Available from: https://www.tbb.org.tr/tr/banka-ve-sektor-bilgileri/istatistiki-raporlar/Bankalarimiz_Kitabi___/6164
Vong, P.I., Chan, H.S. (2009), Determinants of bank profitability in Macao. Macau Monetary Research Bulletin, 12(6), 93-113.