

## INVESTIGATING THE SYMMETRIC EFFECTS OF WORKING CAPITAL ON PROFITABILITY IN TURKISH BANKING: AN ARDL EMPIRICAL ANALYSIS

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**Abstract:** This paper carried out an empirical study on Return on Assets (ROA), total assets turnover, financial leverage, working capital, and debt-to-equity ratio. This study investigated commercial banks operating in Turkey. A secondary data collection method is used for the data collected from fifteen commercial banks. These banks' financial reports were examined from 2011 to 2022. A line graph is presented for each balance that tells us the volatility ratio in the variables, the unit root test applied to resolve the unit root problem, and the cointegration test used for long-term relationships among variables. The Autoregressive Distributed Lag (ARDL) bound test was performed to measure the short-run and long-run effects. Financial leverage, debt-to-equity ratio, and working capital have short- and long-run effects on ROA. Total asset turnover has only long-run effects on ROA in the

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Turkish banking industry. This study will be beneficial for investment managers, financial specialists, treasurers, and controllers of the banking industry.

**Keywords:** Return on Assets; Total Assets Turnover; Working Capital; Financial Leverage; Debt to Equity Ratio.

**JEL Codes:** G1, G2, G21.

## 1. Introduction

A company's working capital (WC) is an essential factor for short-term investments; it's one of the crucial parts because it is related to cash. Other liquid assets include inventory, account receivables, marketable securities, and the profitability of the business (Hidayat & Dewi, 2023; Murugesu, 2013). Most companies are surviving by managing the cash and credit of their entire business sector. Money tends to be short-term assets, and credit works with short-term liabilities; collectively, these are known as working capital management (Takon, 2013). The central theme of understanding working capital management is to ensure that companies can run their operations with enough funds or have efficient cash inflows. Brigham (2007) said that working capital is a financial metric that reflects the operating liquidity that is accessible for entire companies, financial institutions, and state organizations. Current investments can be easily converted into cash, and cash is the most efficient asset in the company (Ganesan, 2007). In Turkey, so many commercial banks are operating their businesses and working in significant provinces like Istanbul, Ankara, Izmir, Nevsehir, Trabzon, Rize, Eskisehir, etc. Those banks have more fluctuations in their cash flows; they want to manage their short-term assets by paying their short-term liabilities, attracting financial sources, and finding out the excellent source of their current debt (Enow & Birijal, 2014). The working capital is the determiner and driving force behind current operations (financial relations with clients and suppliers, production process, etc.). This is the fundamental cause behind this. I.e., by practicing and planning the operating cycle, cash conversion cycle length, and current liquidity ratio (current ratio). Thus, a company's business is unswervingly affected by the current balance and management of working capital (Rodean & Balteș, 2014). Consequently, it helps achieve the primary goal of value-based management, which entails an increase in shareholder worth. Numerous claims have been made that financial leverage is the preeminent factor among all other significant factors through which various finance researchers can affect a firm's profitability. It incorporates ideas about capital structure management. The path to capital structure formulation depends on the manager's choice of making an equity-intensive or debt-intensive company and financing the company's assets (Raza et al., 2022). Through various accounts, it has been perceived that company managers

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utilize some degree of debt and a certain degree of equity to fund their assets. Wherefore, managers need to make correct decisions regarding the amalgamation of debt and equity of any corporation. Corporations that are reluctant to borrow money to finance their assets have to depend on equity financing; hence, a fixed sum of charges does not apply to those companies. Consequently, no financial leverage is associated with that company. Management of working capital and various similar determinations, including the scale of measurement, produced products, and capital structure, can also determine the company's profitability (Santhi & Dewi, 2014). Better company condition, derived from higher profitability. The excellent condition of the company leads to an increase in profits, which will induce the investors to fund the company (Iskandar et al., 2014; Larasati, 2011).

A commercial bank that makes revenue by borrowing and organizing cash. Overall, in emerging economies such as Turkey, commercial banks are less impacted by the worldwide COVID-19 crisis than larger economies. Currently, Turkish banks have adopted technology and automation strategies to increase their ROE, ROA, and net profit margins. While the banking industry also worked on short-term investment strategies such as the current ratio and working capital, Turkish banks are facing short-term investment problems due to the depreciation of the Turkish Lira, so commercial banks in Turkey started working capital loans, which serve the purpose of providing money for investments and have no term constraints and maturities of not more than one year. This study aims to explore the long-run and short-run effects of working capital and profitability. Secondly, this study examines the relationship between total asset turnover, financial leverage, debt-to-equity ratio, working capital, and profitability. The objectives of the study are as follows:

- To identify the short-run and long-run effects of total asset turnover on Turkish Commercial Banks' financial performance.
- To identify the short-run and long-run effects of financial leverage on Turkish Commercial Banks' financial performance.
- To identify the short-run and long-run effects of the debt-to-asset ratio on Turkish Commercial Banks' financial performance.
- To identify the short-run and long-run effects of working capital on Turkish Commercial Banks' financial performance.

There has been no other study conducted before that determines the relationship between total asset turnover, financial leverage, debt-to-equity ratio, working capital, and profitability in the Turkish banking industry. It is believed that working capital contributes to the drive of the bank's short-term investment levels, the allocation of working capital elements, the efficient utilization of limited funds, and the availability and longevity of foreseeable expenditures through the use of working capital, which will improve the bank's profitability in Turkey. Our study shows that

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TAT, debt-to-equity ratio, financial leverage, and working capital have short- and long-run effects on profitability. While total asset turnover has only long-term effects on profitability. This study will be beneficial for financial managers, bank managers, investment practitioners, asset allocators, and those who are responsible for short-term investment decisions in the banking industry. Section 2 goes over the relevant literature. Section 3 outlines the conceptual framework, hypotheses of the study, research methodology, and data. Section 4 presents the empirical findings and discussions, and Section 5 concludes the study with economic implications.

