



PERFORMANCE ANALYSIS OF AGRICULTURE, LIVESTOCK AND HUNTING SECTOR FIRMS USING PIOTROSKI F-SCORE METHOD

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Abstract: The agricultural sector is critical in providing nutrition, which is one of the basic needs of the world population. The financial performance of the industry, which has been affected by global climate changes in recent years and is sensitive to social, economic, and technological risks, is a point that should be emphasized for investors and countries in terms of sectoral development. This study will discuss the financial performance of agriculture, livestock and hunting sector firms traded in Borsa İstanbul (BIST) between 2020-2023 through the Piotroski F Score. Piotroski F Score calculations used nine financial indicators showing the firms' profitability, operating efficiency, leverage and liquidity status. In the research on four firms listed on the BIST, averages were calculated and grouped by scoring from 9 to 1. As a result of the Piotroski F Score method, agricultural sector firms differed yearly. In general, according to the Piotroski F scores of the firms, their financial performance was at a medium level, and they were worth investing in. It can be said that only one of the two firms has a strong financial position in two years and the other in one year, while the financial position of the other firm is at a medium level in all years during the analysis period. In the analysis, it was determined that the top three financial indicators of the firms according to the F score method are the return on assets, the change in return on assets and the change in the current ratio. Conversely, earnings quality and the change in leverage ratios are the least successful indicators. Also, their asset turnover rates are low.

Keywords: Financial performance, Agriculture sector, Piotroski F-score, Borsa İstanbul

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1. Introduction

Agriculture is one of the most important sectors that maintains its importance worldwide. Although it is a sector supported and protected by all countries to meet food needs, it has a relatively low share compared to the industry and services sector in the world. According to the 2024 Statistical Yearbook published by the Food and Agriculture Organisation of the United Nations (FAO), although the global agricultural value has increased by 89% in real terms in the last two decades and reached USD 3.8 trillion in 2022, the contribution of agriculture to global economic output has remained relatively constant. The proportion of the worldwide workforce employed in agriculture has decreased from 40% in 2000 to 26% in 2022 (www.fao.org). According to the report, further investment in agri-food systems is considered necessary to ensure malnutrition and food security, which continue to be a problem affecting a significant portion of the world's population. The agricultural sector also contributes to employment and a substantial portion of national income (Özbay, 2024). Therefore, to survive efficiently, it needs to be developed and financed by more investors than it has. The Gross Domestic Product (GDP) ratios of the agriculture, forestry, and fisheries sectors in Türkiye stated that the agricultural sector's contribution

to GDP was 6.7% in 2020, which decreased to 5.5% in 2021, 6.5% in 2022, and 6.2% in 2023. It is seen that the share of the agricultural sector in the Turkish economy has decreased over the years. The agricultural sector's growth figures, while the industry's growth rate was 5.8% in 2020, decreased to -3% in 2021, 1.3% in 2022 and -0.2% in 2023 (www.tarimorman.gov.tr.). It can be said that there is a similar decline in employment figures in the agricultural sector. While the 2020 agricultural sector employment rate was 17.8%, this figure declined over the years and decreased to 14.8% in 2023 (TURKSTAT, 2023). On the other hand, The World Bank supports the financing of the agricultural sector and attaches importance to agricultural loans among its loans. In 2022, the Bank provided Türkiye with a loan of 341.27 million USD to support the sustainable agrarian sector (tarimorman.gov.tr). In the agricultural sector, reasons such as high costs and long production periods, being rapidly affected by seasonal fluctuations and loss of income reduce the capital turnover rate. This situation may cause an increase in firms' short-term debt. Although the sector is supported, access to finance, industry development, provision of funds, and continuity of production are problems for firms (Şahin, 2025). Financial systems in developing countries are insufficient



