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Using combined accrual and cash ratio analysis to determine pre-bankruptcy status

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Abstract

***Research Questions**:* 1) To what extent does the combined use of accrual-based and cash-based ratio analysis provide comprehensive insights into a company's solvency, liquidity, profitability and efficiency? 2) Does the combined accrual-based and cash-based ratio analysis help in revealing manipulations in accrual financial statements? 3) How does the analysis of profitability and efficiency explain the results and levels of solvency and liquidity in a company? Do solvency and liquidity depend on external or internal sources of financing? 4) Does the present method of analysis indicate which company is closer to the pre-bankruptcy stage?

Motivation: despite high demand from business practice and academics, there are not enough literature and methods combining cash-based and accrual-based ratio analyses in the specific dimensions of solvency, liquidity, profitability and efficiency for the determination of the pre-bankruptcy state of production companies.

Idea: in this paper, the author created a method of analysis combining cash-based and accrual-based ratios in four dimensions (solvency, liquidity, profitability and efficiency) for the determination of the pre-bankruptcy state of production companies.

Data: historical panel data for the years 2013-2022 obtained from the annual, managerial, and auditor's reports of two production companies listed on the Baltic Stock Exchange.

Tools: The mixed methods were used combining quantitative ratio calculations based on the historical panel data from financial statements with qualitative explanatory information from financial reports.

Findings: The developed combination of ratio counterparts proves to be highly informative. The ratios used across all dimensions complement each other, providing a comprehensive picture of the companies' financial positions. Discrepancies within the ratio pairs suggest possible manipulations in accrual-based ratios. Low profitability and efficiency results during

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the first five years of analysis predicted a subsequent decrease in solvency and liquidity. Maintaining high levels of profitability and efficiency, and avoiding reliance on debt is crucial to sustain solvency and liquidity. A company is closer to pre-bankruptcy if the ratio analysis reveals significant discrepancies between the counterparts, with negative results prevailing.

Contribution: the paper contributes to both business practice (accountants, auditors, financial managers) and the ongoing academic discussion with the dual method of ratio analysis for a more precise determination of the pre-bankruptcy state of the companies. This method allows to determine manipulations in accrual-based financial statements more effectively.

Keywords: cash flow ratios analysis, accrual-based ratios analysis, solvency analysis, liquidity analysis, profitability analysis, efficiency analysis.

JEL codes: M41, M42

1. Introduction

Nowadays, there are two main approaches to ratio analysis used by accountants, auditors, financiers, banks and investors to determine the financial position of the companies. The main method of analysis commonly used by practitioners and studied by academics is accrual-based ratio analysis where the data for these ratios is taken from the income statement (profit and loss statement) and balance sheet (statement of financial position) (Bhandari *et al.*, 2019). The second method is a cash flow ratios analysis where the data is taken from the cash flow statement, however, this method is used more rarely despite its high predictive and analytical value (Ahmad *et al.*, 2010). It is important to mention that when Aziz *et al.* (1988) compared the cash flow model to accrual-based Altman's Z and Zeta models, the cash-flow model showed the ability to predict bankruptcy up to five years prior to the event. Thus, the research showed that the cash flow model provided an early warning three or more years before failure, while Zeta was superior in the two years preceding bankruptcy (Aziz *et al.,* 1988). Each ratio analysis is used for specific purposes which are explicitly described in the existing literature (Bhandari *et al.,* 2019, Das, 2019; Mills & Yamamura, 1998), and each of them has strengths and weaknesses. Laitinen (1994) noted that accrual and cash-based ratios might refer to different financial dimensions which lead to different predictive power and explained: "why cash-based and accrual-based cash flow ratio may lead to different classification schemes in failure prediction". For now, the usage of accrual-based and cash-flow-based ratios is unproportional. Both practitioners and scientists focused mostly on accrual-based ratios, thus 562 accrual-based ratios versus 92 cash-flow-based ratios were used in the study by Bellovary *et al.* (2007).

The main purpose of the present research is to create a combination of accrual-based and cash-based analysis which nowadays requires further development both in the scientific world and in practice. It is crucial to underline the equal importance of the cash-based approach and accrual-based approach in ratio analysis. The combination of the accrual-based and cash-based ratio analysis can help to eliminate the weaknesses of both methods and empower the strengths. The main benefit provided by the combined method is to reveal the manipulations in the accrual-based financial statements which represent a significant agency problem discussed by researchers (Arola, 2015; Bhandari *et al.*, 2019). The manipulations in cash-based statements are rare as they require profound knowledge and high competencies of the manipulating managers as well as strong proficiency of the auditors trying to acknowledge manipulations (Arola, 2015). As researchers point out there are three factors which might refrain auditors from the quality check of cash-flow statement manipulations: the education not emphasising the cash-flow statement analysis (Mills & Yamamura, 1998), ignorance and indifference of the auditors towards cash-flow statement manipulations (Siegel, 2006), alleged lack of interest in auditing the cash flow statement (Hanini & Abdullatif, 2013). The perfect combination of accrual-based and cash-based analysis has not been developed yet, but academic and business populations are working on developing it (Bhandari, 2014; Barac, 2010). For the broad use of combined accrual-based and cash-based ratio analysis approach the methodology of analysis has to be changed.

Accrual-based ratio analysis historically was the most reliable source of information for shareholders (Lee & Tweedie, 1975) and accrual financial statements were the most widely read sections of financial statements (Wilton & Tabb, 1978). A few decades later the focus of investors and top managers shifted to the cash-flow-based ratio analysis which aimed at better prediction of the pre-bankruptcy stage with the use of major dimensions (solvency, liquidity, efficiency and profitability) (Carslaw & Mills, 1991). Nowadays the evolution of financial analysis methods dictates the use of the strengths of both accrual-based and cash-based methods for better precision and trustworthiness of ratio analysis.

The present work uses four types of ratios for the analysis, both accrual-based and cash-based: solvency, liquidity, profitability and efficiency. The goal of the present research is to determine the financial health of the companies with the use of these four types of ratios. The other types of ratios are not used in the present work as they focus on the determination of prebankruptcy stage determination.

For the present research, I used mixed methods of research. I analyzed two production companies from Eastern Europe publicly listed on the Baltic Stock Exchange. Quantitative methods were used for the analysis of the financial statements of the companies for ten years. Qualitative methods were used for the analysis of the auditors' reports and managerial reports of the companies.

It is important to note that it is not the goal of this paper to analyse many companies with the use of existing forms of analysis. The focus is to introduce a new method of financial ratios analysis to the scientific world based on the analysis of two companies. The method presented in this paper is an intermediate stage in building a pre-bankruptcy stage model which I am currently working on. It will include the elements of simple and complex financial ratios both accrual-based and cash-based which will be presented in the next publications. This model will be built based on the Bayesian statistics in R-Studio script and more companies will be analyzed both from the USA and Europe. However, this paper focuses on the introduction of a combined method of analysis.

In the present paper, I answer the following research questions and hypotheses:

1) To what extent does the combined use of accrual-based and cash-based ratio analysis provide comprehensive insights into a company's solvency, liquidity, profitability and efficiency?

H1. The combination of accrual-based and cash-based ratio analysis provides explicit information and a full picture of the solvency, liquidity, profitability and efficiency of the company.

2) Does the combined accrual-based and cash-based ratio analysis help in revealing manipulations in accrual financial statements?

H2. The combined accrual-based and cash-based ratio analysis helps to reveal the manipulations in the accrual financial statements.

3) How does the analysis of profitability and efficiency explain the results and levels of solvency and liquidity in a company? Do solvency and liquidity depend more on external or internal sources of financing?

H3. The levels of profitability and efficiency in earlier years affect solvency and liquidity results in later years.

4) Does the present method of analysis indicate which company is closer to the pre-bankruptcy stage?

H4. The method of analysis in this paper reveals which company is closer to the prebankruptcy stage.

The paper contributes to ongoing academic discussions addressing the limitations of accrual-based and cash-based ratio analyses separately. It proposes a novel hybrid approach, the development of an equally-weighted ratio method of financial analysis that leverages the strength of both resulting in more comprehensive and balanced financial analysis for more precise and early determination of the pre-bankruptcy state of the companies.

The work will be useful for finance practitioners: accountants, auditors and financial managers. For auditors, it will be useful because the present financial analysis method allows them to recognize possible financial health problems in advance, especially it reveals the accrual-based manipulations. This method is worth to be included in the regular audit methodology used by auditors as it allows to determine

manipulations in accrual-based financial statements more effectively. The current methods of ratio analysis do not allow to determine the pre-bankruptcy state of the company in advance and show bankruptcy only at a later stage when it already happened and the going concern principle stops working being replaced by the cash principle.

For accountants, the present method allows to consider possible discrepancies between accrual and cash ratios during the creation of annual report with the use of major financial ratios. For financial managers, the present method allows to plan the company strategy in advance to control solvency and liquidity based on the profitability and efficiency indicators (as the present work showed the interconnection between them).

The present paper consists of the following parts. The literature review in the first section creates a fundamental theoretical base for my research. The research design in the second section and the methods of research in the third section describe the methodology of the present paper. The fourth section describes the results of the research and presents the analysis. The research is summarized in the conclusions section, followed by the reference list and appendices. Appendices contain the calculations.

2. Literature review

In this part of the research, I bring out the most relevant theoretical grounds regarding both the accrual statement analysis and the cash flow statement analysis. This theory is intended to provide the foundation for the analysis of the case study and for making the conforming conclusions further on. The precision in analyzing financial statements is crucial as it aids in forecasting a company's future financial condition, identifying potential issues, and informing sound managerial decisions (Jasman & Aminatunnaza, 2023). The analysis output must accurately reflect the company's financial status and emphasize areas critical to its financial health. Therefore, selecting the appropriate analysis method is essential for a clear understanding of a company's strengths and weaknesses (Laković *et al.*, 2016). It is important to note that financial statement analysis is a transformative process where raw financial data is converted into clear, usable information for making well-weighted financial decisions. This process is appropriately defined by John Nicolas Myer (1969) who described it as a study of relationships among various financial factors in a business, as revealed by a single set of statements, and a study of the trends of these factors over time as shown in a series of statements. This definition underscores the critical attributes of financial analysis: reliability, understandability, relevance, and comparability. Consequently, it becomes evident that comparative techniques are indispensable in financial statement analysis. This is because each statement provides a snapshot of a company's financial position at a specific point in time.

Therefore, to gain a comprehensive understanding and discern possible trends, it is essential to compare the data from different financial statements across multiple periods.

Financial statement analysis, employed by professionals like accountants and investors to understand a company's financial situation, is subject to limitations impacting decision-making (Li, 2019). These include the reliance on the accuracy of financial statements, which may contain varying or non-standard calculations, the inability to capture qualitative aspects like customer satisfaction or worker dedication, and a focus on past performance that doesn't guarantee future results (Jackson, 2021). Despite its utility, users should be aware of these constraints, leading to the development and growing trust in cash flow statement analysis as an alternative analysis of financial statements across multiple periods (Li, 2019).

2.1 Financial analysis for bankruptcy prediction

It is important to bring up interesting nuances between insolvency, pre-bankruptcy and bankruptcy states of the company. Insolvency presumes that a company cannot meet its debt obligations, and it can be of two types. Balance sheet insolvency is when company's total liabilities exceed its total assets. Cash flow insolvency is when the company is unable to pay debts despite its assets exceeding liabilities. Insolvency can be resolved relatively easily through negotiation of debt terms, restructuring or obtaining new financing (Pindado & Rodrigues, 2004).

Pre-bankruptcy is a broader term which indicates that a company is at high risk of bankruptcy and the formal bankruptcy proceedings soon to follow. Alongside insolvency and financial distress, it includes legal and operational issues.

Bankruptcy is defined as the legal status of an individual or a company which is unable to pay its liabilities and seeks protection under bankruptcy laws which might result in restricting debts or liquidation of assets to pay creditors (Onakoya & Olotu 2017; Kirkos, 2015). Ross *et al.* (1999) outlined four states: business failure when a company cannot pay its debts even after liquidating assets; legal bankruptcy which occurs when either company or creditors file for court with a formal declaration of bankruptcy; technical bankruptcy, where the company failed to repay principal and interest on time; and accounting bankruptcy where net assets of a company are negative on the balance sheet. Legal and accounting texts highlight that when bankruptcy is legally stated, the going concern principle is replaced with the cash principle (Financial Accounting Standards Board, 2012).