## 2. Literature review

In the 21st century, working capital management policies are constructive to make the correct short-term assets and short-term liabilities. Many empirical studies reflect the relationship between ROA and working capital management (Chalmers et al., 2020; Wang et al., 2020; Dhole et al., 2019). Aktas et al. (2015) found a positive relationship between the cash conversion cycle, leverage, and profitability, suggesting that it decreases the cost of supply, develops the best relationship with its customers, and increases the sales volume of the services and products. Alvarez et al. (2021) have recently studied the effects of short-term assets and short-term liabilities on small and medium enterprises and their profitability by taking evidence from emerging economies. Nwude et al. (2018) studied the cash conversion cycle and profitability of publicly listed insurance companies in Nigeria. They used the cash conversion cycle as an independent variable and ROA as a dependent variable and took data only for one year from the annual reports of insurance companies from 2022 to 2011. Multiple regression analyses were used and supported their claim that CCC harms ROA. Twesigye (2022) revised the study on working capital management and liquidity risk. He conducted his study on listed companies at the Nairobi Stock Exchange in Kenya. Six samples are drawn from twelve listed companies by taking the five years' data, the regression analysis used to express the model equation, and the negative relationship between working capital management and liquidity risk. The correlation matrix also suggested a negative relationship between variables. Jihadi et al. (2021) did an empirical study on liquidity, ROA, and leverage and used a purposive sampling method for the LQ45-listed companies studied. Samples drawn from the Indonesian Stock Market were used for analysis and to prove their claim that leverage and liquidity negatively affect the profitability of Indonesian listed companies. Given the interrelationship was not proved to be statistically significant as per the observations of all previous studies. For example, (Stevens et al., 1996) scrutinize a sizeable sample of companies from seven different sectors (professional services, financial services, trade, services, production, construction, and mineral resources) for twenty years. Upon probing factors

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influencing ROA, especially the cash conversion cycle, they determined that examination indicators are inverse. However, there was no statistically significant connection among these indicators in the spheres of financial services and construction, as per the research results. Through such effects of the research, it is now confirmed that the study's outcome gravely relies upon the choice of the observation period and economic section, and possibly on various other factors. Simultaneously, pondering the sample of data (used in the earlier mentioned studies) in general, there is a relatively strong statistically noteworthy opposite linear interdependence amid a firm's return ratio (profitability). Șărămăt et al. (2013) studied the effects of financial ratios and profitability in European capital markets. By taking the quarterly data of 495 companies, they suggest that there is a huge difference between the US and European markets. Financial ratios contribute significantly to ROA and ROE. Pordea et al. (2020) studied the effects of cash flow on profitability in construction companies in Romania. Ordinary Least Square (OLS) suggests that cash flows have negative effects on profitability.

Efficiency measurements used by a firm to indicate sales generation by its assets can be defined as total asset turnover (Gitman 2015). Relative efficiency measurement uses a firm's total assets to obtain sales (Horne & Wachowicz, 1992). Clubb (1992) stated that the sum of efficiency management investments in individual asset items is total asset turnover. A higher ratio of efficiencies of management investment denotes that the company's assets are appropriately managed and efficiently operated and can generate revenue, leading to higher profitability for the company. The debt-to-equity ratio can be seen in the totality of research publications (Al-Shubiri & Aburumman, 2013; Jose et al., 1996; Lazaridis & Tryfonidis, 2006). Lim & Rokhim (2021) studied examined the relationship among profitability, Total Assets Turnover (TAT), firm's growth, size, sales, and the Lerner index of the pharma industry in Indonesia. They found that their TAT and the firm's growth have no significant effect on profitability. While a firm's size, sales, and Lerner index have positive effects on ROA and negative effects on earnings per share and ROE, COVID-19 affects the performance of all short- and long-term investments as well as financial ratios. Zheng et al. (2021) studied the effects of COVID-19 on total asset turnover, ROA, and ROE in listed companies in China. The study found that there is a negative effect of COVID-19 on profitability and turnover in the tourism and airline industries. While there are positive effects of COVID-19 on profitability in pharmaceutical companies.

Enju & Soocheong (2005) investigated the connection between the company's size in the restaurant industry, profitability, and financial leverage. His study took place from 1998 to 2003, and the method used was the ordinary least squares method. The study of the cooperation among restaurants' profitability, risk, and financial leverage

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was the study's primary purpose, which was conducted between the years 1998 and 2003 with the ordinary least squares method. He made three hypotheses for the achievement of the objective of this study. The first hypothesis was that those restaurant firms have higher profitability, which uses a lower level of financial leverage. Therefore, a substantial figure of interest is needed despite the current business situation for those restaurant firms with higher financial leverage levels. Hypothesis number two was that those firms with higher financial leverage levels are at higher risk than their counterparts with lower financial leverage levels. According to this study, return on equity (ROE) was used as a gauge for measuring the profitability and enduring debt to total assets, and total assets as the size of the firm's financial leverage. It is supported by the results of the study that the more prominent assets of restaurant firms were more profitable than small firms. Furthermore, indicating that firms with higher debt rates were less likely to generate the same levels of profitability, the financial leverage variable sign. Khdour (2021) backed the adverse connection between a firm's past profitability and financial leverage. He used a cross-sectional regression analysis to investigate the leverage behavior of 32 companies providing their services in two different industries in Jordan: the manufacturing sector and the hotel or hospitality industry. He discovered and manifested that all leverage determinants are noteworthy in defining the leverage variation in debt behavior except for the firm's size. Akhtar et al. (2021) studied the effects of financial leverage on profitability in Pakistani firms from 2001 to 2017. The study is based on three independent variables, including financial leverage, debt-to-equity ratio, and long- and short-term debt, and three dependent variables, including ROE, ROA, and Tobin'Q. By applying Generalized methods of moments their study suggests that there is an inverted U-shaped relationship between financial leverage and ROA. Short-term debts are the main sources of debt financing and thus create more risk. Grau & Reig (2021) analyzed the impact of leverage on a firm's profitability. The sample was taken from European Agri-food SMEs between 2009 and 2016. The study suggests that profitability significantly depends on financial and operating leverage.

