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Master Thesis

DuPont analysis, future firm performance, and stock returns

To what extent do the DuPont components have explanatory power regarding a firm's future profitability and its market value?

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Management Summary

This master thesis aims to examine how financial information can be used to predict a firm's future performance and value. Specifically, five hypotheses are tested to explore the usefulness of the DuPont analysis framework in predicting future profitability and stock returns. The thesis thus builds upon prior research by replicating previous findings with more recent data and analyzing the explanatory power of the leverage DuPont components, namely financial and operating liability leverage, in predicting a firm's future performance and value. While previous studies primarily focused on analyzing the predictive ability of the operational DuPont components, this thesis extends previous research by conducting a more comprehensive analysis that also incorporates a firm's financial activities. The study conducts pooled regression analyses based on a data sample comprised of 482 listed US companies to assess the predictive ability of all DuPont components. In addition, the thesis investigates whether market participants fully appreciate the components' forecasting power.

The results indicate that the DuPont components possess explanatory power in predicting a firm's future profitability and stock returns, thus providing valuable insights beyond what is already known from ΔROE_t. Specifically, ΔATO_t and ΔPM_t are positively associated with a firm's one-year-ahead profitability and market value, indicating that improved asset utilization efficiency and better cost control have a favorable impact. Market participants consider the information contained in both variables to be incrementally informative beyond ΔROE_t. However, while the market fully appreciates the predictive power of ΔPM_t, it fails to fully comprehend the implications of ΔATO_t. The variable's significant relation with future stock returns suggests that fully exploiting the information of ΔATO_t can yield abnormal returns, indicating that the market is not completely efficient.

Moreover, the thesis's findings highlight the importance of incorporating information about a firm's leverage when forecasting and valuing its performance. The results demonstrate that a firm's financial activities have significant predictive ability regarding its future performance. Specifically, $\Delta FLEV_t$ is a positive and significant predictor regarding one-year-ahead return on equity, confirming the suggestion of the DuPont model that leverage can increase a firm's return on equity. Despite its positive association with a firm's future profitability, the regression results indicate that the market appears to negatively price higher financial leverage. Furthermore, the results show that considering

operating liability leverage separately from financial leverage provides additional explanatory power in the forecasting and valuation context. In contrast to financial leverage, higher levels of operating liability leverage are favorably priced by market participants. These findings refute the capital irrelevance proposition of previous research and demonstrate that leverage affects a firm's market value.

Table of contents

Table of figures

List of tables

List of abbreviations

RNOA	Return on net operating assets
ATO	Asset turnover
PM	Profit margin
ROE	Return on equity
GDP	Gross domestic product
NOA	Net operating assets
WC	Non-cash working capital
NCO	Non-current operating assets
FIN	Net financial assets
OLLEV	Operating liability leverage
ROOA	Unlevered return from operating activities
io	Implicit interest costs for operating liabilities
OLSPREAD	Operating liability spread
NYSE	New York Stock Exchange
FLEV	Financial leverage
NBC	Net borrowing costs
NFO	Net financial obligations
NFE	Net financial expenses
EARN	Earnings
EPS	Earnings per share
P/B	Price-to-book ratio
TLEV	Total leverage
IPO	Initial public offering
OA	Operating assets
OL	Operating liabilities
FL	Financial liabilities
FA	Financial assets