It is worth mentioning the distinction between classical bankruptcy prediction models and financial analysis methods serving to determine it. Usually, bankruptcy prediction models have predefined statistical modelling coefficients helping to

determine the difference between the healthy, pre-bankruptcy and bankruptcy states of the companies. Financial analysis methods of bankruptcy prediction may not use such predefined statistical coefficients. Although they might use industry benchmarks or historical data for interpretation, their major focus is on using ratios which are calculated based on absolute values taken directly from financial statements.

The majority of existing bankruptcy prediction models use accrual ratios and are based on the going concern principle instead of the cash principle which would be more logical to take use in prediction models in relation to bankruptcy. Based on the explicit list of 38 existing bankruptcy prediction models (Kirkos, 2015), I performed an analysis of their components. The analysis showed that 20 models out of them used only accrual ratios, 14 models had combined ratios with significant dominance of accrual ratios, and 4 models did not use ratios for bankruptcy prediction at all.

It is important to underline that accrual ratios are suitable for bankruptcy prediction based on the going concern principle. When legal bankruptcy takes place, the going concern principles are replaced with cash principles for the satisfaction of the creditor's claims. Therefore, it is impossible to predict bankruptcy using accrual ratios solely. All modern models either do not consider the cash-based ratios at all or use just a few of them without balancing with accrual.

2.2 Breaking down solvency, liquidity, profitability and efficiency

The analysis in the present research is done via four dimensions: solvency, liquidity, profitability and efficiency. This part briefly explains the dimensions by which the analysis will be done in this paper and brings up the main research done by the scientists. This is essential to ensure the profound understanding of the readers.

Solvency, in the context of ratio analysis, refers to the ability of a company to meet its long-term financial obligations and sustain its operations over time. This concept is crucial in assessing the financial health and stability of a business. Solvency ratios, a subset of financial ratios, are used to evaluate a company's ability to continue functioning as a going concern. These ratios provide insights into the long-term financial viability of a company by measuring its capital structure, leverage, and ability to service debt.

Liquidity, in the context of ratio analysis, pertains to a company's ability to meet its short-term obligations using its most liquid assets. This concept is a critical indicator of a company's financial health, as it reflects the ease with which it can pay off its current liabilities without raising external capital. Liquidity ratios are key tools in financial analysis, used to evaluate a company's short-term financial stability and risk. Liquidity ratios are essential components of ratio analysis, providing insights

into a company's short-term financial health. These ratios help to understand how well a company can meet its immediate financial obligations, which is vital for maintaining operational stability and creditworthiness.

Profitability, in the realm of ratio analysis, is a measure of a company's ability to generate earnings relative to its revenue, assets, and equity. Profitability ratios provide insights into how well a company can achieve returns on its sales, assets, and equity, which are essential for investors and stakeholders. Overall, profitability ratios are vital in ratio analysis, offering insights into a company's ability to generate earnings and efficiently utilize its resources. These ratios are key indicators of a company's financial health and performance, guiding investment and business decisions.

Efficiency, in the context of ratio analysis, refers to a company's ability to effectively use its assets and liabilities to generate sales and maximize profits. Efficiency ratios, also known as activity ratios, are key indicators that help assess how well a company manages its operational resources to produce revenue. These ratios are crucial for understanding a company's operational performance and for benchmarking against industry standards. Efficiency ratios are integral components of ratio analysis, providing insights into a company's operational effectiveness in using its resources.

2.3 Accrual-based financial ratios analysis

Accrual ratio analysis refers to the accounting method that analyzes revenues and expenses when they are incurred based on the balance sheet and income statement, regardless of when cash transactions occur (Nissim & Penman, 2001). This concept is a fundamental aspect of accrual accounting, contrasting with cash accounting, where transactions are recorded only when cash changes hands. Accruals are crucial for understanding a company's true financial performance, as they provide a more accurate picture of income and expenses over a given period. In ratio analysis, the impact of accruals is often assessed through various measures that help in understanding a company's operational efficiency, earnings quality, and the timing of revenue and expense recognition. Key considerations include the quality of earnings, the timing of revenue recognition, and the management of expenses.

Understanding the impact of accrual financial statements is essential for accurately assessing a company's earnings quality, revenue recognition practices, and expense management. Accrual ratio analysis plays a significant role in ratio analysis by providing a more comprehensive view of a company's financial performance. However, researchers found (Flint, 2018) that companies fail to a deficiency in cash flow despite the well-calculated accrual-based financial ratios considered as predictor variables (Bhandari *et al.*, 2019).

2.4 Cash flow ratios analysis

The statement of cash flows, an essential component of annual financial reports for many years, tracks the movement of cash within a company over a certain time. It details where the cash originated and how it was utilized, offering a reconciliation between accrual-based accounting and actual cash movements (Broome, 2019; Hodder *et al.*, 2008; Steyn & Hamman, 2003). Unlike the balance sheet, which provides a static snapshot, and the income statement, which includes non-cash items like depreciation, the cash flow statement gives a dynamic and tangible account of cash transactions, making it more reliable for liquidity analysis (Mills *et al.*, 1998).

The topic of the cash flow statement analysis as an effective predictor of failure has been studied for many decades. Thus, Donaldson (1961; 1969), Lawson (1971), Helfert (1982), Aziz *et al.* (1988) and Gentry, Newbold and Whitford (1985; 1987) found the components of a cash flow statement which represents the most powerful predictors of failure.

To effectively analyze companies, grasping the purpose of the cash flow statement is crucial. It's a key tool for investors, creditors, financial managers, and stakeholders to assess a company's potential to generate future positive net cash flows, fulfil obligations, and distribute dividends. Additionally, cash flow analysis can serve as an early indicator of potential financial distress (Pornupatham *et al.*, 2022). The Financial Accounting Standards Board (FASB) highlights its main function as offering insights into a company’s cash transactions within a specific period (Carslaw *et al.*, 1991). Researchers note that the cash flow statement reveals a company's cash-related efficiency in its operations, investments, and financing activities, along with its liquidity and solvency, which are not evident in standard financial statements (Brycz & Pauka, 2012).

The cash flow statement is invaluable for management, playing a pivotal role in organizational decision-making. It offers insights into an organization's liquidity, solvency, and adaptability to future cash flow changes. It also aids in assessing changes in assets, liabilities, and equity, enhancing comparability between organizations by neutralizing the impact of varying accounting practices. It further details future cash flow amounts, timings, and probabilities. Auditors also find cash flow analysis crucial, as it aids in accurately evaluating a company's financial health and mitigating assessment errors (Mills *et al.*, 1998).

Overall, the cash flow statement is a comprehensive tool for understanding a company's financial status, predicting future scenarios, and pre-empting potential financial difficulties. Speaking of cash flow analysis, it is evident that one of its main objectives is the assessment of a company's ability to meet its obligations towards investors, owners, and creditors, in other words, to be able to pay dividends and

repay debts. Thus, the analysis must show if the company is able to generate enough cash to be solvent. It is recommended to use the following ratios to analyze a company's ability to meet its obligations (Carslaw *et al.*, 1991): Cash Interest Coverage Ratio, Cash Debt Coverage and Cash Dividend Coverage as shown in the formulas in Appendix B.

The researchers found that their counterparts from accrual-based ratios, namely Current Ratio, Quick Ratio and Interest Coverage ratios often lead to incorrect decisions about the liquidity of the analyzed companies and therefore should be compared against cash flow ratios mentioned above to test the correctness (Kirkham, 2012; Mills & Yamamura, 1998).

Another benefit that is drawn from the statement of cash flows is that it helps users evaluate the quality of income by determining reasons for distinctions between net income and associated cash receipts and payments (Carslaw *et al.*, 1991). If one compares the income statement to the statement of cash flows, then the latter provides us with more detailed information for analysis on the kind of inflows and their sources.

One of the approaches suggested for analysis of quality of income is to use ratio which compares cash flows from operations to the operating income. This comparison will indicate the divergence between the reported earnings and the cash flows (Billah *et al.*, 2015). Sometimes the discrepancy can be substantial between cash flows and earnings. It is so because the reported earnings very often include income or expenses without the current effect on cash, such as instalment sales or depreciation. Therefore, there is an alternative measurement which excludes major non-cash items and results in a closer approximation of cash to income from operations. It is suggested to divide cash flow from operations before interest and taxes by income before interest, taxes, and depreciation. The ratios of Quality of Sales and Quality of Income (Appendix B) are proposed for use (Carslaw *et al.*, 1991).

In order to see a clearer picture of the return on assets, analysts can use the ratios for the cash flow statement to segregate specific data from it. Return is important to assess for all users of financial statements because it shows how efficiently assets are used by the enterprise to generate profit and potential return for the investors (Foerster *et al.*, 2017). Also, based on the evidence from historical cash flows one can presume the future cash flows. The ratios suggested for calculations of returns are represented in Appendix B: Cash Flow per Share, Cash Return on Assets, Cash Return on Debt on Equity, and Cash Return on Stockholders' Equity (Carslaw *et al.*, 1991). Cash flow per share, which represents the available cash for common stockholders divided by the total common shares outstanding, is commonly used by analysts despite FASB's prohibition against its reporting in financial statements

(Carslaw *et al.*, 1991). Additionally, ratios like cash return on assets, debt, equity, and stockholder's equity are seen as crucial for analysis.

According to Charles Carslaw and John Mills, these measures are indicative of a company's capability to generate superior cash flows from invested funds over time and should be assessed relative to industry standards (Carslaw *et al.*, 1991). Operating activities, as the most crucial part of the Cash Flow Statement, encompass the principal revenue-producing activities and all other activities not classified as investing or financing, involving transactions that affect operating income (Alver, 2005). It is important to underline cash flow from operations specifically as it is a major element of the cash flow ratio analysis as it has better predictive abilities than earnings (Troberg, 2007; Chu, 1997; Lorek & Willinger, 1996) and tells investors how much cash the regular business operations of the entity is creating (Arola, 2015).

3 Research design

The research design of the present paper is based on the research questions and hypotheses aiming to contribute to the problem resolution. To confirm or refute the hypotheses, two large production companies from Eastern Europe were chosen which are represented at the Baltic Stock Exchange: Linas Agro Group and Auga Group. These companies are similar to each other by a number of factors including activity sector, size, operations, and geography, which makes them perfectly comparable. Also, as the largest and most famous agricultural production companies in the Baltic region, they possess a diversity in operations, capital intensity, technological innovation, sustainability practice, global supply chain dynamics and compliance with corporate governance structure, them suitable to represent a broader trend for production companies. However, despite all the similarities, they exhibit different financial strategies which are highlighted in the analysis.

The other reason for choosing these two companies is because I am conducting a long-term and multifaceted analysis of these companies, where historical analysis flows into forecasting which flows into analysis again to identify changes, trends, financial strategy, accounting and audit reporting tactics. Despite the comparability, these two companies exploit different strategies and approaches as the present paper will show. One of the previous publications highlighted a rigorous analysis of Linas Agro Group with Jury's cash-based credit risk model and accrual-based Z-Score model (Litvinenko, 2023a, b). The present study analyses both Linas Agro and Auga Group with the use of combined accrual-based and cash-based ratio analysis.

I analyzed the annual reports as well as managerial and auditors' reports of these companies and calculated comparable accrual-based and cash-based ratios within the dimensions: of solvency, liquidity, profitability and efficiency. Further, I compared the results between the two companies analyzing them with the help of annual,

managerial and auditors' reports to answer the research questions set. The comprehensive and multidimensional analysis of the financial statements of Linas Agro Group has been presented in other research (Litvinenko, 2023a, b).

It is important to mention that in order to fulfil the aim of this paper and to apply the new method of analysis which I developed, it was crucial to apply it to the active companies whose patterns and behaviour have been studied by me for a long time.

With the thorough and in-depth introduction of the new method in this paper, further research can be done with the use of bankrupt companies to compare the results with active companies. It can be performed in different economic sectors. Given that the present methodology of analysis is unique and the aim is to introduce it for the first time, the major focus is on the application of the method and thorough analysis to make it clear and useful for practitioners and other researchers.

4 Research method

This paper employs a mixed-methods approach to research. Ratio calculations represent the quantitative method, based on numerical data from financial statements. In contrast, the analysis represents the qualitative method, utilizing explanatory information from annual, managerial, and auditors' reports to explain the results of calculations and answer the research questions.