The comparison between own capital and total debt is portrayed by the debt-to-equity ratio (DER) and leverage ratio (Muhammad, 2018; Maulita & Tania, 2018). This ratio aims to ascertain the amount of money provided by creditors with the firm's proprietor and dig out each rupee of the capital of a firm implied as collateral for the debt. The failure ratio in that firm is correlated with the higher levels of indications of this ratio. Nukala et al. (2021) studied the debt-to-equity ratio, profitability, CAPM, risk and returns of projects, and annual cash flows in the BSE SENSEX and S&P indices. The study reflects when the particular and aggregate returns of two companies were compared, it was discovered that significant returns

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changed not solely due to rising beta but also from an income perspective, company development rate, payout ratios for dividends, and profitability. While there is a negative relation of risk with debt to equity ratio. An exploratory study based on financial statements was conducted (Al-Eitan et al., 2023). The data is based on the top 25 global financial companies from 2016–2021. Regression analysis and the K Nearest Neighbors test suggest that the debt-to-equity ratio has a negative impact on performance optimization. TAT, debt-to-equity ratio, and current ratio all play important roles in investment decisions. Similarly to this, Rodean & Balteş (2014) studied that debt-to-equity ratio and working capital have a negative relationship with profitability in the Romanian banking industry.

Working capital is the primary tool for short-term investments. And profitability can be outlined as the capability of a company to generate revenue and profit through all the attainable potential and causes like cash capital, activities, sales, the total number of employees, and the total quantity of branches of the business (Choudhury & Harahap 2008). Higher profitability levels also increase the company's competitiveness among other companies. Attracting outside investors for a sustainable future of company profitability is an essential factor. ROA is used for this study to measure profitability.

Borlea & Achim (2014) studied working capital, current ratio, and financial equilibrium in listed companies in Romania. The data was retrieved from the Bucharest stock market for 64 companies between 2003 and 2012. The findings support the notion that working capital and the current ratio are the strongest indicators of short-term financial equilibrium. Wang et al. (2020) studied working capital management and policies of working capital and the cash conversion cycle by taking nonfinancial listed companies on the Pakistan Stock Exchange in the period of 2005–2014. The study reflects that there is a negative relationship between firm performance and working capital. Dhole et al. (2019) conducted a study on working capital and financial constraints in Australian firms listed on the Australian Securities Exchange from 2000–2016. Working capital is measured by the cash-to-assets ratio and days receivables. The study suggests that there is a positive relationship between working capital and future share price as well as the firm's profitability. Pirtilä et al. (2020) found a positive relationship between working capital and ROA as well as the cash conversion cycle in the Russian automobile industry. Hussain et al. (2021) analyze the effects of working capital and macroeconomic indicators on profitability by using the dynamic approach of panel analysis. The sample was drawn from energy and fuel companies listed on the Pakistan Stock Exchange from 2013–2018. The results suggest that there is a negative effect of working capital on profitability. One similar study to ours was done by Nayak et al. (2022), who examined the short- and long-term effects of

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working capital, deposits, and fund borrowing on profitability. His analysis is based on two periods (1949–1950) and (2014–2015) of the Odisha Co-operative Bank. ARDL results suggest that working capital and fund borrowing have significant short-run effects. While deposits are significant in the long run, Fernández-López et al. (2020) analyzed that working capital is a significant contributor to maximizing profitability. Their study was based on 444 cheese manufacturing companies in Spain in the period of 2010–2016. Four ratios studied that determine the working capital include the cash conversion cycle, days payable, and days inventory outstanding. Multivariate analysis and robustness analysis suggest that working capital has a negative impact on profitability. Based on the above literature review, the conceptual framework has been developed (See Figure 1).

### 3. Conceptual Framework Data and Methodology

In this study, the dependent variable is profitability. The same was gauged as the net income ratio after taxing the total assets. It helps deliver essential data about the company's performance and how competently the company utilizes its entirety of assets to produce revenue and surplus; therefore, it is one of the most comprehensive and indispensable indicators.

Profitability (ROA) = Net Income / Total Assets

As an independent variable, total asset turnover is studied in this research, which is calculated by dividing net sales by average total assets.

Total Assets Turnover = Net Sales / Average Total Assets.

As an independent variable, financial leverage was gauged as the total debt ratio to total assets in this study. Short-term debt maturity is less than one year, and long-term debt maturity refers to more than one year. Therefore, this ratio indicated total liabilities in relation to the total assets of a company. Thus, the company assumes more risk if the ratio levels are higher and the use of leverage is higher.

Financial Leverage = Total Debt / Total Assets.

Another independent variable is the debt-to-equity ratio, which tells us about the portion of debt and equity in the company and is calculated under the formula:

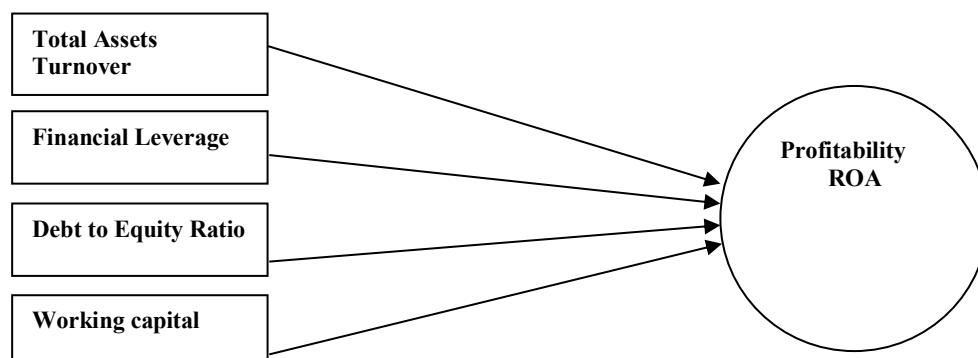
Debt to Equity ratio = Short term Debt + Long term debt / Total Equity.