to finance vital changes such as the transition to sustainable agriculture. Banks, microfinance institutions, and institutional investors provide limited resources to the sector. Agricultural loans and investment portfolios are disproportionately lower than agriculture's GDP share (www.worldbank.org). Risks specific to the agricultural industry, limited effective demand for financing, and lack of expertise of financial institutions in managing agricultural loan portfolios limit the source of investors and funds in the sector. Assessing financial performance and predicting failures is crucial for business owners, managers, investors, and lenders. Therefore, this study aims to analyze the financial performance of firms with service activities related to Agriculture, Livestock, and Hunting listed in Borsa Istanbul (BIST) in Türkiye. For this purpose, financial analysis was carried out using the Piotroski F-score method with the help of annual data obtained from the Public Disclosure Platform (PDP) between 2020-2023 and various ratios. In this way, the sector's financial performance will be revealed, and firms worth investing in will be identified. The study's significant limitation is the data limitation due to the small number of agricultural sector firms traded on the BIST. Financial performance is an indicator that shows the effectiveness of a firm's activities. Business performance is considered when estimating the firm's current investments and the sources of funds provided for investments, capital structure, and competitiveness in investment decisions. Predicting the financial performance and strength of the firms and making investment decisions or determining investment strategies are factors that should be considered by managers, shareholders, and potential investors. Analyzing the information presented in the firm's financial statements provides information about the firm, such as its profitability, liquidity, borrowing structure, activities, and cash flow to those inside and outside the firm. As a result of the ratio analyses made with this information, existing / potential investors who have information about the firm's financial performance take action. Although accounting-based financial ratio calculations provide information about the firm's financial soundness, the combined evaluation of accounting data and stock performance is among the methods used. Piotroski F-Score, developed by Joseph Piotroski (2000), is a score that measures the financial condition of a firm. Based on accounting signals, this scoring distinguishes between firms with good and bad fundamental scores. Piotroski argued that the information in financial statements is useful for selecting good companies for reasons such as the tendency of firms to be ignored by analysts, the low credibility of companies given the poor recent information they announce to the market, and the tendency of firms to be in financial distress (Piotroski, 2000). In the calculation made over nine indicator variables that examine the firm's financial performance, the firm is scored from 0 to 9. Nine (zero) indicates a business with more (less) good

signals and attractive investment opportunities (Piotroski, 2000).

2. Materials and Methods

2.1. Materials

In this study, the financial performance of 4 firms in the Agriculture, Livestock, and Hunting sectors traded in Borsa Istanbul for 2020-2023 were estimated using the data in the annual balance sheet, income statement, and cash flow statement. Financial statement data were obtained from the Public Disclosure Platform (www.kap.org.tr). Instead of using the names of the analyzed firms, it would be legally more appropriate to use abbreviations such as ENT (enterprise) -1, ENT-2, ENT-3, and ENT-4 in the following parts of the study. For these reasons, the results and evaluations regarding the firms in the following parts of the study will continue with these codes.

2.2. Method

Piotroski's F-score provides the opportunity to evaluate and compare the financial performance of firms based on nine different indicators. These nine indicators are categorized into three groups. In scoring as 1 or 0 for each indicator, 0 indicates the firms with the lowest financial performance, and 9 indicates the firms with the highest financial performance. In other words, as the F score approaches nine, the company's strength increases (Gökten et al., 2017). Table 1 shows the criteria for the method. The model that is formed by the indicators shown in Table 1 is presented below (Piotroski, 2000):

$$F\text{-Score} = ROA + CFO + EQ + \Delta ROA + \Delta LEV + \Delta CR + \Delta PIC + \Delta MARGIN + \Delta AT$$
 Nine criteria can be categorized into three groups: profitability criteria, operating efficiency criteria, and change in solvency/liquidity criteria. The profitability criteria have four indicators: ROA is calculated as net profit divided by total assets. CFO is calculated by dividing the cash flows from the company's principal operating activities by the total assets. Change in ROA and EQ (earning quality is the difference between CFO and ROA). The operating efficiency criteria have two indicators: Change in gross margin (Gross profit margin is calculated by dividing gross profit by net revenue.) and change in asset turnover.

The change in solvency/liquidity criteria has three indicators: A change in leverage ratio (leverage ratio is calculated by dividing total debts by total assets), a change in current ratio (current ratio is calculated by dividing current assets by total short-term debt), and a change in paid-in capital.

Table 1. Piotroski F-score Evaluation Criteria*

No	Variable	Criteria
1	Return On Asset (ROA)	If ROA is positive, the score is 1
2	Cash Flow From Operations (CFO)	If CFO is positive, the score is 1
3	Earnings Quality (EQ)	If the difference between CFO and ROA is positive, the score is 1
4	Change in Return on Assets (Δ ROA)	If ROA is greater than the previous year's ROA, the score is 1
5	Change in Leverage Ratio (Δ LEV)	If the ratio of total debt to assets is less than the previous year, the score is 1 (scoring 1 is also given if the company does not have debt even though the assets are increasing)
6	Change in Current Ratio (Δ CR)	If the current ratio increases compared to the previous year, the score is 1
7	Change in Paid-in Capital (Δ PIC)	If the amount of paid-in capital is more than the previous year, the score is 1
8	Change in Gross Margin (Δ MARGIN)	If the gross margin is higher than the previous year, the score is 1
9	Change in Asset Turnover (Δ AT)	If the asset turnover is higher than the previous year, the score is 1

*Source: Asmadi et al. (2021).