To calculate ratios and obtain primary data for further analysis I used historical panel data spanning 10 years from the financial statements of two production companies represented at Baltic Stock Exchange: Linas Agro and Auga Group. The ratios were calculated using absolute values. The absolute values for calculating accrual ratios were obtained from income statements and balance sheets. The absolute values for calculating cash-based ratios were sourced from cash flow statements and balance sheets.

It is important to explain the new method of analysis developed in this paper. I selected 24 ratios for the present analysis. Each accrual-based ratio had a corresponding cash-based ratio with a similar meaning, resulting in a total of 24 ratios (12 accrual-based and 12 cash-based), referred to as "equally weighted ratios" in this paper. The ratios were divided into four equally weighted groups (referred to as "dimensions") to cover solvency, liquidity, profitability and efficiency analysis.
Given that one of the research questions is related to the pre-bankruptcy state of the companies, it was essential to analyze both the long-term and short-term ability to pay through solvency and liquidity analysis. To obtain a comprehensive picture of solvency and liquidity, it was necessary to use both accrual-based ratios (which can be prone to manipulation) and cash-based ratios for a more realistic assessment. Since there are more accrual-based ratios for solvency and liquidity analysis than

cash-based ratios, I selected accrual-based ratios that matched the meaning of the chosen cash-based ratios, as shown in Table 1 below.

Table 1. Cash-based ratios and their accrual-based counterparts for solvency and liquidity analysis.

Accrual-based ratios	Cash-based ratios
Solvency	
Interest Coverage Ratio	Cash Interest Coverage
Debt to Equity Ratio	Total Debt (Cash flow-to-debt ratio)
Equity to Assets Ratio	Capital Expenditure
Liquidity	
Current Ratio	Operating Cash Flow (OCF)
Quick Ratio	Cash Debt Coverage
Equity Multiplier	Investment to Finance Ratio (I/F)
Source: created by the author	

The analysis of profitability and efficiency is another crucial part because these dimensions explain why the solvency and liquidity of the company are getting better or worse. There is a potential correlation where profitability and efficiency reveal the internal or external source of funding which will be explained further in this paper. The accrual-based ratios for profitability and efficiency analysis were chosen to suit the meaning of the particular cash-based ratios as shown in Table 2 below.

Table 2. Cash-based ratios and their accrual-based counterparts for efficiency and profitability analysis.

Accrual-based ratios	Cash-based ratios
Profitability	
Return on Equity	Cash Return on Stockholders' Equity
Return on Assets	Cash Return on Assets
Return on Capital	Cash Return on Debt, Equity
Efficiency	
Assets Turnover	Quality of Sales
Capital Turnover	Cash Flow Per Share (CFpS)
Cash Turnover	Quality of Income
Source: created by the author	

The present method of analysis is more informative and has better predictive power than existing methods of bankruptcy prediction because it is based on a comprehensive selection of groups of ratios (solvency, liquidity, profitability and efficiency) revealing possible bankruptcy. Bankruptcy presumes that a company fails to pay obligations to creditors therefore solvency and liquidity ratios are essential. Solvency and liquidity are connected to profitability and efficiency of the company because it is impossible to sustain the profitability and efficiency of the

company if solvency and liquidity tend to decrease. If the company does not generate sufficient profit from its main activity it has to take loans to maintain solvency and liquidity. However, this increases the risk of credit default and potential bankruptcy if the company's operational earnings continue to struggle, making it unable to cover interest payments and the face value of the debts. But most importantly, the enhanced predictive power is gained through a strong selection of equally weighted accrual and cash ratios, where ratio pairs are formed so that one ratio in the pair is accrual, and another is a cash-based ratio. These ratios in each pair are close by the meaning with similar components in the numerator or denominator.

As discussed in the literature review, the majority of bankruptcy prediction models exploit accrual methods which are based on the going concern principle, and even if the model partly uses few cash ratios in addition to accrual ratios, the going concern principle prevails due to the imbalance. The comprehensive analysis of bankruptcy prediction demands combining a static balance sheet with the dynamic income statement and cash flow statements to naturally flow from going concern to cash principle. Therefore I elaborated an equally-weighted ratio analysis method for bankruptcy prediction.

The formulas of all accrual-based and cash-based ratios are represented in Appendix B.

5 Comparison of accrual-based ratio analysis to cash-based ratio analysis

In this chapter the two production companies are analyzed: Linas Agro Group and Auga Group. The analysis is done via four dimensions: solvency, liquidity, profitability and efficiency where the accrual-based ratios are compared to cash-based ratios to obtain profound information for further analysis. The purposes of analysis are, firstly, to determine the financial state of each company and find possible manipulations in accrual-based statements; secondly, to compare analyses of companies to each other to show the different approaches to their financial management strategy. The results of the analysis called „4 Dimensions Viability Analysis" for both companies are presented in Appendix A. It is important to underline the key years 2018 and 2022 which are the most important years of analysis for both companies and both accrual and cash ratios. The conclusion of the analysis at the end of the chapter will explicitly cover the analysis of these years explaining their peculiarities.

For the convenience of the readers, it is important to explain how to read the figures. Each figure represents a ratio pair, therefore it consists of two parts. The graph on the left shows the accrual ratio, while the graph on the right side of every figure shows the cash-based ratio. Each of them shows ratio results for 10 years for Linas Agro (green line) and Auga Group (blue line). This presentation of results makes the

comparison clear by simply collating the pattern of lines side by side for the ratios within the pair and between the companies. The most important findings are discussed in the text.

5.1 Solvency dimension

The analysis starts with the solvency dimension which is an important indicator of companies' financial health and ability to refrain from bankruptcy. Solvency ratios indicate the ability to pay long-term obligations. The first pair is the accrual interest coverage ratio versus cash-based cash interest coverage ratio as shown in Figure 1.

The interest coverage ratio measures the ability of a company to pay the interest on its debt outstanding (Kim and Kross, 1998). Cash interest coverage determines the amount of cash available to cover the interest of the debt outstanding. The ratios are similar in meaning as they both have interest expense in the denominator, while in the numerator they have profit and cash from operations for accrual and cash ratio respectively. Both ratios also have interest expense in the numerator. Companies analyzed show different results for this ratio. Auga Group shows higher volatility during the whole period than Linas Agro. However, the highest value of 9.3 was reached in 2014 which equals the same value Linas Agro Group has in the same year underlining the fact that these two companies are comparable. The interest coverage ratio shows that Linas Agro could cover both the interest and the face value of the debt in all years besides 2019, while Auga Group could cover both the interest and face value of the debt only in the years 2014-2017, while in the years 2019, 2020, and 2022 it could only cover the interest rate of the debt.

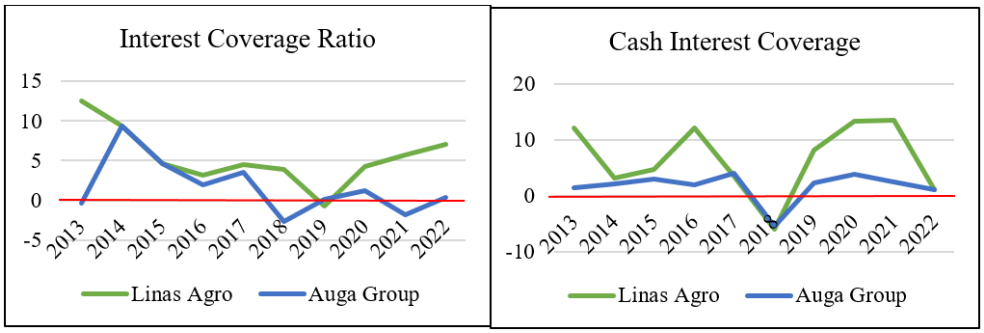

Figure 1. The first pair of solvency ratios
Source: created by the author

The next ratio in the pair is cash interest coverage which shows how many times cash exceeds debt. The indicators of Linas Agro are extremely negative with the apogee in the year 2018 reaching -6.06 which means that the debt of the company 6 times exceeds the cash of the company, similar to Auga Group, which reaches a bottom of -5.57. In the year 2022 Linas Agro and Auga Group reached 1.08 and 1.09

positive results respectively which says that debt was almost equal to cash, which is positive but a very weak position. For the rest of the years, the companies showed similar patterns for good positive results, although Linas Agro was more volatile with a peak of 13.52 in the year 2021 versus an earlier peak for Auga Group reaching only 3.76.

To compare the accrual interest coverage ratio with the cash interest coverage ratio it is clear that these ratios show different trends for Linas Agro Group. In the year 2018 accrual interest coverage ratio showed a positive result (3.9) while the cash interest coverage ratio in the year 2018 was strongly negative (-6.06) and the accrual ratio turned negative only the next year 2019. It is evident that the cash ratio shows an early warning signal one year earlier for solvency. In the year 2022, the accrual interest coverage ratio for Linas Agro had a strongly positive result (7.03) but the cash interest coverage ratio showed a weak positive result of 1.08 which speaks of tremendous differences in the accrual and cash ratios analysis.

Auga Group in the year 2018 had a negative accrual interest coverage ratio value of -2.7 was supported by a cash interest coverage ratio negative result of -5.57. In the year 2022 a weak positive accrual ratio result of 0.4 was supported by a weak positive result of cash ratio 1.09. But an interesting indication comes from the year 2013: regardless of the negative values of the accrual interest coverage ratio of -0.4 the cash ratio was positive at 1.37.

To summarize the pair, the close alignment of accrual and cash ratios for Auga Group even in times of distress speaks of a consistent financial management approach as it shows fewer sharp cash-based fluctuations compared to Linas Agro. In contrast, Linas Agro may allow to take more financial risk, yet its accrual metrics may obscure limitations of cash flow which are crucial for solvency analysis and early warning signs.

The next pair of ratios are debt to equity accrual ratio and total debt (a.k.a. cash flow to debt) cash ratio, both are shown in Figure 2.

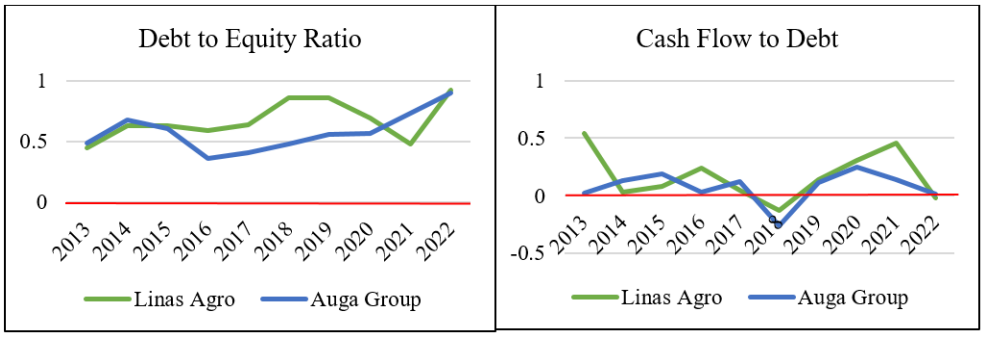

Figure 2. Second pair of solvency ratios
Source: created by the author

This pair of ratios are close to each other by meaning, because the numerator of debt to equity ratio consists of borrowings, while for the cash flow to debt ratio, the denominator consists of borrowings. The debt-to-equity ratio shows the proportion to which extent the company is financed through debt or through equity (Kim and Kross, 1998). The high result shows that the company is mostly financed through borrowing external debts from financial institutions, while the low result (less than 1) indicates that it is financed through equity which is safer for the company to remain further from the prebankruptcy state.

For the debt to equity accrual ratio, Linas Agro shows above the average values throughout all analyzed periods reaching the maximum of 0.92 in the year 2022 and in the years 2018-2019 the ratio is held at stable 0.86. The debt-to-equity ratio for Auga Group shows moderate results around 0.5 throughout the years reaching its maximum of 0.9 in the year 2022, which means that the company mostly used equity for financing. Linas Agro Group has a 0.68 average value for debt to equity ratio for 10 years while Auga Group has 0.58 which speaks of the different financial management strategy approaches. Linas Agro is more focused on the new debt lines opening and attraction of funds from financial institutions while Auga Group is more focused on its own equity financing as a preferred method.