The last independent variable for this study is working capital for short-term investments, which is measured by the formula working capital = current assets – current liabilities. At the same time, this variable is measured by the working capital ratio and calculated by current assets / current liabilities.



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**Figure 1 The hypothesized model of Profitability**

Source: Author's view.

The following hypotheses are formulated based on Figure 1:

H1 = Total Assets Turnover has a negative impact on Profitability in Turkish commercial banks.

H2 = Financial leverage has a negative impact on Profitability in Turkish commercial banks.

H3 = Debt-to-Equity Ratio has a negative impact on Profitability in Turkish commercial banks.

H4 = Working capital has a negative impact on Profitability in Turkish commercial banks.

In this study, Turkish commercial banks have been studied. Thirty-four commercial banks are operating their services in Turkey; fifteen banks are drawn randomly as a sample from those 34, namely: IS Bank, Ziraat Bank, Halk Bank, Yapi Kredi Bank, and Garanti Bank, respectively. The data has been gathered in two ways. Firstly, some data has been taken from the balance sheet system analysis of commercial banks in Turkey for the period of 2011–2022, and secondly, the data has been adopted from the financial reports of fifteen banks selected as samples. Mostly in these reports, there is only availability of the balance sheet and income statement, and all the values come from these calculated financial ratios: ROA, TAT, working capital, debt to equity ratio, and financial leverage, respectively.

For data analysis, unit root estimations were performed to determine the stationarity issues in the dataset. The repressors can be I (0), I (1), or mutually cointegrated, but none of the variables must be I (2). Enders (1995) suggests that employ both Phillips-Peron unit root tests (Phillips & Peron, 1988), and Augmented Dickey-Fuller unit roots (Dickey & Fuller, 1979) for stationarity. Unit root tests estimated the first

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difference with intercept and trend both. The Augmented Dickey-Fuller test was used to estimate the unit root. The J.J. Cointegration test was employed to see the long-run relationships among the variables (Johansen & Juselius, 1990). Ordinary Least Squares is a widely used and common technique to see the effects of independent variables on the dependent variable (Kilmer & Rodriguez, 2017). For diagnostic analysis, several tests will be performed. For greater-order heteroscedasticity and serial correlation, the Breusch-Godfrey (BG) test works in the event of the existence of unpredictable coefficients that include lag numbers for the explained variable (Rois et al., 2012). The test value is simultaneously equal to the context of Durbin h figures, which can be thought of as a subset of the Breusch-Godfrey trial data. The technique of Durbin h analysis, on the other hand, is inapplicable to evaluating the intermediate or greater degree of serial correlation in no predictive models. Considering no independence in the measurement error dispersion, the BG test generates the multiplier determined by the Lagrange test. For normality, the Jarque-Bera test was employed (Gel & Gastwirth, 2008). The test provides more strength when a sample is expected to originate from an asymmetrical distribution having thicker (or thinner) ends than the average distribution. The CUSUM series of tests performed is now routinely employed in formal circumstances to assess variable stability (Turner, 2010). The CUSUM analysis is preferred because it eliminates the issue concerning the analysis's maximum dispersion being dependent on the character of the inaccurate procedure in the proposed linear regression model.

Conducting a unit root test in the ARDL model is not essential because, regardless of their arrangement of cointegration, ARDL bounds testing has been exercised in every series. Schwarz information criteria were used to carry out lag selection, as advocated by (Pesaran & Shin, 1997). The ARDL bounds test method was employed to probe the cointegration among the variables, such as LINF, LGNPP, and LDEP, developed by (Pesaran et al., 2001). Employing the ADRL model for financial linkages can provide numerous advantages. Initially, the ARDL test for cointegration has preference over the cointegration test developed by Johansen whenever the number of samples is limited and restricted. Furthermore, to properly execute, the ARDL model does not require that every parameter be incorporated to the same degree. Finally, instead of a large number of regression functions, the ARDL approach could be executed with just one regression function. Methods of cointegration were used to conclude the enduring interconnection between the variables, and those methods were given by (Engle & Granger, 1987; Hansen & Phillips, 1990). Additionally, a combined cointegration approach was used to ratify the enduring interconnection between variables that Bayer and Hanck primitively introduced, in which four distinct procedures were combined collectively to predict

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the joint cointegration between growth, economic deposits, and the inflation rate (Bayer et al., 2013). Based on that, we prepared the following regression model equation:

$$ROA = \beta_0 + \beta_1 TAT + \beta_2 FL + \beta_3 DER + \beta_4 WC + u. \quad (1)$$

The above regression equation shows the research model of this research where ROA measures the banks' profitability, and  $\beta_0$  has represented the intercept. At the same time,  $\beta_1$  and TAT are the coefficients of Total Assets Turnover;  $\beta_2$  and F.L. are showing the coefficient of financial leverage;  $\beta_3$  and DER are representing the coefficient of debt-to-equity ratio; the last variable is W.C. so that  $\beta_4$  and W.C. are showing the coefficient of Working capital. At the same time,  $u$  is the error term in the data set.