3. Results

In the analysis, calculations related to nine financial indicators between 2020 and 2023 in 4 firms listed in the agricultural sector in Borsa Istanbul were carried out by applying them in an Excel environment.

Each firm's F-score was calculated according to the criteria shown in Table 1. Table 2 shows the firms' F-score results. Table 2 shows that the F-score value of ENT-1 in 2021 and 2022 was 8. The firm's financial condition is good and highly worth considering for

investment. However, the F-score of the firm in 2023 decreased to 3, and it can be said that its financial conditions have been weak in the recent period. The Piotroski F-scores of the ENT-2 in 2020 and 2023 were calculated as 6. It can be stated that the firm's financial condition is at a medium level and worthy of investment consideration (Asmadi et al.,2021). The lowest f-score value was determined as 3 in 2021, and it can be said that the firm's financial strength is weak and unsuccessful.

Tablo 2. Piotroski F-score of Agriculture Sector Firms

Indicator	ENT-1				ENT-2				ENT-3				ENT-4			
	2023	2022	2021	2020	2023	2022	2021	2020	2023	2022	2021	2020	2023	2022	2021	2020
ROA	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1
CFO	0	1	1	1	1	1	1	0	1	0	1	0	0	1	0	0
EQ	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0
Δ ROA	0	1	1	0	1	1	0	1	1	0	1	0	1	1	1	1
Δ LEV	0	1	0	1	1	0	1	1	0	0	1	0	0	0	0	1
Δ CR	1	1	1	0	1	1	0	1	1	1	0	0	1	1	1	1
Δ PIC	1	1	1	0	0	1	0	1	1	0	1	0	0	0	1	0
Δ MARGIN	0	1	1	0	1	0	0	1	1	0	0	0	1	1	1	1
Δ AT	0	0	1	0	0	0	0	1	1	1	1	1	0	0	1	0
F SCORE	3	8	8	4	6	5	3	6	8	3	6	2	4	5	6	5

The ENT-3 had the highest F score (8) in 2023, and it was determined that it is financially strong and highly preferable for investors, while in 2020 and 2022, it had a low f score, and its financial situation was unsuccessful. Finally, it was observed that the F score values of the ENT-4 were 4-6 for the periods included in the analysis; in other words, the financial strength was moderately acceptable. When analyzed for financial indicators, the ROA of ENT-1, ENT-3, and ENT-4 were calculated as 1 in all analysis periods. On the other hand, the ROA ratio of

ENT-2 was calculated as 0 in all periods. The CFO and EQ of ENT-1 took the value of 1 in all periods except 2023, the change in the current ratio and the change in paid-in capital ratios took the value of 1 in all years except 2020. On the other hand, the change in asset turnover was calculated as 0 in all periods except 2021. It is determined that ENT-1 has the highest F score value (8) for the years 2021 and 2022. In other words, according to the model, its financial situation is the strongest and the most investable years for investors. ENT-2, another

firm within the scope of the analysis, determined that the CFO and EQ indicators were calculated as 1 in all periods except for 2020. The indicators of change in return on assets, change in current ratio and change in leverage were also calculated as 1. On the other hand, the most unsuccessful indicator of ENT-2 was the change in asset turnover rate (ΔAT). In general, it was found that ENT-2 had a maximum F-score value of 6 in 2020 and 2023. It was determined that the firm had a moderate financial performance and was feasible for investment. The year 2021 had the lowest F-score value for ENT-2, and it can be said that the firm failed financially during this period. ENT-3, another company included in the analysis, was analyzed; the indicator that received a value of 1 for all periods was the change in asset turnover (ΔAT). The model found the EQ, ΔLEV , and $\Delta MARGIN$ indicators to be the most unsuccessful ENT-3 had the highest F-score value (8) in 2023; in other words, according to the model, its financial situation was the strongest and the most investable year for investors. On the other hand, in 2020 and 2022, it had the lowest F-score value. It was determined to be financially weak during these periods. The last company, ENT -4, was analyzed; the EQ indicator was calculated as 0 in all analysis periods. On the other hand, ΔROA , ΔCR , and $\Delta MARGIN$ were calculated as 1 in all periods. The firm's F-score values between 4 and 6 were observed. According to the model, the firm's performance was stated to have a moderate financial condition and was feasible for investment.