The cash flow to Debt ratio shows how long it would take for the companies to repay the debts if all cash flows are directed to debt repayment. The important part of the ratio is its numerator, operating cash flow, which is also a crucial part of the whole ratio analysis as it shows how much cash the company earns through its major activity. If cash flow to debt has a negative value it means that the company is not earning cash through its major activity but finances its debt payments through external borrowings, paying the interest and face values and increasing its debts at the same time. Linas Agro had low results prevailing for the cash flow to debt ratio, with the negative picks of -0.13 and -0.02 in the key years 2018 and 2022 respectively, indicating the inability of the company to pay out its debts through obtaining cash from its major activity. Only in the year 2013 Linas Agro had the highest value of 0.54 and quite a good indicator 0.46 in the year 2021 for the cash flow to debt ratio. Auga Group had generally positive results besides a negative value of -0.26 in the key year 2018. The analysis shows that Auga Group earns enough cash flow from its major operations to finance and repay its debts while Linas Agro in the years 2018 and 2022 financed its debt repayment through the additional debts.

If we compare the accrual debt to equity ratio to cash flow to debt ratio the accrual one for Linas Agro does not show any negative results or warning signs in the key years 2018 and 2022, although the values for these years are not ideal they do not show the size of the problem. However, the cash flow to debt ratio in the key years 2018 and 2022 shows clearly negative results for Linas Agro. Comparing the ratios for Auga Group, it is clear that the company has a negative result of -0.26 in the year 2018 based on the cash flow to debt ratio, while the debt to equity accrual ratio has a positive value of 0.48.

To summarize the analysis for the second pair, Linas Agro shows higher reliance on debt as is evident from the accrual ratio, and in addition, the company experiences inconsistent cash flow to debt ratio highlighting potential liquidity issues in covering debt through operations. In contrast, Auga Group has a moderate debt-to-equity ratio aligned with a generally positive cash flow to debt ratio, showing a healthy approach to debt which counts primarily on internally generated funds instead of external financing. Comparing companies, it is evident that the growth strategy of Linas Agro relies on debt and therefore exposes the company to greater financial risks in periods of low operational cash flow, while Auga Group shows a conservative strategy focusing on equity which leads to greater financial stability.

The next pair is accrual equity to assets versus capital expenditure cash ratio shown in Figure 3. They are similar in meaning. Both have a denominator consisting of assets, while the numerators are different: accrual ratio has total equity in the numerator while cash ratio has cash flow from operations.

For the equity-to-assets ratio the higher the value the better, meaning that most of its assets are owned by the company, while small values indicate that the assets are leveraged through external debts. Similarly to Auga Group, Linas Agro shows balanced financing strategy with moderate results of an average of 0.46 throughout all 10 years of analysis however its key years 2018 and 2022 do not show any warning signs.

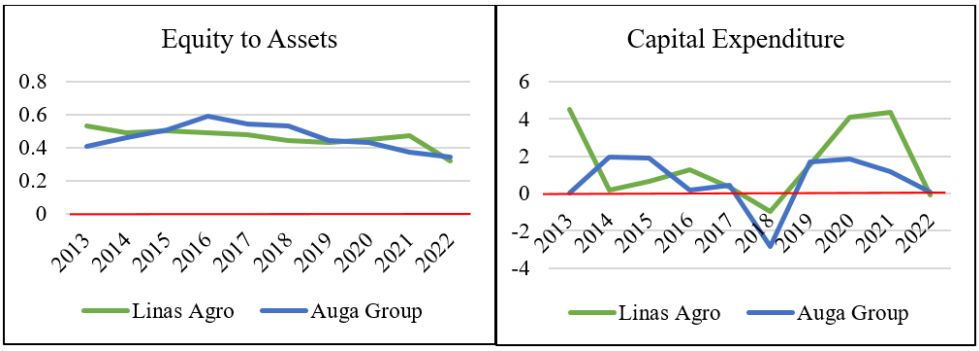

Figure 3. Third pair of solvency ratios
Source: created by the author.

The capital expenditure cash ratio shows the ability of the company to finance the purchase of long-term assets through cash flow from operations. The higher the result the better, as the small amount shows that the company is unable to generate enough cash internally even to maintain the long-term assets. The negative result is the worst-case scenario when there is no cash and financing of the long-term assets comes through debts. The Capital Expenditure cash ratio for Linas Agro has quite strong results for five years out of ten. In the years 2014, 2015, and 2017 it had weak

positive results meaning that cash flow from operations slightly covers major assets. In key years 2018 and 2022 company shows negative values of -0.94 and -0.07 respectively indicating cash flow limitations for financing long-term assets. Auga Group showed a softer performance with moderate values in most years not reaching the strong peaks of its competitor, and a negative result of -2.85 in the year 2018, showing a reliance on debt for long-term assets purchases due to not enough operational cash flow.

Comparison of two ratios within the pair reveals the difference in patterns between equity-to-assets, indicating stable asset ownership, and capital expenditure cash ratio expressing fluctuations in cash availability for both companies. For Linas Agro the volatility of its cash availability contrasts with its steady accrual ratio, meaning that the company relies on debt to replenish cash flow during challenging periods. Meanwhile, Auga Group shows a more conservative yet potentially constrained financial approach, remaining stable in accrual ratio but lacking the financial capacity for capital expenditure.

For both companies, the accrual equity to assets ratio shows a consistent asset ownership approach. However, the stronger but volatile capital expenditure capacity for Linas Agro reflects strategic flexibility supported by sufficient cash flow in some years and complemented by debt during cash flow dips. In contrast, Auga Group remains stable in ownership but is limited in its growth with internal funding, preferring moderate financial practices rather than aggressive expansion through leveraging assets.

To conclude the analysis of solvency, Linas Agro strongly relies on debt as a strategic tool for its growth strategy. However, its debt-financed growth results in solvency stress, especially in challenging periods where debt payments depend on cash flow from operations. The cash ratios of Linas Agro show solvency risks earlier than accrual ratios, especially in key years 2018 and 2022, underscoring that cash ratios provide warning signs in advance. On the other hand, Auga Group has a different, stability-oriented approach with fewer solvency risks due to cautious financial management. Its consistent cash-based solvency is reflected in the low volatility of results throughout the years, as the company maintains moderate debt and prefers to rely on equity in its conservatively stable strategy. The aggressive growth strategy of Linas Agro which largely relies on debt is contrasted to Auga Group’s restrained investment approach through conservative asset management with reliance on equity. While Auga Group prefers financial stability exhibiting an equity-driven approach, Linas Agro chooses a riskier strategy yet potentially more flexible in high-growth periods. It is evident from a comparison of ratios within the pairs that cash-based ratios consistently indicate warning signs earlier than their accrual counterparts, and provide deeper insights into solvency risks. For Linas Agro, it was especially evident that cash-based ratios revealed critical insights and underlined cash flow risks due to a debt-reliant approach which was not shown in accrual-based analysis.

5.2 Liquidity

The next section is dedicated to liquidity analysis which shows the ability of the companies to perform their obligations on short-term debts as well as selling their assets quickly raising cash. The first pair is the accrual current ratio and operating cash flow ratio as shown in Figure 4.

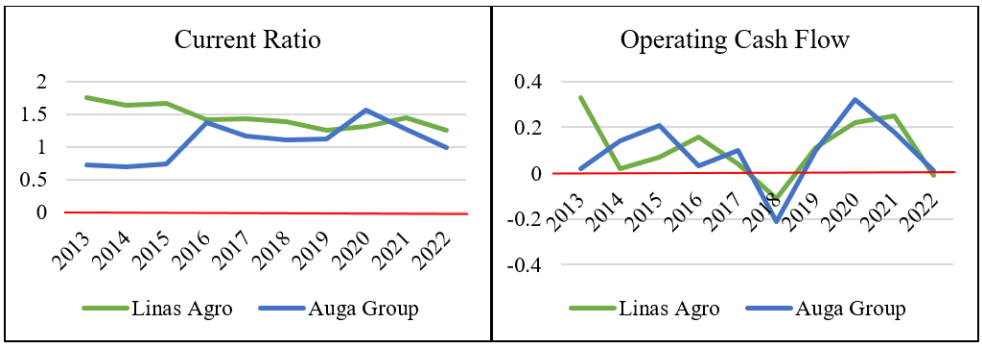

Figure 4. The first pair of liquidity ratios
Source: created by the author

The ratios in this pair are similar in meaning having the same denominator which is a total current liability. The current ratio shows the relationship between assets and liabilities, in other words, how many times a company's liabilities can be paid out by its assets (Carslaw and Mills, 1991). So, the result of the ratio should be safely high and the proportion of assets to liabilities should be smart with leverage amount as well.

The current ratio for Linas Agro and Auga Group shows that current assets safely exceed current liabilities for the majority of the years. Overall, both companies have tolerable results with no special indications in the key years 2018 and 2022. The operating cash flow ratio shows companies' ability to pay their current liabilities with existing cash flows, therefore a ratio greater than one indicates that the company is in a strong position to pay its debts without taking additional liabilities. The operating cash flow ratio for both companies is weak, with results below the threshold, where Linas Agro Group has two negative results in the key years 2018 and 2022, and Auga Group is negative only in the year 2018.

Comparing ratios within the pair, the current ratio for both companies shows a stable liquidity position throughout the period, with no warning signs for the significant years 2018 and 2022. It shows a consistent and conservative approach for the short-term financial stability of both companies with minimised risk in leveraging short-term obligations. In contrast to the accrual counterpart, the operating cash flow ratio shows cash flow limitations with negative results in key years 2018 and 2022 for

Linas Agro and in 2018 for Auga Group indicating potential liquidity issues, challenges in generating cash to cover current liabilities during these years resulting in reliance on non-operational financing. It is clear that both Linas Agro and Auga Group need to avoid reliance on external financing during operational pitfalls and improve liquidity management reconsidering how to enhance cash generation possibilities.

The next pair is the accrual quick ratio versus cash debt coverage ratio as shown in Figure 5. This pair is close to each other meaning their denominator contains liabilities. Quick ratio shows how many times a company could pay out current liabilities, so an amount greater than 1 is preferred (Carslaw & Mills, 1991).

The quick ratio for Linas Agro experienced a slide from confident 1.24 in the year 2013, to 0.96 and 0.78 in the later years, which speaks of the weakening yet still tolerable position of Linas Agro. The quick ratio for Auga Group is even weaker for all years ranging from 0.43 to 0.85, reflecting a comparatively weaker ability than Linas Agro to cover short-term liabilities throughout the years analyzed.

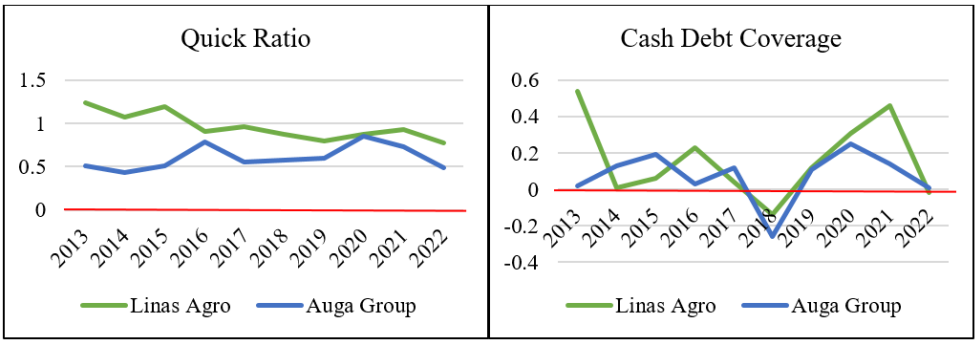

Figure 5. Second pair of liquidity ratios
Source: created by the author

The cash debt coverage ratio shows whether the company has enough cash to pay debts so a ratio greater than 1 is preferred as well. Both companies show extremely weak results not even reaching 0.6. Linas Agro had negative results of -0.14 in the year 2018 and -0.02 in the year 2022 which highlights the cash flow stress. Auga Group had only one negative result of -0.26 in the year 2018, which speaks of slightly better cash management in other years yet not fully reaching optimal debt coverage.

Comparing the quick ratio to cash debt coverage ratio it is visible that for both Linas Agro and Auga Group accrual ratio showed moderately tolerable results during all periods analyzed with no significant volatility or indications in the key years. On the other hand, the cash debt coverage ratio showed expressive volatility and indicated negative results for Linas Agro in the years 2018 and 2022 and for Auga Group in

the year 2018 contradicting moderate results of the accrual ratio. Such contrast between accrual and cash ratio shows that while both companies seem to be manageable from an accrual perspective, they both face issues in cash availability to meet debt obligations. Thus, there is room for cash management improvement to strengthen financial resilience.