#### 4. Empirical Results and Discussion

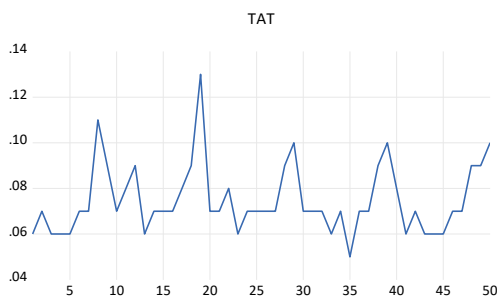
This section explains the results of the model. Figure 2 explains the total asset turnover of Turkish banks from 2011 to 2022; here, this ratio has many fluctuations ranging from 0.06 to 0.13. Over the past 12 years, Yapi Kredi Bank had a high turnover of 0.11 in 2018 and 2022, which is 0.07; Garanti Bank had a high turnover of 0.10 in 2019. From 2011 to 2017, it was between 0.06 and 0.07; Halk Banks had a stable turnover ratio of 0.07 for up to 4 years from 2014 to 2017. It increased to 0.10 in 2019 and in 2022 it is 0.07 again, which decreased a lot. Its banks turnover ratios were 0.06, 0.07, and 0.09 in the time period 2011-2019, while in 2022 it was 0.10, and Ziraat Bank has a huge asset turnover. In 2019, the ratio was about 0.13, and in 2022 it had a huge decrement of 0.07. While financial leverage varies from time to time, bank to bank, and in ratio, it had more volatility in 2011–2022, mostly ranging from 0.87 to 14.80, especially at Ziraat Bank, which had more leverage in 2013—nearly 10.29—and it decreased after 2013. In 2022, it grows up to 9.10; the U.S. banks leverage also increased in 2022 to 10.31; and in 2014, it was 9.08, while it also decreased after 2014. Yapi Kredi Bank had low volatility in leverage, ranging between 8.23 and 9.44 over the last twelve years. Since 2016 leverage of Halk Bank is continuously increasing from 9.87 to 13.1 and very high leverage in 2022 up to 14.8. At last, Garanti Bank has decreased its leverage in 2022 up to \$5.92. Figures 4 and 5 represent the line graph summary of the debt-to-equity ratio and financial leverage, respectively. Figure 4 illustrates that the debt-to-equity ratio is constantly running, with not many fluctuations in the banking industry of Turkey between 2011 and 2022. Almost 40 banks have a ratio between 0.89 and 0.99, and some banks have a debt-to-equity ratio as high as 9.89. In contrast, as Figure 5 shows, working capital has a lot of high and low volatility in the commercial banks of Turkey; this is expressing the short-term investments in the firms, so that's why it creates a lot of

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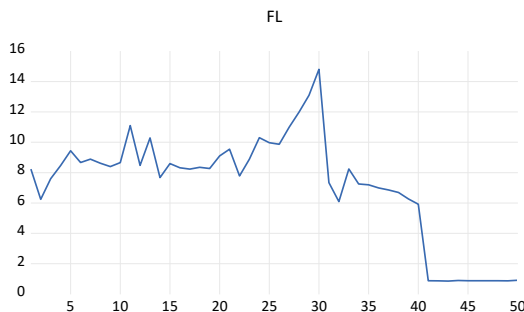
fluctuations in all the sampled banks values, which are ranging from 0.74 to 1.54, respectively.

The above-given figure shows the ROA values; the trend is as usual, and there have been minor movements in ROA during 2011-2022 in commercial banks of Turkey, Garanti Bank ROA is ranging between 0.47 and 0.74 in the last 12 years; it was highest in 2015 and lowest in 2011. Bank ROA is smoothly running between 0.66 in 2011 and 1.05 in 2022; in 2012, ROA was decreasing from 0.6 to 0.52, but later they improved the bank's profitability. Ziraat Bank was continuously decreasing from 2012 to 2018 from 0.61 to 0.54, but later in 2019 it increased to 1.05, and in 2022 it was at 1.20. Yapi Kredi Bank is also the same as Ziraat Bank. Still, Yapi Kredi has many fluctuations in ROA. ROA has increased and decreased frequently in the last 12 years; in 2011, it was 0.58. In 2013, it increased to 1.26, dropped to 0.82 in 2017, rose to 1.07 in 2018, and decreased again to 0.90 in 2022. Halk Bank has a higher ROA in 2019 and 2022, with 2.61 investors moving towards Halk Bank. Therefore, it is getting more profit on ROA. In 2011, ROA was 0.44, and Halk Bank worked a lot to maintain the ROA during these 12 years.



**Figure 2 Total Asset Turnover Ratio**

Source: Author's view.



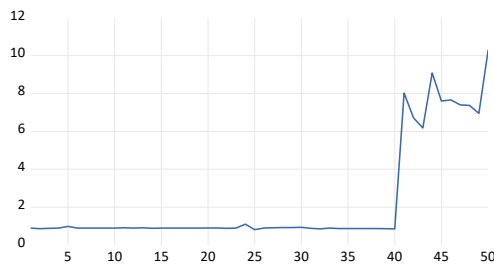
**Figure 3 Financial Leverage**

Source: Author's view.

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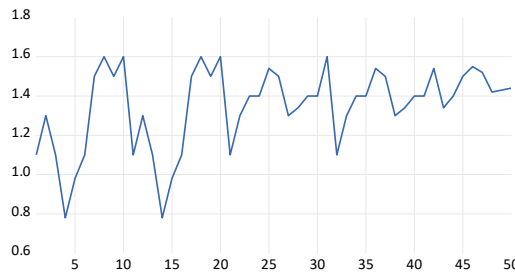
DER



**Figure 4 Debt to Equity Ratio**

Source: Author's view.

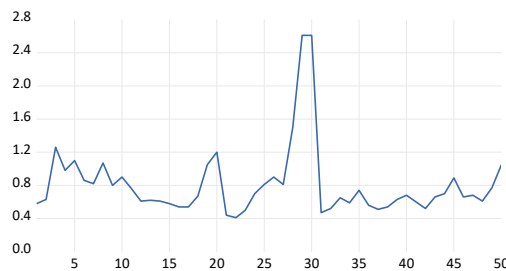
WC



**Figure 5 Working Capital**

Source: Author's view.