4. Discussion

This study analyzed the financial performances of four firms in the Agriculture, Livestock, and Hunting sectors traded on BIST between 2020 and 2023 using the Piotroski F-score method. Based on financial reports, the model calculates the firms' financial status using nine indicators collected under three headings. When the literature is examined, the Piotroski f-Score method is not found among the studies conducted to evaluate financial performance in the agricultural sector. The studies conducted to evaluate the sector's financial performance and those that include the method used in the research are given below. In the studies conducted in the Agriculture, Livestock, and Hunting sectors, Koç et al. (2016) analyzed the financial performance of 3 agricultural sector firms registered in BIST between 2010 and 2015. They conducted panel data analysis by calculating seven different ratios that they thought would be effective on Return on Assets (ROA) and Return on Equity (ROE) ratios. The results show that the change in asset turnover rate positively affects ROA and ROE compared to other ratios. According to the study, it is possible to increase the performance of agricultural sector firms in Türkiye using an effective asset turnover ratio. The results obtained from the study support this research. Similarly, Şahin (2025) made a financial analysis of the agricultural sector and a publicly traded sector enterprise in 2016-2022. In the study, in which the

Central Bank of Türkiye's agriculture, forestry, and fisheries sector data were used, many ratios such as profitability, borrowing, activity, liquidity, cash flow, and growth rates were calculated. According to the study results, agricultural firms remained dependent on short-term borrowing due to low asset turnover, operational profitability, and difficulties in obtaining long-term financing. Besides, some studies have documented the financial structure of the agricultural sector. According to Ağızan and Bayramoğlu (2023), the liquidity and financial structures of the firms are strong and competitive, while their profitability is not at a sufficient level. Tiryaki and Kandil Göker (2021) examined the riskiness and financial structure of the sector with the ratios obtained from Central Bank annual financial reports between 2009 and 2019. They stated that short-term borrowing is high, creating a liquidity squeeze. It was noted that the agricultural sector has a low capital turnover rate and that seasonal conditions and lack of savings will create short-term financing needs. There are different studies on the factors affecting the financial performance of the agricultural sector. For instance, Odalo et al. (2016) examined the effect of firm size on agribusinesses' financial performance in the Nairobi Stock Exchange in Kenya, using ROA, ROE, and earnings per share ratios to measure financial performance. It was concluded that firm size has a positive effect on financial performance. Pokharel et al. (2019) compared financially stressed and non-stressed co-operatives using financial ratios to identify the causes of financial stress in 583 agricultural co-operatives in the United States and to make management-based recommendations to their shareholders, dividing financial stress between return on assets, leverage and interest rate issues and determining that the primary source of stress is a low real return on assets. Intan et al. (2024) examined the effects of endogenous and exogenous factors on the financial performance of 17 agribusinesses listed on the Indonesia Stock Exchange; ROA was used to measure financial performance. As a result, it was stated that the debt-to-asset ratio and exchange rate ratio are negatively related to ROA and that the ratio of production costs should be reduced. Previous studies suggested that the Piotroski F-score model performs well with different sectors. For instance, Duran-Vazquez et al. (2014) examined 63 firms in Mexico between 2005 and 2011 with Piotroski F-score management. As a result of the study in which the Ohlson Model was added to the scores obtained, it was determined that there were asymmetric signs in Piotroski score variables, and the Ohlson model provided explanatory power for Mexican data. Sasikala (2021) examined the risk of bankruptcy with the Altman Z-score, business trend distress with the Piotroski F-score, and earnings manipulation risk with Messod Beneish's M-score models between 2008 and 2017 for a single firm and stated that Piotroski's F-score can be used to detect the distress of industrial enterprises. Asmadi et al. (2021) analyzed the financial performance of 30 Sharia stocks in