The next pair is the equity multiplier accrual ratio versus investment to finance cash ratio as shown in Figure 6 below. The ratios are comparable because the equity multiplier has average total assets in the numerator while the investment-to-finance ratio has cash flow from investment activities in the numerator which consists mostly of cash flow-related assets as is evident from the cash flow statements of the companies. Denominators are related as well because the equity in the denominator of the equity multiplier is indirectly related to liabilities, while the denominator of the investment-to-finance ratio consists of some parts of liabilities largely as evident from the cash flow statements of the companies. Equity multiplier shows the relationships between the company's total assets and stockholders' equity, where the lower result (between 1 and 2) is better meaning that the company uses lower financial leverage and rather uses stockholders' equity to finance the purchase of assets needed to operate its business. The result higher than 2 shows that debt financing of assets is dominating.

The equity multiplier of Linas Agro is growing from slightly below 2 reaching the maximum of 2.72 in the year 2022 which shows that the proportion of liabilities' financing against equity financing of assets was gradually increasing. The equity multiplier of Auga Group was lower than 2 in the years 2016 to 2018 while in all other years, the result exceeded 2 reaching the highest 2.84 in the year 2022. Generally, the financial strategy of Auga Group was to increase the equity financing of assets from 2013 to 2018 which was followed by the decrease of equity financing of assets from 2019 till 2022.

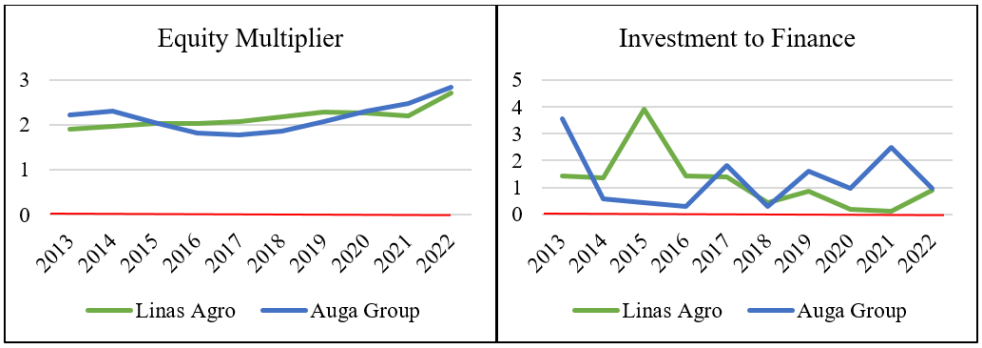

Figure 6. Third pair of liquidity ratios
Source: created by the author.

The investment-to-finance ratio is not commonly used in financial and accounting practices but it is important as it reveals the financial strategy of the companies. This ratio indicates how the investments are financed — whether through debt, equity or internal cash flows. A company with sufficient cash flow from operations has enough cash to invest in assets for its operations. Conversely, if operating cash flow is insufficient and the company aims to maintain positive cash and cash equivalents by year-end, it can increase cash inflow from financing activities by securing more loans or issuing shares. The section on financial activities measures the flow of cash between a firm and its owners and creditors (Alver, 2004). The investment-to-finance ratio for Linas Agro was greater than 1 from the year 2013 till the year 2017 which says that cash outflow to investment activities was higher than cash inflow from financing activities. Starting from the year 2018 till 2022 the company changed proportions to the opposite having cash outflow to investment lower than cash inflow from financing. Looking into the cash flow statement of Linas Agro Group it becomes evident that cash flow from financing increased due to the high proceeds from loans. Auga Group had an investment-to-finance ratio greater than 1 in the years 2013, 2017, 2019 and 2021, while the other years had a ratio lower than 1, which exhibits an inconsistent approach with a less stable financing strategy.

Comparing the two production companies we see an interesting fact, Linas Agro had one strategy before the key year 2018 and then made a notable and structured shift to a debt-financing strategy in both ratios, combining a consistent increase in debt reliance (as evident from equity multiplier) with the use of financing to support investments (investment to finance ratio). Auga Group keeps volatile in both ratios, which makes it quite unpredictable and sensitive to annual financial dynamics, without any clear long-term trend. If companies continue these strategies, they will impact the financial stability of each company and especially the risk profile of Linas Agro using debt for investment financing.

As is evident from the cash flow statements of Linas Agro and Auga Group these companies chose to boost cash inflows from financing activities through proceeds from loans in order to cover the cash outflow for investing activities which shows quite an unhealthy way of financing investments if it continues for a long period of time.

To conclude the liquidity analysis, it becomes evident that accrual ratios (current ratio and quick ratio) exhibit a stable liquidity picture for both firms, whereas cash-based ratios (operating cash flow and cash debt coverage) uncover vulnerabilities in generating sufficient cash to meet obligations. Especially it is evident from the analysis of Linas Agro, which experiences challenges in generating cash, as uncovered by cash-based ratios, while accrual metrics hide any fluctuations and warning signs under the picture of financial stability and sufficient liquidity buffer. For Auga Group the moderate liquidity figures in accrual ratios are contracting with volatile results in cash-based ratios, illustrating that cash-based ratios provide a more

nuanced view of liquidity stress. The liquidity analysis highlights the importance of cash ratio usage for recognition of early warning signs and underlines the importance of improvement of cash management for Linas Agro and Auga Group to avoid reliance on external financing during the operational pitfalls.

5.3 Profitability

The next part of the analysis is the profitability dimension, which is also called going concern analysis, it is another important part of financial scrutiny (Mills & Yamamura, 1998). The first pair of ratios include the return on equity accrual ratio and cash return on stockholders' equity as shown in Figure 7. These ratios are close in meaning, as they both have equity in the denominator and in the numerator they have profit and operating cash flow in accrual and cash-based ratios respectively.

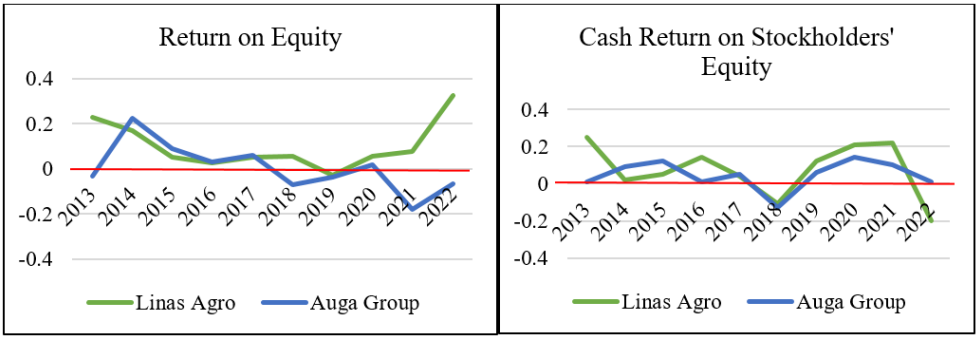

Figure 7. The first pair of profitability ratios in natural numbers
Source: created by the author

The return on equity ratio shows how efficiently the money is used by stockholders to grow the company and generate profit (Dimitropoulos & Asteriou, 2009). The bigger the ratio result is the better the company's management is generating income and growth from the company's equity financing. The optimal ROE in the agricultural sector in the EU ranges around 10% (Beyer & Hinke, 2020). Linas Agro exceeded the threshold in only three years, peaking at 32.4% in 2022. It had a negative result of -2.8% in 2019, with other years ranging from 5% to 7.5%. This indicates that for seven years, Linas Agro did not generate sufficient profits for growth. Auga Group showed high volatility, with negative ROE in five out of ten years, reaching a low of -18% in 2021. Only in 2014 did Auga Group achieve 22.7%, failing to reach the 10% benchmark in other years, indicating an insufficient focus on this profit metric.

Cash Return on Stockholders' Equity (CRSE) highlights how effectively a company uses equity investments to generate cash, with a preferred industry benchmark of 10% (0.1). Linas Agro had negative CRSE in 2018 and 2022, hitting a low of -0.11

in 2018, but exceeded 0.1 in 2013, 2016, 2019, and 2021, indicating good returns. Auga Group had one negative CRSE of -0.13 in 2018, achieving 0.1 in 2015 and 2020, with satisfactory results in other years.

It is clear that the accrual-based return on equity contradicts with cash-based CRSE for Linas Agro which suggests that the company focuses on accrual profitability and improvements over cash liquidity and stability. CRSE shows two negative results in the key years 2018 and 2022, while ROE has only one negative in the year 2019, which speaks of the possibility of the cash ratio giving more warning signs. Comparing other years, ROE generally shows more optimistic results than CRSE which means that Linas Agro is focusing on the betterment of accrual ratio results while not paying enough attention to the cash ratio result, which is typical for this company as it becomes clear from analysis.

Comparing ROE and CRSE for Auga Group shows a stronger alignment between the ratios. Auga Group had a negative result in 2018 for both ratios, but in all other years cash ratio had positive results even in the years with poor accrual performance. This fact indicated a strategic preference for cash management, contrasting with the accrual-oriented approach of Linas Agro. Companies have different financial priorities where Linas Agro prioritizes accrual metrics and Auga Group focuses on cash flow management, yet each of the approaches provides unique benefits and risks for their financial strategy. This factor will be discussed more in the conclusion of the chapter.

The next pair of ratios includes accrual return on assets and cash return on assets ratios as shown in Figure 8. These ratios are similar in meaning as both have assets in the denominator, and their numerators include net profit for accrual-based and cash flow from operations for cash-based ratio. Return on assets shows how effectively the company's management uses assets for profit generation, so the higher result is better with the contingent benchmark of around 10% for the agricultural industry (Dimitropoulos & Asteriou, 2009).

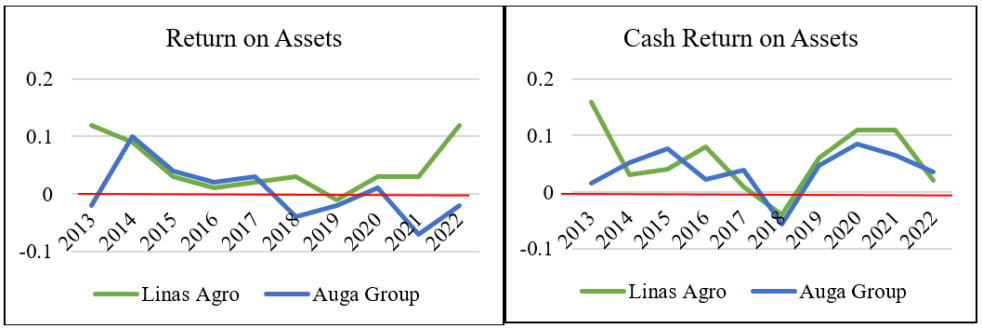

Figure 8. The second pair of profitability ratios
Source: created by the author

Return on assets for Linas Agro shows a negative result of -1.2% in the year 2019, exceeding the benchmark in the years 2013 and 2022 while all other years have moderate results not reaching 10%. Auga Group has negative ROA in the years 2013, 2018, 2019, 2021 and 2022 reaching the minimum of -7.2% in the year 2021. In all other years, the company has moderate results not reaching 10%.

Cash return on assets shows how much cash the company is able to generate from its available assets. Cash return on assets for Linas Agro shows only one negative result of -0.04 in the key year 2018, exceeding the benchmark in the years 2013, 2020, and 2021. Auga Group has one negative of -0.057 in the key year 2018, with moderate results for other years not exceeding 0.085.

Comparing the ROA and cash return on assets (CROA) ratios results for Linas Agro, it is visible that CROA indicates warning signals earlier – the negative results are shown one year earlier than ROA. This means that CROA could be considered as a more immediate indicator of financial tension for Linas Agro. All other years ROA and CROA showed more or less similar results. For Auga Group the picture is different from Linas Agro and similar to the previous ratio analysis: accrual ROA shows negative results in five out of ten years while cash return on assets only shows negative results for one year. This indicates that Auga Group focuses mostly on maintaining positive cash stable ignoring low accrual profitability, because as visible from Figure 8, ROA has more drops to negative results, while CROA mostly remains positive.