ROA



**Figure 6 Return on Assets**

Source: Author's view.

Augmented Dickey-Fuller tests are generally used for unit root estimation. In the hypothesized framework, is there any unit root issue or not? The unit root tells the stationarity of the data. Mathematically speaking, stationarity is characterized as an accumulation of data that looks flat, has no trend, has constant variability over the years, has constant autocorrelation across time, and has no periodic swings (seasonality). I (0) suggests that variables are stationary at the level, and I (1)

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suggests that variables have stationarity at the first difference (Asteriou & Agiomirgianakis, 2001). I (0) means that time series data is stationary without requiring any variation. I (1) is the property of a time series in which the mean remains static throughout time but other statistics, such as variance and standard deviation, will not change (Paparoditis & Politis, 2018).

According to the results of these variables, three don't have unit root (stationarity) problems like ROA, where the P-value at level 5% is less than 0.0007; hence, ROA has no unit root problem. TAT at level 5% is 0.0005, and it is below 5%, so TAT also doesn't have a unit root problem. Financial leverage has a unit root problem, and the value is 0.6732, so the lag of financial leverage has been applied, and the unit root problem is resolved; the value is 0.000. The debt-to-equity ratio also has a unit root problem of 0.9293; hence, it is above 5%, so using a lag of the debt-to-equity ratio and unit root, it is resolved to 0.000. Finally, working capital has no unit root problem because the value at the level is 0.0041 and it is below 0.05 at a 5% significance level (see Table 1). Table 2 presents the co-integration analysis. A co-integration test is usually used to determine the relationship between variables in the proposed research model. Here, the Johansen Co. integration test has been used to run the model in the long run. Hence this test has been calculated with all relationships between x variables, and the probability value is 0.2069, and it is above 0.05 at a 5% significance level, even if we see that at most 1\* to 4 of the P-values are above 5%; they are 0.39, 0.39, 0.60, and 0.71, respectively. So based on these results, these variables don't have a strong relationship with each other. So, this model has been run on a short-term basis. Table 3 presents the Granger Causality Test. This test is beneficial to see the Granger effect among variables (Granger, 1969); it also checks the relationship among variables instead of the correlation matrix. The model proposed five variables. Granger produces twenty null hypotheses for checking the Granger effects. Here only two variables have Granger causality, while the rest of the variables have no Granger causality in this model; like the total asset, turnover has Granger causality with ROA, the p-value is 0.01, and ROA has Granger causality on financial leverage with 0.0005. First, ROA doesn't have any discernible impact on TAT with 0.86 p-values, the debt-to-equity ratio with 0.817, or working capital at 0.631. Secondly, total asset turnover doesn't have a Granger cause-effect with financial leverage, with a p-value of 0.213, a debt-to-equity ratio of 0.0812, and a working capital of 0.136 all above 5%. Thirdly, financial leverage doesn't have a Granger effect on ROA with 0.285 p-values, TAT of 0.394, debt to equity ratio of 0.144, and working capital of 0.516, respectively; hence, these all are below 0.05. Finally, the debt-to-equity ratio doesn't have a Granger effect on ROA with 0.928 p-values, TAT of 0.977, financial leverage of 0.425 p-values, and working capital of 0.430. In the end, working capital doesn't have any Granger effect

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on ROA (0.969); total asset turnover (0.439); financial leverage has an p-value of 0.893; and the debt-to-equity ratio is 0.906. All Granger null hypotheses are accepted since all P-values are above 5% except the two hypotheses mentioned above.

**Table 1 Unit root estimations**

Variables	Level	1 <sup>st</sup> Dif.		Unit root /No unit root
Return on Assets	0.0007	-	I (0)	No Unit root
Total Assets Turnover	0.0005	-	I (0)	No Unit root
Financial Leverage	0.6732	0.0000	I (1)	I (1) have No Unit root
Debt to Equity Ratio	0.9293	0.0000	I (1)	I (1) have No Unit root
Working Capital	0.0041	-	I (0)	No Unit root

Source: Author's view.

**Table 2 Co-integration estimations**

Hypothesized No. of C.E. (s)	Eigen Value	Trace Statistics	0.05 Critical Value	Prob.**
None *	0.404554	60.96746	69.81889	0.2069
At most 1*	0.279450	36.08210	47.85613	0.3922
At most 2*	0.245887	20.35053	29.79707	0.3993
At most 3*	0.129834	6.804334	15.49471	0.6005
At most 4*	0.002682	0.128897	3.841465	0.7196

Source: Author's view.

**Table 3 Causality relationships**

Null Hypothesis	Obs.	F Statistics	Prob.
TAT does not have Granger cause ROA	48	4.68315	0.0145
ROA does not have Granger cause TAT	48	0.14520	0.8653
FL does not have Granger cause ROA	48	1.29073	0.2855
ROA does not have Granger cause FL	48	9.05175	0.0005
DER does not have Granger cause ROA	48	0.07386	0.9289
ROA does not have Granger cause DER	48	0.20201	0.8179
WC does not have Granger cause ROA	48	0.03099	0.9695
ROA does not have Granger cause W.C.	48	0.46410	0.6318
F.L. does not have Granger cause TAT	48	0.95124	0.3942
TAT does not have Granger cause FL	48	1.59904	0.2139
DER does not have Granger cause TAT	48	0.02267	0.9776
TAT does not have Granger cause DER	48	2.66276	0.0812
WC does not have Granger cause TAT	48	0.83840	0.4393
TAT does not have Granger cause W.C.	48	2.09026	0.1360
DER does not have Granger cause FL	48	0.87417	0.4245
FL does not have Granger cause DER	48	2.02188	0.1448

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WC does not have Granger cause FL	48	0.11241	0.8939
FL does not have Granger cause W.C.	48	0.67164	0.5161
W.C. does not have Granger cause DER	48	0.04076	0.9601
DER does not have Granger cause W.C.	48	0.85933	0.4306

Source: Author's view.