1. Introduction

The Residual Income Model proposes that a firm's current value is determined by its expected future performance and can be enhanced by expanding its underlying assets or improving its profitability. Financial statement information can be utilized to forecast a firm's future performance, making it useful in determining a firm's value. Prior research suggests that utilizing the DuPont analysis framework, which proposes a structured approach to analyzing financial information, can improve the accuracy of predicting a firm's future performance. The DuPont framework decomposes a firm's profitability into its drivers, including the return of operating activities (RNOA), which is driven by asset turnover (ATO) and profit margin (PM), and the return on a company's financial activities, which is affected by the extent to which a firm uses external financing sources and the associated costs thereof. ATO captures asset utilization and the firm's efficiency in using its assets to generate sales, while PM reflects a company's ability to manage the costs associated with generating those sales. The findings of Bauman (2014, p. 199), Fairfield & Yohn (2001, p. 378), Jin (2017, p. 219), and Soliman (2007, p. 24) indicate that changes in ATO and PM have explanatory power regarding a firm's future operating profitability and that both are related to stock returns. Market participants appear to favorably consider information from both operating DuPont components as incrementally informative beyond a comprehensive profitability measure like RNOA and price improvements in ATO and PM (Amir et al., 2011, p. 321; Baik et al., 2013, p. 1012 - 1013; Soliman, 2007, p. 44). While such studies focus on examining the predictive ability of the operating DuPont components, limited evidence is available concerning the DuPont components related to a firm's financing activities. Although the DuPont model suggests that a company's profitability can be enhanced using favorable operating or financial leverage, numerous studies omit the effects of leverage in forecasting and valuation, basing their approach on Modigliani and Miller's (1958, p. 268) capital structure irrelevance proposition, which suggests that in perfectly efficient markets without tax, bankruptcy costs, and information asymmetry, leverage has no impact on a firm's value. Penman (2013, p. 451) argues that the favorable effect on a firm's return on equity is offset by financing risk, resulting in stronger discounted residual income. However, other studies motivated by the desire to relax the economic assumptions made by Modigliani & Miller (1958) show that leverage has significant implications for a firm's value that should not be disregarded. They propose debt-related advantages such as tax-shields (Kemsley & Nissim, 2002, p. 2071; Modigliani & Miller, 1963, p. 438) and lower transaction and contracting costs

(Harris & Raviv, 1991, p. 332 - 333; Myers, 1984, p. 585), but also negative implications such as a greater likelihood of financial distress, including the associated bankruptcy costs or agency problems (Altman, 1984, p. 1076 - 1077; Jensen & Meckling, 2004, p. 164 - 165; Leland, 1994, p. 1213). These implications are related to the studies of Abarbanell & Bushee (1998, p. 31), Bernard & Stober (1989, p. 30), Richardson et al. (2005, p. 482), and Sloan (1996, p. 305), which demonstrate that markets are not fully efficient and abnormal returns can thus be achieved through the exploitation of accounting information. Amir et al. (2011, p. 325), Baik et al. (2013, p. 1014), and Soliman (2007, p. 47) confirm market participants' inability to fully understand the predictive ability of financial data by demonstrating that changes in ATO are related to future stock returns, thereby indicating that exploiting the information from this DuPont component can generate excess returns.

1.1. Extension to prior research & research objectives

This master thesis aims to build upon prior research by replicating previous findings using more recent data, in addition to extending the focus on analyzing the predictive ability of the operating DuPont components by conducting a more comprehensive profitability analysis incorporating a firm's financing activities. Specifically, the thesis extends previous studies by examining the explanatory power of the leverage DuPont components, namely financial and operating liability leverage, in predicting a firm's future profitability and stock returns. Furthermore, it investigates whether fully exploiting the information related to the DuPont components can generate abnormal returns, thereby analyzing whether market participants fully appreciate the components' predictive ability.

The research question of the master thesis is:

«To what extent do the DuPont components have explanatory power regarding a firm's future profitability and its market value?»

The analysis is divided into four sections. The first section aims to replicate previous literature findings about the forecasting power of the operating DuPont components regarding a firm's future profitability; in addition, it intends to extend prior research by including a firm's financial leverage into the analysis. The second section tests two hypotheses. The first hypothesis analyzes the association between the operating DuPont components of ATO and PM and contemporaneous stock returns, thereby investigating whether they effectively provide important information for market participants. The

second hypothesis aims to refute the capital irrelevance proposition by examining whether financial leverage is significantly correlated with current stock returns, indicating that it has an impact on a firm's market value. The third section analyzes the ability of market participants to not only incorporate but also fully comprehend the implications of the DuPont components. It aims to explore whether an investment strategy that fully exploits the information of all DuPont components can generate abnormal returns. The study's fourth section plans to determine if considering operating liability separately from financial leverage could improve the predictive ability of the model and reveal distinct implications for a firm's future profitability and market value. To address the potential model bias arising from the correlation of operating liability leverage with other DuPont components, its effect is examined separately.