The next pair consists of accrual return on capital and cash return on debt and equity as shown in Figure 9. Return on capital (ROC) shows how effectively the company turns capital (debt and equity) into profits, where the higher the result the stronger the company is. Cash return on debt and equity (CRDE) shows how much cash is generated for each unit of financing (whether through debt or equity), where a higher ratio is better, as it means that the company effectively generates enough cash relative to the capital it has raised. The ratios are close to the meaning as is evident from their formulas and description.

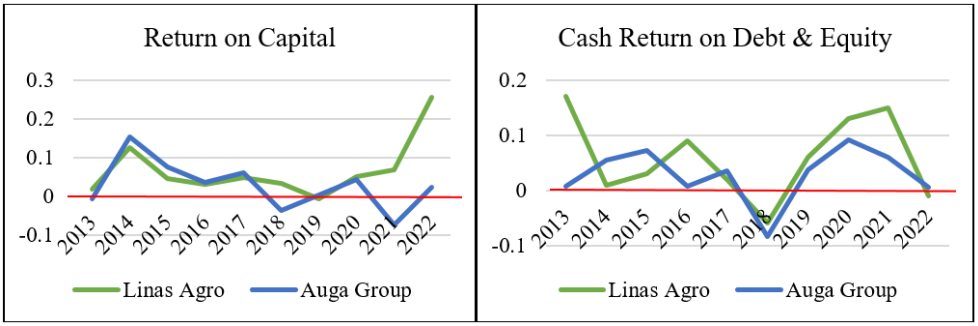

Figure 9. Third pair of profitability ratios.
Source: created by the author

Return on capital (ROC) for Linas Agro shows generally positive results, with only one negative result of -0.8% in 2019. The company had ROC higher than 10% in 2013, 2014, and 2022, peaking at 25.6% in 2022. In other years, Linas Agro's ROC was satisfactory but below 10%. Auga Group's ROC was negative in 2013, 2018, and 2021, with only one strong result exceeding 10% in 2014. In other years, Auga Group's ROC was satisfactory.

There is a mixed performance for Linas Agro, CRDE was negative at -0.06 in 2018 and -0.01 in 2022, with good results ranging from 0.13 to 0.17 in 2013, 2020, and 2021. In other years, CRDE did not exceed 0.1 which reflects limited cash returns on debt and equity. Auga Group had one negative CRDE result of -0.084 in 2018, with moderately good results in other years, reaching a maximum of 0.092 in 2020.

Comparing ROC and CRDE for Linas Agro it is visible that ratios show different pictures, thus in the year 2018 accrual ratio showed a moderately positive result while the cash ratio showed a negative result. In the year 2022, the picture is different: The accrual ratio hits the maximum of 25.6% while the cash ratio shows a negative result of -0.01 which indicates a significant manipulation of the ROC accrual ratio relying on accrual improvements rather than cash-based financial resilience and overstating the financial health relative to cash-based measures. In contrast, Auga Group has a closer alignment between accrual and cash ratios. Its ROC shows negative results for three years out of ten while the cash ratio has only one negative result, which speaks that the company is more focused on cash management rather than manipulations on the accrual side. It is evident that Linas Agro and Auga Group have different strategies, where Linas Agro relies on accrual metrics, while Auga Group exhibits a consistent cash-focused approach.

To conclude, profitability analysis revealed different approaches to the financial strategies of the companies. Linas Agro focuses on accrual gains with less regard for cash stability, while Auga Group emphasizes a more cash-oriented approach and cautious cash management prioritizing liquidity and operational stability. Also, there are contradictions between accrual and cash-based ratios for Linas Agro. Particularly, CRSE and CROA provided early warning signs about cash limitations and financial stress, unlike their accrual counterparts. The ratio pairs for Auga Group are more aligned, yet in some cases, cash ratios show a better picture revealing the cash-focused management strategy. Some critical insights into liquidity sustainability occurred for Linas Agro suggesting that its profitability might be overstated relative to actual cash performance.

5.4 Efficiency

The next dimension is efficiency analysis which is necessary to perform in addition to profitability analysis, though, in many scientific papers, the ratios from these two analyses are mixed, their differences are described in greater detail in the theoretical

part of the work. For this group of ratios, it was the most difficult to pair accrual ratios with cash ratios because the accrual efficiency ratios prevail while there are not enough cash ratios. This work represents an attempt to build balanced accrual-cash pairs with close meanings.

The first pair includes the accrual assets turnover ratio and quality of sales cash ratio. These ratios are relatively similar in meaning as shown in Figure 10. The numerator of the accrual ratio contains sales, while the cash ratio has sales in the denominator. The denominator of the accrual ratio has average assets which includes the cash element and the cash ratio contains operating cash flow in the numerator. Assets turnover shows how efficiently a company uses its assets, so the higher the ratio the better. The quality of sales cash ratio shows how efficiently a company turns sales into cash which is vital for funding operations, paying debts and suppressing growth (Carslaw & Mills, 1991).

For Linas Agro, the assets turnover ratio shows strong asset utilization, exceeding 2 in the years 2013, and 2021, and reaching its maximum of 2.93 in the year 2022. The lowest point of 1.68 was in the key year 2018 suggesting a decrease in efficiency. For Auga Group assets turnover is low and stable represented in a straight line reaching its maximum of only 0.4 in the year 2020 indicating limited efficiency in generating sales from assets. The quality of sales ratio for Linas Agro shows negative results in the key years 2018 and 2022 while all other years are satisfactory with low positive results. For Auga Group quality of sales cash ratio is more volatile than its assets turnover results, thus it shows a negative result in the year 2018 while other years are quite positive reaching the maximum of 0.17 in the year 2015. Auga Group has clearly stronger results maintaining better cash quality in its sales than Linas Agro.

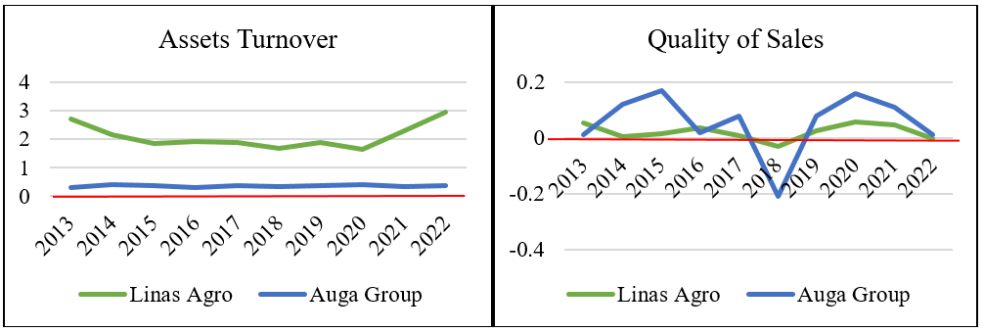

Figure 10. The first pair of efficiency ratios
Source: created by the author.

Comparing assets turnover to quality of sales, Linas Agro has a very strong positive result for accrual ratio and a weak result in cash ratio with two negative results in the key years 2018 and 2022. Again, it is visible that Linas Agro reaches its maximum

accrual ratio in the year 2022 while the cash ratio has clearly negative results which reveals probable over-reliance on accrual adjustments. For Auga Group assets turnover accrual ratio shows weakly positive results while the quality of sales cash ratio is quite strong except for one negative result in the year 2018 indicating a conservative approach with an emphasis on cash quality over asset efficiency. However, this negative result from the cash ratio was not reflected in the accrual assets turnover ratio which might speak of possible manipulations on the accrual side for assets turnover, because the negative results in cash ratios from previous ratio analyses were supported by negative results in accrual ratios. The comparison underlines contrasting strategies that while Linas Agro might leverage accruals for the enhancement of perceived efficiency, Auga Group prioritizes cash flow stability, potentially sacrificing accrual-based efficiency.

The next pair includes capital turnover accrual ratio and cash flow per share cash ratio as shown in Figure 11. The capital turnover ratio shows how efficiently a company uses its capital to generate sales. The cash flow per share ratio shows the company's ability to generate cash from its operations, which is a key indicator of financial health. The ratios have similar elements in the denominator, the accrual ratio has average capital while the cash ratio has an average number of shares outstanding which is a portion of capital. For both, the higher result is preferred.

Capital turnover for Linas Agro shows very good results, reaching a maximum of 4.59 in the year 2022 indicating strong capital efficiency. The smallest result is 2.11 in the year 2020 which still reflects an effective use of capital for revenue generation. For Auga Group capital turnover shows moderately positive results reaching a maximum of 0.58 in the year 2014, which is significantly lower compared to its competitor. It is important to underline that the line of capital turnover for Auga Group shows a flat trend over the years reflecting a much lower efficiency in capital utilization compared to Linas Agro.

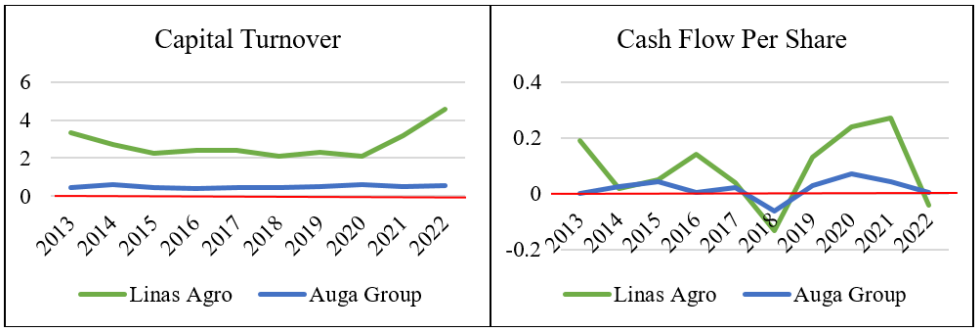

Figure 11. The second pair of efficiency ratios
Source: created by the author.

The cash flow per share ratio for Linas Agro is volatile. It has a negative result in the key years 2018 and 2022, while in all other years, it has moderately positive results. Cash flow per share for Auga Group has only one negative result in the year 2018, all other years are satisfactory positive.

Comparing capital turnover and cash flow per share the significant differences are visible. The results of accrual capital turnover are more positive than cash flow per share results. Especially for Linas Agro in the key years 2018 and 2022 capital turnover has the highest result 4.59 for all years of analysis, while cash flow per share has a negative result of -0.04 which speaks of possible reliance on accrual adjustments. Auga Group has a more consistent alignment between accrual and cash indicators within the ratio pair except for the year 2018 with a negative cash ratio which suggests possible accrual smoothing. There is also higher volatility of the cash ratio compared to the accrual ratio for both companies. Generally, it is visible that the strategy of Linas Agro emphasizes capital turnover efficiency even with weaker cash flow indicators, while Auga Group remains steadier yet with lower indicators with accrual and cash indicators more aligned.

The final pair of analyses is accrual cash turnover versus cash quality of income as visible in Figure 12. The cash turnover accrual ratio shows how many times a company turns over its cash into sales within the accounting period, where the high result speaks of the higher efficiency of this process. The quality of income cash ratio shows to what extent the company's reported income is backed by actual cash generation. Both accrual and cash ratios contain cash elements in their formulas and for both ratios, the higher result is preferred.

For Linas Agro cash turnover accrual ratio shows strongly positive results reaching its maximum of 97.67 in the year 2022, suggesting efficient conversion of cash into sales. Auga Group has positive yet lower results reaching its maximum of 42.92 in the year 2017, reflecting a slower cash-to-sales cycle.

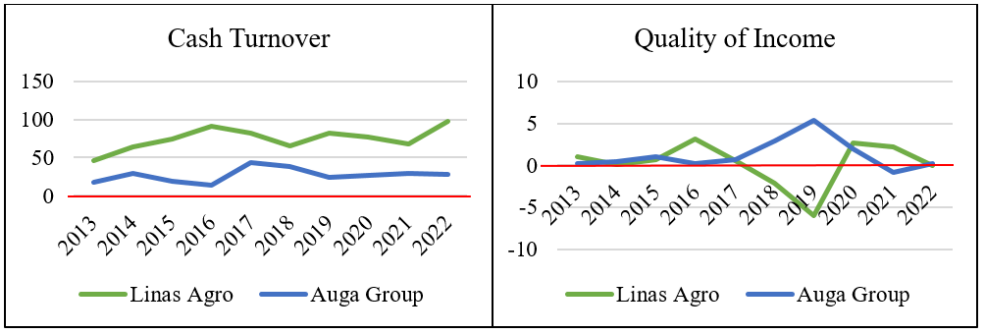

Figure 12. Third pair of efficiency ratios
Source: created by the author.