The model is tested by simple linear regression; R square suggests that total asset turnover, financial leverage, debt-to-equity ratio, and working capital account for 55% of variations in ROA. In comparison, the model tests the hypothesis by supporting it or not, focusing on p-values for each variable. As presented in Table 4, the TAT p-value is 0.16, which is above 0.05; hence, H1 is rejected. Total asset turnover has no negative impact on ROA in Turkish commercial banks. The F.L. p-value is 0.000. accordingly, it accepts that the H2 p-value is below 0.05 financial leverage harms ROA in Turkish Commercial Banks, DER p-value is also 0.000 below 0.05, so it supports H3 debt-to-equity ratio and harms ROA in Turkish Commercial Banks: Only working capital p-value is above 5%, which is 0.621, so it rejects H4 working capital has no negative impact on ROA in Turkish commercial banks. Table 5 presents the residual diagnostic problems. First of all, Breusch and Pagan Godfrey's heteroscedasticity estimation test was used to detect the heteroscedasticity problem. The P-value of 0.0003 is below 0.05, so there is no heteroscedasticity problem in this model, and there is homoscedasticity present in this model. Table 6 presents the serial correlation analysis in the model; here the Bresuch-Pagon test is used to check the serial correlation since the P-value is less than 0.02. It is below 0.05, so the null hypothesis is rejected. Therefore, the model has a serial correlation problem, and the alternative hypothesis is accepted and says that this model doesn't have a serial correlation problem. Table 7 highlights the multicollinearity in the model with centered variance. Again, inflation factors are to be considered for testing the multicollinearity; the values of all variables are between 1 and 5. Hence, TAT, financial leverage, debt-to-equity ratio, and working capital have a moderate correlation, and there is no perfect multicollinearity among these variables. Table 8 presents the model specification summary. The Ramsey reset test is used to specify whether the model is correctly established or not. It considers the t-statistic and p-values, so the p-value is 0.000, as above said to be considered for all tests at a 5% significance level. The below-mentioned value is below this value, so that model is correctly specified. ROA is ideally determined by total assets turned, financial leverage, debt-to-equity ratio, and working capital.



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**Table 4 Ordinary Least Square estimations**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Total Asset Turnover	4.183583	2.999484	1.394767	0.1699
Financial Leverage	0.172191	0.024445	7.044081	0.0000
Debt to Equity Ratio	0.174398	0.031156	5.597510	0.0000
Working capital	0.112775	0.226890	0.497045	0.6216
C	-1.276614	0.387362	-3.295658	0.0019
R-Square	0.552209	Adjusted R-Square	0.512406	

Source: Author's view.

**Table 5 Heteroscedasticity estimations**

F-Statistics	4.147086	Prob. F (14,35)	0.0003
Observed R-Sq.	31.19477	P Chi-Square (14)	0.0052
Scaled Explain SS	40.84318	P Chi-Square (14)	0.0002

Source: Author's view.

**Table 6 Serial Correlation Estimations**

F-Statistics	4.079317	Prob. F (2,43)	0.0239
Observed R-Sq.	7.973859	P Chi-Square (2)	0.0186

Source: Author's view.

**Table 7 Auto Correlation estimations**

Variable	Level	Un Centered VIF	Centered VIF
Total Asset Turnover	8.996907	28.44391	1.118221
Financial Leverage	0.000598	20.54078	4.046878
Debt to Equity Ratio	0.000971	6.768250	4.075869
Working capital	0.051479	51.69681	1.188468
C	0.150050	81.45347	NA

Source: Author's view.

**Table 8 Ramsey Reset estimations**

	Value	DF	Probability
t-Statistics	6.551292	44	0.0000
F-Statistics	42.91943	(1, 44)	0.0000
Likelihood ratio	34.03960	1	0.0000

Source: Author's view.

Figure 7 shows the normality analysis of the model. The chart indicates that the model is standard, considering the P-value of 0.010, which is less than 0.05, so there is no skewness or normality in this model. The kurtosis value presents how tails are thickly distributed; the value is 4.232, and it is above three, so the model has thick

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tails with a normal distribution. The curve is a leptokurtic distribution, and the skewness is 0.843, which is closer to 0.5, and the data is symmetric in this model. Data is dispersed up to 0.2908 showings by standard deviation. Figure 8 represents stability in the parameters of the Cusum test. It is applied to measure the stability of the model since the orange line represents 5% significance and the blue line presents Cusum, as seen in the graph, with the blue line in between these two orange lines so that all parameters are in range. Therefore, this model has stable content.

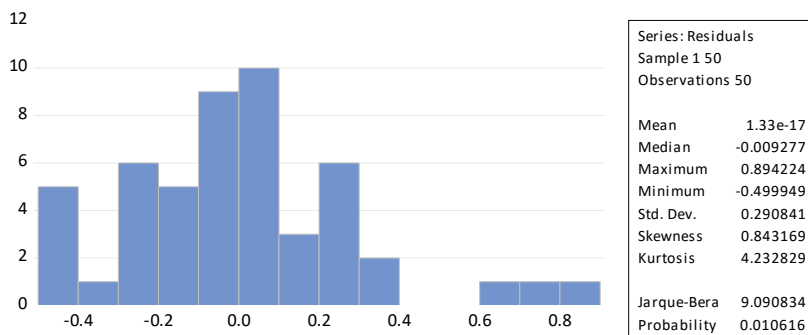


Figure 7 Normality Test estimations

Source: Author's view.