1.2. Method

The hypotheses of all four sections are analyzed using pooled regressions. To address the non-normal distribution of the model variables and reduce the impact of outliers, the hypotheses are tested using rank regressions, where the independent variables are annually ranked into deciles. To account for potential cross-sectional correlations in the model residuals, regressions are conducted for each fiscal year separately and coefficients are averaged across the years. Each section contains 3-5 regression models with varying combinations of independent variables to evaluate the distinct impacts of the model variables. To control for mean-reverting profitability, current return on equity is included in all regression models. The data sample used for the analysis consists of financial data from a total of 482 listed US firms, all of which form part of either the S&P 500 or the NASDAQ Composite index. Annual data for the fiscal years between 2010 and 2022, collected by Refinitiv, are utilized. In total, there are 4,280 observations available to conduct the regression models. After conducting the regression analyses using Python, the results are compared with existing research findings, and any deviations and similarities are examined and discussed. Finally, conclusions are drawn from the results, and their subsequent implications are extracted.

1.3. Structure

The master's thesis is structured as follows: Chapter 2 provides an overview of the theoretical foundations of firm valuation, including contrasting views on the impact of leverage on a firm's value. Additionally, it introduces the DuPont analysis framework and explains the usefulness of several descriptors in financial data, including some of the

DuPont components, based on prior research. In Chapter 3, the empirical analysis is divided into the four aforementioned sections, and corresponding hypotheses are formulated to address the research question. Chapter 4 describes the data sample used in the analysis, provides an overview of all variables included in the regression models, and presents insights into the applied research design and statistical examinations, whilst Chapter 5 presents the results of the regression analyses. Finally, the study's main findings are summarized and discussed in Chapter 6, followed by the identification of recommendations for potential future research.

2. Theoretical foundations and literature review

2.1. Valuation framework

A firm's current value needs to be determined in numerous investment decisions. Fundamental analysis provides several methods for determining this value, with one widely used method for equity valuation being the Residual Income Model (1) (Ohlson, 1995, S. 662). The model suggests that the current market value of a firm is driven by the book value of equity (the net assets of a company) and its infinite sum of discounted residual earnings:

$$P_t = B_t + \sum_{i=1}^{\infty} \frac{E_t[(ROE_{t+i} - r_e)B_{t+i-1}]}{(1+r_e)^i} \quad (1)$$

where:

P_t = stock price at time *t*
B_t = book value at time *t*
E_t = expectation based on information available at time *t*
ROE_{t+1} = return on book equity at time *t*
$E_t[(ROE_{t+i} - r_e)B_{t+i-1}]$ = expected residual earnings / future abnormal return
r_e = cost of equity capital

Accordingly, the value of a firm depends on both its book value and the future residual earnings that its net assets are likely to generate (Penman, 2013, p. 141). Residual earnings can be defined as the difference between a firm's expected earnings and a capital charge for the underlying net assets (book value). Thus, the value of a firm can be increased by increasing its profitability or growing its assets. The Residual Income Model is based on the concept of clean-surplus accounting (Ohlson, 1995, p. 661; Penman, 1992, p. 479), which requires that all gains and losses that affect the book value of a company be reflected in its earnings. This leads to the change in book value always being equal to earnings minus dividends (Lee, 1999, p. 415). To value a company using the Residual Income Model, it is necessary to forecast future residual earnings; this includes forecasting profitability and the book value that is expected to be put in place to earn the forecasted residual earnings. Consequently, this forecasting process is an essential aspect of fundamental analysis (Nissim & Penman, 2001, p. 111; Penman, 2013, p. 233). The respective components are forecasted from information, so one cannot avoid the analysis of information (Nissim & Penman, 2001, p. 148). Financial statements are a primary source of information that listed firms publish on a regular basis. Penman (2013, p. 17) calls financial statements the "lens of the business" as they translate the economic factors

driving a company's value into accounting numbers, thus providing useful information for determining the fundamental value of a firm. Hence, the purpose of financial statement analysis is to use accounting information to gain insights into a firm's strategy, identify its performance drivers, and predict its future performance to determine its current value. Indeed, Nissim & Penman (2001, p. 124) state that the analysis of accounting information should be guided by the "predictive ability" aspect; any component that improves forecasts is an innovation. Additionally, there is considerable interest in determining whether disaggregating these components enhances their information power and thus further improves forecast accuracy. Moreover, a distinction should be made between the transitory and permanent drivers of firm performance. While transitory components can be understood to only affect the present, permanent drivers can be used to forecast future residual income.