The quality of income ratio for Linas Agro has negative results in the years 2018, 2019, and 2022 reaching the lowest result of -6.09 in the year 2019, while all other years have moderate results. Such pattern indicates a disconnection between reported income and actual cash flow. Quality of Income for Auga Group has only one negative result of -0.83 in the year 2021, all other years are quite positive reaching a maximum of 5.37 in the year 2019. If to compare the quality of income for Linas Agro and Auga Group, they have completely different and even opposite pictures. Auga Group results show a stronger alignment between reported income and cash flows.

This pair of ratios is relatively comparable and is used in this analysis for the sake of certain trend visibility. It is visible that while Linas Agro has a strong positive result for all years in accrual cash turnover ratio, the quality of income cash ratio shows negative results in three years 2018, 2019 and 2022. Again in the year 2022, the accrual cash turnover ratio has the strongest result while for quality of income cash ratio has the negative result. It is clear that Linas Agro has a consistent trend where high accrual-based cash turnover does not translate into positive cash-based income quality. Auga Group has a different picture compared to Linas Agro, both accrual and cash ratios have moderately positive results except for the negative result in the year 2021. While the key years 2018 and 2022 have moderately positive results. Thus, it is visible that while Linas Agro focuses on accrual adjustments to enhance turnover metrics, Auga Group in contrast maintains a steadier connection between income and cash flow, prioritizing financial stability over accrual-driven efficiency.

To conclude the efficiency analysis, it is important to highlight several observations. First, the efficiency analysis underlines the contrasting strategic focus of Linas Agro and Auga Group, where Linas Agro focuses mostly on accrual adjustments, disregarding cash-based metrics, while Auga Group places attention primarily on cash-based stability and has less contrasting results within the ratio pairs.

Second, almost all accrual-based ratios show moderately positive results for Linas Agro, especially in the key years 2018 and 2022, reflecting strong accrual-based efficiency in the use of assets, capital and cash for generation of sales. At the same time, almost all cash-based ratios show negative results in the years 2018 and 2022 revealing weakness of this aspect with over-reliance on accrual adjustments that are not reflected on cash flows. Auga Group in contrast consistently shows more alignment within accrual-cash pairs of ratios with steadily low or average results reflected in both metrics yet cash-based ratios are slightly better than accrual ones. It points to a conservative, cash-focused approach with the stable link between reported sales and cash flows.

Third, from all four groups of ratios, efficiency ratios show the most contrasting results within pairs where the results in accrual ratios differ from cash results a lot. Linas Agro's strategy focuses on accrual adjustments, especially in key years 2018

and 2022 to create the appearance of efficiency and turnover gains. However, its cash-based ratios reveal significant volatility and deficiency in cash conversion, emphasizing potential liquidity risks masked by adjustments of accrual statements. Auga Group in contrast exhibits a conservative strategy aligning accrual and cash indicators, prioritizing consisting cash flow resulting in cash stability and quality, yet at the expense of lower accrual-based efficiency metrics.

Last but not least, the analysis of efficiency highlighted once more that cash ratios often provide early warning signs, revealing the actual financial health that accrual ratios might obscure.

6 Conclusion

The present paper answered the research questions and confirmed the hypotheses. Thus, the following answers were obtained during the analysis.

Question 1. To what extent does the combined use of accrual-based and cash-based ratio analysis provide comprehensive insights into a company's solvency, liquidity, profitability and efficiency?

The analysis showed that the combined use of accrual-based and cash-based ratio analysis indeed provides comprehensive insights into a company's solvency, liquidity, profitability and efficiency thanks to the integral composition of the ratios. This confirmed hypothesis number one. For this analysis in order to cover all four dimensions and ensure a comprehensive investigation, the main accrual ratios were picked based on the major elements of the companies' financial statements, such as assets, equity, and liability, taken from the balance sheet, as well as sales and profits taken from the income statement. To strengthen the analysis and ensure its clarity and fairness the cash-based ratios were picked based on the major elements of the cash flow statement, such as cash flow from operations, cash flow from finance and cash flow from investments. Thus, the ratios in this analysis consisted of major elements of all financial statements encompassing four dimensions (solvency, liquidity, efficiency, and profitability), and comprehensively analysing the companies' financial positions. During the analysis, it becomes evident that all elements in the ratios chosen for the analysis at all dimensions are dependent and tied to each other contributing to the comprehensive and clear picture of the companies' financial state and financial management strategy. The findings of the analysis show that cash-based ratios reveal fluctuations and vulnerabilities in liquidity and solvency, which would remain obscured in accrual-only assessments. Confirming hypothesis one, the combination of accrual and cash ratios suggested in this article provides a comprehensive picture of all four dimensions and serves the diverse interests of stakeholders.

Question 2. Does the combined accrual-based and cash-based ratio analysis help in revealing manipulations in accrual financial statements?

The combined use of accrual-based and cash-based ratio analysis helps in revealing manipulations in accrual financial statements, which confirms hypothesis number two. According to the calculations in Appendix A as well as the analysis in the previous chapter, it becomes evident that accrual-based ratios show positive and optimistic results in many ratios, while cash-based ratios show moderate or negative results. The pairs of accrual-based and cash-based ratios were chosen to be close to each other by the meaning, therefore the difference and contrast between optimistic accrual-based ratios' results and moderate to negative results of their cash-based counterparts was especially evident, which speaks of the clear manipulation of financial managers in the accrual-based ratios. For example, the analysis of Linas Agro showed a significant variance between accrual and cash-based ratios in the key years 2018 and 2022 which revealed that financial managers might have adjusted certain accrual ratios to present a more favourable financial picture. The contrasts in results between accrual and cash ratios help to reliably identify red flags in financial statements, highlighting the value of this comprehensive approach.

Question 3. How does the analysis of profitability and efficiency explain the results and levels of solvency and liquidity in a company? Do solvency and liquidity depend more on external or internal sources of financing?

The present analysis and calculations in Appendix A reveal that the long-term deterioration of profitability and efficiency during the first five years (2013-2017) strongly affected the solvency and liquidity of the companies in the following years (2018-2022). It is evident that solvency and liquidity were adequate from 2013 to 2017 before the decline began. Therefore, weak profitability and efficiency in those initial years could be considered red flags and predictors of the subsequent decline in solvency and liquidity for the following years. This confirms hypothesis number three, which states that the levels of profitability and efficiency in earlier years affect solvency and liquidity in later years. The results of the analysis also showed that if the company does not improve its profitability and efficiency, then to support solvency and liquidity it has to attract funds from external sources through borrowing and increasing debt. This indicates that companies' solvency and liquidity are maintained not through internal sources (generated profit) but by relying on external debt. The dependency on debt from external sources increases leverage bringing companies closer to a pre-bankruptcy stage and increasing the chance of credit risk default. The empirical analysis shows this dynamic in the example of Linas Agro, where limited internal cash flow was refuelled with external debt to support liquidity, however, this strategy increases the credit risk of default under unfavourable economic conditions. This observation could help practitioners realize the importance of strong profitability and efficiency strategies in maintaining financial sustainability.

Question 4. Does the present method of analysis indicate which company is closer to the pre-bankruptcy stage?

From the present method of analysis it becomes evident that a company exhibiting negative results for the majority of accrual-based and cash-based ratios, or significant discrepancies within these pairs, is closer to the pre-bankruptcy stage than the company which does not have these warning signs. This is particularly true when accrual-based ratios are overly optimistic, while their cash-based counterparts show negative results. Another indicator that a company is getting closer to the pre-bankruptcy stage is the repeated negative results of cash-based ratios. This trend is especially visible in the key years of 2018 and 2022. It is important to highlight why these years were crucial for analysis. The year 2018 was characterized by low harvest in Europe, as evidenced by the annual reports of the companies analyzed. The year 2022 was significant due to the impacts of the COVID-19 pandemic, the energy crisis and war-related sanctions, as both companies have operations linked to Ukraine and Russia.

An important indicator of financial distress is if a company fails to improve, or worsens, its efficiency and profitability over the years analyzed. To maintain the appearance of moderate solvency and liquidity the company has to increase its external debt. This reliance on external debt can lead to bankruptcy if there are negative changes in the external economic environment.

As it becomes evident from the ratio analysis in this paper, Linas Agro displayed consistent discrepancies where accrual ratios suggested financial health while cash ratios revealed cash-flow risks. The continuous reliance on external debt, combined with moderate to negative cash-based ratios points to a possible pre-bankruptcy trend. On the other hand, Auga Group showed a conservative financial strategy with fewer discrepancies within ratio pairs and lower solvency risks. Thus, the analysis method presented in this paper has proven itself to be a warning tool, helping to identify the red flags in advance and be cautious about possible debt dependence patterns of the companies analysed.

The present method with 24 ratios was applied to the production companies from the agricultural sector with shares outstanding, however, this method could be further used for analysis in various industries, including service and retail companies with shares outstanding. Also, smaller companies without shares outstanding could also benefit from it. Depending on the size and industry specifics, the choice of ratios and their quantity should vary, while keeping the logical balance between accrual and cash ratios established in this paper. Future research will test the method from this paper on different industries and company types.

To conclude, it is important to mention that this method of analysis is an attempt to present a balanced, dual-ratio approach including accrual-based and cash-based elements which enable the method to provide comprehensive insights into corporate financial health. The present paper has introduced a method of analysis, which is a stage in my work on the pre-bankruptcy state model where not only simple ratios but

also complicated ratios will be included. Hopefully, the present work will serve practitioners in better estimation of the financial health of the companies and suggest food for thought to academics for future research.

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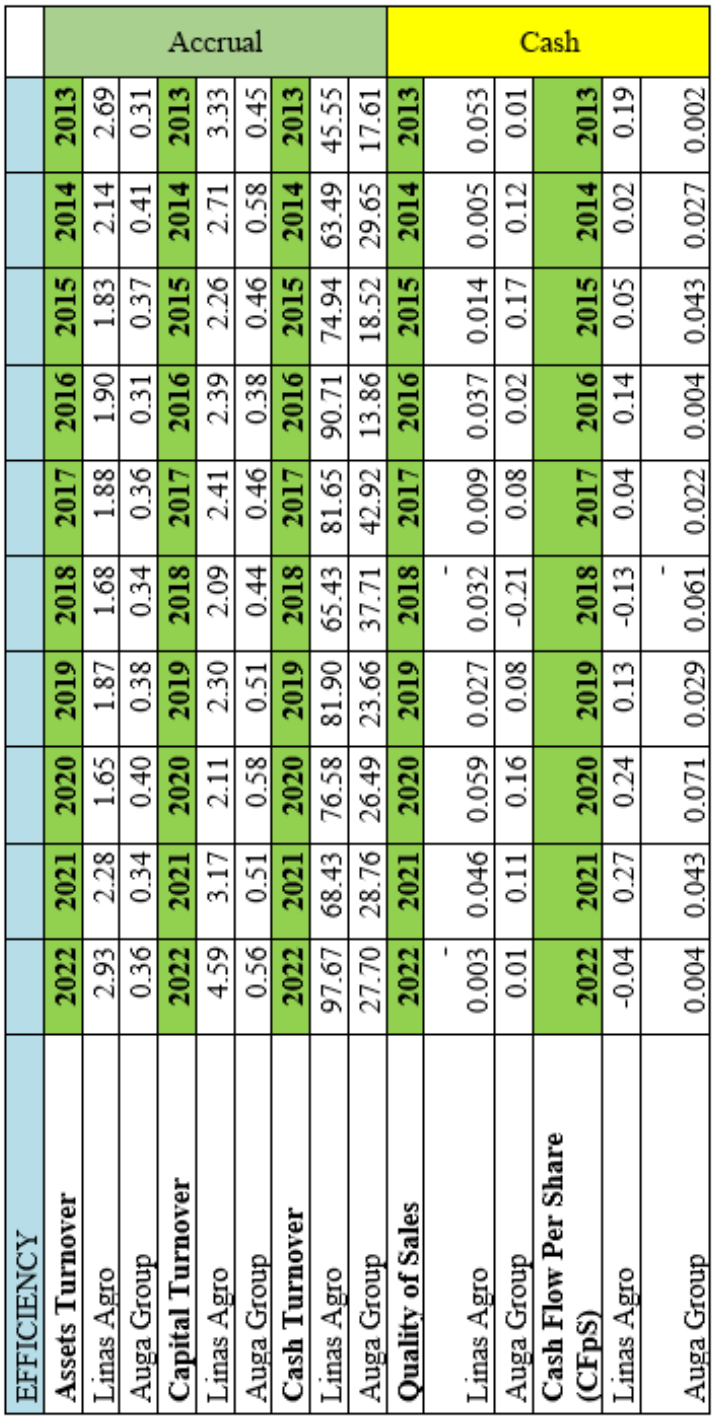
APPENDIX A. FOUR DIMENSIONS VIABILITY ANALYSIS. CALCULATIONS.