Indonesia between 2017 and 2018. They found that a few stocks were worth investing in due to their excellent financial condition, while others had moderate financial conditions. Karadeniz and İskenderoğlu (2024a) analyzed the financial performance of health enterprises operating in BIST with the Piotroski F-score method. According to the study's results, which included four firms, the most substantial financial indicators were ROA and cash flows from operating activities. However, all companies failed regarding earnings quality indicators, and cash flows were lower than net profit. Abdioğlu and Aytakin (2024) revealed the financial determinants of manufacturing enterprises with the Piotroski F-score. The study found that Altmaz's Z-score, return on investment, market/book value ratio, and Tobin's Q ratio significantly affect the Piotroski score. Karadeniz and İskenderoğlu (2024b), examined the financial performance of football clubs using the Piotroski F-Score method. As a result of the research, clubs exhibit moderate financial strength, and the most successful indicators are changes in paid-up capital, earnings quality, and cash flows from operating activities; on the other hand, ROA, changes in leverage, and changes in MARGIN are the poorest financial indicators of the model. The Piotroski F-score results of this study show that ENT 1 (2021-2022) and ENT-3 (2023) scored 8, indicating strong financial performance and investment potential. Therefore, it has been determined that these firms are suitable for investment and financially excellent. The Piotroski F score value of the ENT-4 was moderate for all analysis periods. This indicates that it has medium financial conditions and is worthy of consideration for investment. However, it can be stated that ENT-3 in 2020 and 2022, ENT-2 in 2021 and AGROT in 2023 are unsuccessful for investment due to their weak financial conditions. The weak financial performance of the firms in 2020 and 2021 may be due to the negative effects of the Covid 19 pandemic. In particular, ENT-1 was found to have the lowest F score value in 2023, unlike other firms in the sector. Although the change in the firm's ability to pay its short-term debts is high, indicators such as the change in return on assets, change in leverage ratio, and change in asset turnover rate are low. Low asset turnover, operating profitability, and insufficient long-term funding sources in the agricultural sector increase the sector's financial risk by leading to dependence on short-term borrowing (Şahin, 2025: 396). Generally, the firms listed in the BIST agriculture, livestock, and hunting sectors have medium-level financial performance and are worth evaluating for investment activities (Asmadi et al., 2021; Karadeniz, İskenderoğlu, 2024a; Karadeniz ve İskenderoğlu, 2024b). Regarding the F Score value, ENT-4 shows the least fluctuation, while ENT-1 and ENT-3 show the highest fluctuation. According to the scope of the analysis, the top three financial indicators that all firms of this study are the strongest in, according to the F-score method, are ROA, change in the current ratio, and change in ROA. On

the other hand, changes in earnings quality, leverage, and asset turnover ratio are found to be the three least effective financial indicators. It can be said that firms in the agricultural sector utilize their assets efficiently. The financing support provided to the sector, which does not have much difficulty paying its short-term debts, especially the loans provided by the World Bank, relieves the firms in the short term. Although it has been found in previous studies that the increase in the short-term borrowing rate increases the Piotroski F Score value (Tepeli and Kahraman, 2023), the low change in the borrowing rate in the study indicates that firms in the agricultural sector resort to short-term borrowing due to the high use of foreign resources and limited access to long-term financing opportunities in the sector (Tiryaki and Göker, 2021; Şahin, 2025: 395). The results show that the decrease in asset turnover rate is not due to the firm's inability to use its assets effectively. The fact that the sector is adversely affected by seasonal movements, cost increases, loss of income and the decrease in growth over the years may negatively affect the change in asset turnover rate. Effective asset management, agricultural policies, and incentives are recommended to help the sector provide the resources it needs to finance assets and overcome the difficulties arising from financing.

5. Conclusion

Investors seeking stable returns should prioritize firms with consistently high Piotroski F-Scores (7-9). These firms exhibit strong profitability, liquidity, and operational efficiency. Moreover, monitoring changes in asset turnover and leverage ratios can help identify firms that are improving their financial health. For risk-averse investors, companies with profitability may also be worth considering. Diversifying across multiple agricultural firms can further mitigate sector-specific risks.

Author Contributions

Percentages of the author' contributions are present below. The author reviewed and approved final version of the manuscript.

	N.Y.E.
C	100
D	100
S	100
DCP	100
DAI	100
L	100
W	100
CR	100
SR	100
PM	100
FA	100

C= concept, D= design, S= supervision, DCP= data collection and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision, PM= project management, FA= funding acquisition.

Conflict of Interest

The author declared that there is no conflict of interest.

Ethical Consideration

Ethics committee approval was not required for this study because there was no study on animals or humans.

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