2.2. Use of financial statement information

There is extensive prior research devoted to understanding the relationship between financial statement information and firm performance, including various measures such as stock returns, profitability, and earnings. Many of them provide evidence on the usefulness of several descriptors in accounting data. Within this sphere, Lipe (1986) was one of the first to investigate the relation between stock returns and the decomposition of reported earnings. Specifically, he decomposed earnings into six components: gross profit, general and administrative expense, depreciation expense, interest expense, income taxes, and other items, ascertaining that they all have statistically significant additional explanatory power regarding stock returns over an aggregated earnings measure (Lipe, 1986, p. 47). Moreover, Lipe (1986) revealed that these components have different time-series properties and therefore imply different return reactions, concluding that earnings components with higher persistence have a stronger relation with stock returns than those with more transitory components (Lipe, 1986, p. 52), indicating that investors react differently to various time-series properties of earnings components (Lipe, 1986, p. 59). Fairfield et al. (1996) investigate an alternative approach of earnings aggregation by decomposing a company's earnings according to the classification scheme dictated by the accounting profession. Indeed, they examine whether this approach of decomposing earnings improves the ability to forecast future profitability. By conducting out-of-sample tests, Fairfield et al. (1996) analyzed the extent to which different levels of earnings disaggregation contribute to forecasting a firm's profitability one year ahead. Their results confirm Lipe's (1986) suggestion that disaggregating earnings improves future profitability forecasts

(Fairfield et al., 1996, p. 345). Additionally, Fairfield et al. (1994, p. 348) state that the highest out-of-sample accuracy is achieved by decomposing earnings into operating income, non-operating income and income taxes, special items, and non-recurring items. They also suggest that further disaggregation along the classification scheme does not improve forecast ability regarding future profitability (Fairfield et al., 1996, p. 354). Moreover, they argue that operating earnings should receive the most weight when forecasting future profitability, followed by non-operating earnings. Their findings indicate that line items further down the income statement provide less predictive power (Fairfield et al., 1996, p. 338).

However, Lev & Thiagarajan (1993, p. 193) adopt a different approach to analyze the relation between financial data and future firm performance forecasts. In their study, they analyze the correlation between 12 fundamental signals that analysts commonly use and a firm's stock returns, investigating whether these signals provide explanatory power in predicting a firm's future performance. Specifically, they examine if these signals are incrementally informative beyond the annual earnings changes (Lev & Thiagarajan, 1993, p. 198).

The 12 fundamental signals are composed as follows:

	Signal	Measured as:
1	Inventory[a]	Δ Inventory (78 or 3) − Δ Sales (12)
2	Accounts Receivable	Δ Accounts Receivable (2) − Δ Sales (12)
3–4	Capital Expenditure, *R&D*	Δ Industry Capital Expenditures or *R&D* (30(46)) − Δ Firm Capital Expenditures (*R&D*)[b]
5	Gross Margin	Δ Sales − Δ Gross Margin (12–41)
6	Sales and Administrative Expenses (*S&A*)	Δ *S&A* (189) − Δ Sales
7	Provision for Doubtful Receivables	Δ Gross Receivables (2+67) − Δ Doubtful Receivables (67)
8	Effective Tax	$PTE_t (T_{t-1} - T_t)$ PTE_t = pretax earnings (170) at t, deflated by beginning price T = effective tax rate[c]
9	Order Backlog	Δ Sales − Δ Order Backlog (98)
10	Labor Force	$\dfrac{\left(\dfrac{\text{Sales}_{t-1}}{\text{No. of Employees}_{t-1}} - \dfrac{\text{Sales}_t}{\text{No. of Employees}_t}\right)^{d}}{\dfrac{\text{Sales}_{t-1}}{\text{No. of Employees}_{t-1}}}$
11	*LIFO* Earnings	0 for *LIFO*; 1 for *FIFO* (59)
12	Audit Qualification	1 for Qualified; 0 for Unqualified (149)