	Accrual										Cash					
SOLVENCY RATIOS																
Interest Coverage Ratio	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Linas Agro	7.03	5.73	4.21	-0.73	3.92	4.50	3.16	4.60	9.31	12.55	12.16	3.21	4.68	12.13	3.44	-6.06	8.06	13.40	13.52	1.08
Auga Group	0.41	-1.78	1.28	0.09	-2.70	3.58	1.92	4.66	9.33	-0.39	1.37	2.12	2.95	1.95	3.92	-5.57	2.24	3.76	2.39	1.09
Debt to Equity Ratio	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Linas Agro	0.92	0.48	0.69	0.86	0.86	0.64	0.59	0.63	0.64	0.45	0.54	0.03	0.08	0.24	0.05	-0.13	0.14	0.31	0.46	-0.02
Auga Group	0.90	0.73	0.57	0.56	0.48	0.41	0.36	0.61	0.68	0.49	0.02	0.13	0.19	0.03	0.12	-0.26	0.11	0.25	0.14	0.01
Equity to Assets Ratio	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Linas Agro	0.32	0.47	0.45	0.43	0.44	0.48	0.49	0.50	0.49	0.53	0.41	0.46	0.51	0.59	0.54	0.53	0.44	0.43	0.37	0.34
Auga Group																				
Cash Interest Coverage	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Linas Agro	1.08	13.52	13.40	8.06	-6.06	3.44	12.13	4.68	3.21	12.16	1.37	2.12	2.95	1.95	3.92	-5.57	2.24	3.76	2.39	1.09
Auga Group																				
Total Debt (Cash flow-to-debt ratio)	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Linas Agro	-0.02	0.46	0.31	0.14	-0.13	0.05	0.24	0.08	0.03	0.54	0.02	0.13	0.19	0.03	0.12	-0.26	0.11	0.25	0.14	0.01
Auga Group																				
Capital Expenditure	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Linas Agro	-0.07	4.33	4.07	1.51	-0.94	0.32	1.30	0.63	0.16	4.49	0.01	1.96	1.92	0.19	0.45	-2.85	1.67	1.84	1.16	0.10
Auga Group																				

	Accrual										Cash									
LIQUIDITY RATIOS																				
Current Ratio	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**										
Linas Agro	1.25	1.44	1.31	1.26	1.38	1.43	1.42	1.67	1.63	1.75										
Auga Group	0.99	1.27	1.57	1.12	1.11	1.16	1.37	0.74	0.70	0.72										
Quick Ratio	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**										
Linas Agro	0.78	0.93	0.87	0.80	0.87	0.96	0.91	1.19	1.07	1.24										
Auga Group	0.49	0.73	0.85	0.60	0.58	0.55	0.79	0.51	0.43	0.51										
Equity Multiplier	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**										
Linas Agro	2.72	2.19	2.27	2.28	2.18	2.07	2.02	2.02	1.97	1.91										
Auga Group	2.84	2.48	2.30	2.08	1.86	1.77	1.82	2.06	2.30	2.23										
Operating Cash Flow (OCF)	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**										
Linas Agro	-0.01	0.25	0.22	0.11	-0.11	0.04	0.16	0.07	0.02	0.33										
Auga Group	0.01	0.18	0.32	0.10	-0.21	0.10	0.03	0.21	0.14	0.02										
Cash Debt Coverage	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**										
Linas Agro	-0.02	0.46	0.31	0.12	-0.14	0.04	0.23	0.06	0.01	0.54										
Auga Group	0.01	0.14	0.25	0.11	-0.26	0.12	0.03	0.19	0.13	0.02										
Investment to Finance Ratio (I/F)	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**										
Linas Agro	-0.89	-0.14	0.18	0.87	-0.45	-1.39	1.42	-3.90	-1.36	-1.42										
Auga Group	-0.96	2.51	0.98	1.61	-0.31	-1.84	-0.31	0.44	-0.60	-3.56										

APPENDIX A (CONTINUED)

	Accrual										Cash									
PROFITABILITY	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**
Return on Equity	0.32	0.08	0.06	-0.03	0.05	0.05	0.02	0.05	0.17	0.23	-0.02	0.22	0.21	0.12	-0.11	0.04	0.14	0.05	0.02	0.25
Linas Agro	-0.07	-0.18	0.02	-0.04	-0.07	0.06	0.03	0.09	0.23	-0.03	0.01	0.10	0.14	0.06	-0.13	0.05	0.01	0.12	0.09	0.01
Auga Group	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**
Return on Assets	0.12	0.03	0.03	-0.01	0.03	0.02	0.01	0.03	0.09	0.12	0.02	0.11	0.11	0.06	-0.04	0.01	0.08	0.04	0.03	0.16
Linas Agro	-0.02	-0.07	0.01	-0.02	-0.04	0.03	0.02	0.04	0.10	-0.02	0.036	0.066	0.085	0.047	-0.057	0.039	0.023	0.077	0.052	0.015
Auga Group	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**
Return on Capital	0.26	0.07	0.05	-0.01	0.03	0.05	0.03	0.05	0.12	0.18	-0.01	0.15	0.13	0.06	-0.06	0.02	0.09	0.03	0.01	0.17
Linas Agro	0.02	-0.07	0.04	0.00	-0.04	0.06	0.04	0.08	0.15	-0.01	0.005	0.060	0.092	0.038	-0.084	0.035	0.008	0.072	0.054	0.007
Auga Group																				
Cash Return on Stockholders' Equity																				
Linas Agro																				
Auga Group																				
Cash Return on Assets																				
Linas Agro																				
Auga Group																				
Cash Return on Debt, Equity																				
Linas Agro																				
Auga Group																				



	Accrual										Cash									
EFFICIENCY																				
Assets Turnover	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**										
Linas Agro	2.93	2.28	1.65	1.87	1.68	1.88	1.90	1.83	2.14	2.69										
Auga Group	0.36	0.34	0.40	0.38	0.34	0.36	0.31	0.37	0.41	0.31										
Capital Turnover	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**										
Linas Agro	4.59	3.17	2.11	2.30	2.09	2.41	2.39	2.26	2.71	3.33										
Auga Group	0.56	0.51	0.58	0.51	0.44	0.46	0.38	0.46	0.58	0.45										
Cash Turnover	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**										
Linas Agro	97.67	68.43	76.58	81.90	65.43	81.65	90.71	74.94	63.49	45.55										
Auga Group	27.70	28.76	26.49	23.66	37.71	42.92	13.86	18.52	29.65	17.61										
Quality of Sales	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**										
Linas Agro	- 0.003	0.046	0.059	0.027	0.032	- 0.009	0.037	0.014	0.005	0.053										
Auga Group	0.01	0.11	0.16	0.08	-0.21	0.08	0.02	0.17	0.12	0.01										
Cash Flow Per Share (CFpS)	**2022**	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**										
Linas Agro	-0.04	0.27	0.24	0.13	-0.13	0.04	0.14	0.05	0.02	0.19										
Auga Group	0.004	0.043	0.071	0.029	- 0.061	0.022	0.004	0.043	0.027	0.002										

APPENDIX B. RATIO FORMULAS.

Formulas are presented with the mathematically correct signs used for calculations in excel based on the financial statements.

1)

$$\text{Interest Coverage Ratio} = \frac{(PROFIT\ BEFORE\ TAXES\ +\ Interest\ Expense)}{Interest\ Expense}$$

2)

$$\text{Debt to Equity Ratio} = \frac{(Current\ borrowing\ +\ Non-Current\ Borrowings\ +\ Current\ portion\ of\ non-current\ borrowing)}{Total\ Equity}$$

3) $$\text{Equity to Assets Ratio} = \frac{Total\ Equity}{Total\ Assets}$$

4) $$Cash\ Interest\ Coverage = \frac{((Net\ cash\ from\ (to) operating\ activities + (-Income\ tax) + (-Interest))}{(-Interest\ Paid)}$$

5)

$$Total\ Debt\ (Cash\ flow\ to\ debt\ ratio) = \frac{(Net\ cash\ from\ operating\ activities\ +\ (Dividends\ Paid\ +\ Divideds\ (paid) to\ non\ controlling\ shareholders))}{(Non\ current\ borrowings\ +\ Current\ portion\ of\ non\ current\ borrowings\ +\ Current\ borrowings)}$$

6)

$$\text{Capital Expenditure} = \frac{Net\ cash\ from\ operating\ activities}{Acquisition\ of\ intangible\ assets, PPE, investment\ property\ +\ Acquisition\ of\ subsidiaries, and\ payments\ for\ subsidiaries\ + + Acquisition\ of\ other\ investment}$$

7)

$$\text{Current Ratio} = \frac{TOTAL\ CURENT\ ASSETS}{TOTAL\ CURENT\ LIABILITIES}$$

8)

$$\text{Quick Ratio} = \frac{(TOTAL\ CURENT\ ASSETS\ -\ Inventories)}{TOTAL\ CURENT\ LIABILITIES}$$

9)

$$\text{Equity Multiplier} = \frac{Average\ total\ assets}{Average\ total\ equity}$$

10) Operating Cash Flow (OCF) $= \frac{Net\ Cash\ from\ (to)\ operating\ activities}{Total\ Current\ Liabilities}$

11)

$$\text{Cash Debt Coverage} = \frac{(Net\ cash\ from\ (to)\ operating\ activities\ +\ (\ Dividends\ Paid\ +\ Divident\ s\ (paid)\ to\ non-controlling\ shareholders))}{(Non-current\ borrowings\ +\ Current\ portion\ of\ non-current\ borrowings\ +\ Current\ borrowings)}$$

12)

$$\text{Investment to Finance Ratio } \left(\frac{\text{I}}{\text{F}}\right) = \frac{Net\ cash\ flows\ from\ (to)\ investing\ activities}{Net\ cash\ flows\ from\ (to)\ financing\ activities}$$

13)

$$\text{Return on Equity} = \frac{NET\ PROFIT}{Average\ Equity}$$

14)

$$\text{Return on Assets} = \frac{NET\ PROFIT}{Average\ Assets}$$

15)

$$\text{Return on Capital} = \frac{(PROFIT\ BEFORE\ TAXES\ +\ interest\ expense)}{Average\ capital}$$

16)

$$\text{Cash Return on Stockholders' Equity} = \frac{Net\ cash\ from\ (to)\ operating\ activities}{Total\ Equity}$$

17)

$$\text{Cash Return on Assets (CRA)} = \frac{(Net\ cash\ from\ (to)\ operating\ activities\ +\ Interest\ expenses\ -\ Income\ tax\ (paid)\ )}{Total\ Assets}$$

18)

$$\text{Cash Return on Debt, Equity} = \frac{Net\ cash\ from\ (to)\ operating\ activities}{(\ TOTAL\ EQUITY\ +\ Non\ current\ borrowings\ +\ Current\ borrowings\ +\ Current\ portion\ of\ non\ current\ borrowings\ )}$$

19) $$\text{Assets Turnover} = \frac{Sales}{Average\ assets}$$

20) $$\text{Capital Turnover} = \frac{Sales}{Average\ capital}$$

21)

$$\text{Cash Turnover} = \frac{Sales}{Average\ Cash\ and\ cash\ equivalent\ from\ Balance\ sheet}$$

22)

$$\text{Quality of Sales} = \frac{Net\ cash\ from\ (to)\ operating\ activities}{Sales}$$

23)

$$\text{Cash Flow Per Share (CFpS)} = \frac{Net\ cash\ from\ (to)\ operating\ activities}{Weighted\ Common\ Stock\ LNA\ in\ thousands\ EUR}$$

24)

$$\text{Quality of Income} = \frac{Net\ cash\ from\ (to)\ operating\ activities}{Operating\ Profit}$$