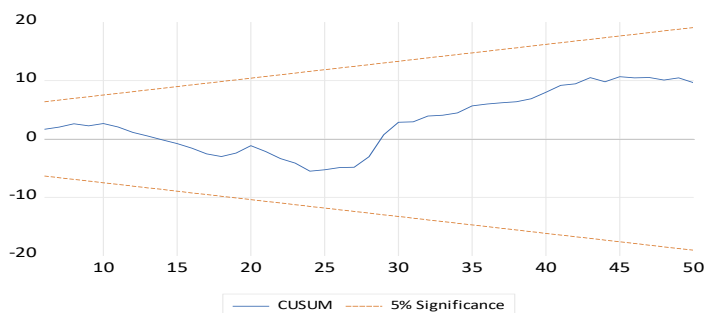


Figure 8 CUSUM Test estimations

Source: Author's view.

The ARDL model is beneficial for determining the long-run and short-run relationships among variables such as ROA, TAT, financial leverage, working capital, and debt-to-equity ratio. Auto-regressive distributed lag is a general statistical tool for showing the co-integration among variables (Pesaran & Shin, 1999). This model is also good for small sample sizes, especially when it is 30 to 50. ARDL gives authentic results and can get more unbiased estimators for long-run models (Harris & Sollis, 2003). R squared is more than the typical OLS results,

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where TAT, financial leverage, debt-to-equity ratio, and working capital declare 70% variations in ROA. Individually, the short-run and long-run results are presented in Table 9. It expresses the short-run model with the variables of financial leverage and shows that the debt-to-equity ratio and working capital are statistically significant in the short run. Only total asset turnover is not significant in the short run for profitability at Turkish banks. The estimated betas for the long-run relationship with a constant trend between financial leverage and ROA are statistically significant because the p-value is 0.000 at 5%. Working capital also has long-run effects on ROA in Turkish banks with the constant trend or no trend analysis in the model.

The coefficient for TAT is 0.29, indicating that an increase of 1% in total asset turnover in the ARDL long-run model suggests that ROA will increase by 29% in Turkish banks. The coefficient for financial leverage is 0.214017, indicating an increase of 1% in financial leverage. ARDL's long-run model suggests that ROA will increase by 21% in Turkish banks. The coefficient for debt-to-equity is 0.2357, indicating that if there is an increase of 1 point in the debt-to-equity ratio, the ARDL long-run model suggests that ROA will increase by 23% in Turkish banks. The coefficient for W.C. is 0.2245, indicating that if it increases by 1 point in the working capital ARDL long-run model, ROA will increase by 22% in Turkish banks. In this research, a constant and no trend in the ARDL model are expressed by:  $EC=ROA-(0.29635*TAT + 0.2140*FL + 0.25357*DER - 0.2246*WC - 1.1788)$ .

**Table 9 ARDL estimations (Short run and Long run effects)**

Variable	Coefficients	t-Stat	P-Values
Total Asset Turnover	1.912670	0.496445	0.6223
Financial Leverage	0.138127	5.636377	0.0000
Debt to Equity Ratio	0.152151	5.226520	0.0000
Working capital	0.144935	0.708411	0.0482
lnTAT	0.296351	0.500652	0.0009
lnNFL	0.214017	5.592550	0.0000
lnDER	0.235745	4.831741	0.0000
lnWC	0.224565	0.691963	0.0000
R-Square	0.70000		

Source: Author's view.

### 5. Conclusions

This paper examines the ROA, working capital, TAT, financial leverage, and debt-to-equity ratio in commercial banks of Turkey from 2011 to 2022 using ARDL model approach to find out the short-run and long-run effects among variables. ROA as a dependent variable, the ARDL model suggests that TAT, financial leverage,

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debt to equity ratio, and working capital affect ROA in the long run. In contrast, Total asset turnover does not negatively affect ROA in Turkish banks in the short run. Unit root suggests that model has no stationarity problem. Breusch Godfrey suggests that the model has no heteroscedasticity issue. The Breusch-Pagon test suggests that the model has no serial correlation. Variance inflation factors tell us that the model has no autocorrelation. This model only has a cointegration problem, so the ARDL approach is used to integrate the variables in the long run and short run. The Granger causality test was applied to find the Granger effect among variables, financial leverage, and TAT have a Granger effect on ROA. The Ramsey Reset test suggests that the model is specified correctly. The Cusum test also indicates that parameters are in range and stable. Therefore, financial managers and chief financial officers can use TAT, financial leverage, and the debt-to-equity ratio as good indicators to increase banks' profitability. Our findings also indicate that economic considerations have significant impacts overall on the WC-ROA relationship. Low economic conditions are often observed to have a detrimental impact on bank financial performance. Commercial banks should work on WC, financial leverage, and total asset turnover and maintain their debt-to-equity ratios in financial planning. Banks can create employment opportunities and increase income levels. Government economic policies targeted at increasing firm revenue may strengthen enterprises' ability to fund operational capital internally, specifically during recessions. The model was studied in the commercial banking sector of Turkey. It is strongly recommended that the same model be studied in savings centers, central banks, mutual funds, and insurance companies in Turkey. After COVID-19, the Middle East also faces working capital problems. The model can be applied to the Middle East banking industry. The sample size was 50 reports. These financial and annual reports were available on the commercial bank's sites. It is recommended to use the snowball sampling method to get more reports and increase the sample size for future study. Future research can be conducted in financial markets, including insurance companies, mutual funds, savings centers, and Islamic banks in Turkey. The model can be expanded by using controlled variables such as firm size, listing period, and independent auditing. Other financial ratios can be used as independent variables, such as the current ratio, quick ratio, and time interest earned ratio, to see the future effects on profitability in the Turkish banking industry.

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### Author contributions

TR is responsible for the data analysis, interpretation, and drafting of the manuscript. The other authors have provided inputs for the manuscript's content and editing.

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