Figure 1: Signals tested by Lev & Thiagarajan (1993, p. 193)

The study finds a positive coefficient on changes in earnings, indicating that market participants price higher earnings favorably. However, coefficients on gross margin, inventory, sales & administrative expenses, order backlog, receivables, and capital

expenditures are significantly negative at the 5% level (Lev & Thiagarajan, 1993, p. 201 - 203). The results suggest that a disproportionate decrease in gross margin relative to sales is viewed negatively by market participants. They contend that, as gross margin is driven by factors such as market competition or operating liability leverage, unfavorable changes of gross margin indicate lower earnings persistence in the future (Lev & Thiagarajan, 1993, p. 195). Increases in inventories that outweigh increases in sales may signal difficulties in generating sales, leading to lower future earnings as management attempts to reduce inventory levels. Disproportionate inventory increases may further indicate the existence of slow-moving or obsolete items that will be written off in the future (Lev & Thiagarajan, 1993, p. 193). Additionally, unbalanced increases in accounts receivable may also suggest difficulties in selling products and therefore imply lower future earnings due to increases from receivables provisions. As sales & administrative costs are mostly fixed costs, a disproportionate increase in sales is also viewed negatively by investors as it may imply a managerial loss of cost control (Lev & Thiagarajan, 1993, p. 196). Furthermore, Lev and Thiagarajan (1993, p. 195) argue that relative decreases in capex and R&D investments indicate managerial concerns with future cash flows to maintain current investment/earnings levels. The other signals did not show consistent significance during the examination period. Thus, the researchers ascertain that conditioning the signals on macroeconomic variables, such as changes in inflation, GDP, and business inventories, considerably strengthens the relation between the fundamentals and excess returns. The inventory signal, for example, is substantially stronger during high inflation years due to the expected higher cost of carrying inventories. This highlights the importance of contextual capital market analysis (Lev & Thiagarajan, 1993, p. 206). Furthermore, Abarbanell & Bushee (1997) extend Lev & Thiagarajan's (1993) study by examining 9 of their 12 fundamental signals and their predictive power regarding future earnings changes rather than stock returns. They test whether Lev & Thiagarajan's (1993) suggested relation of the signals with stock returns can be explained by the signals' ability to predict future earnings, providing evidence that many of the fundamental signals are related and incrementally informative beyond current earnings in predicting future changes in earnings. Consistent with previous research, their results show significant negative coefficients for the signals inventory, accounts receivable, capex, and gross margin in relation to one-year-ahead earnings changes (Abarbanell & Bushee, 1997, p. 5). However, not all fundamental signals that are suggested to be statistically significant regarding stock returns are confirmed to be related to future earnings. A potential explanation proposed by

Abarbanell & Bushee (1997, p. 9) is that fundamental signals may provide information regarding the quality of contemporaneous earnings changes, rather than predictive power for future earnings. Expanding on previous findings, in a follow-up study Abarbanell & Bushee (1998) investigate whether an investment strategy fully exploiting the information of these signals can generate abnormal returns. Conducting a decile ranked portfolio regression analysis, they confirm that some fundamental signals are related to subsequent returns, thus indicating a market underreaction to financial information (Abarbanell & Bushee, 1998, p. 31). Notably, the study highlights that relative changes in inventories, gross margin, selling expenses, capex, and effective tax rates are strong predictors for forecasting one-year-ahead earnings information that the market tends to underreact to (Abarbanell & Bushee, 1998, p. 43).

In contrast to the signals used by Abarbanell and Bushee in 1998, Sloan (1996) decomposes operating earnings into two components – accruals and cash flows – and assesses their relation to a firm's stock returns. Additionally, he examines the two components' persistence and the resulting implications for stock returns. Accruals represent estimates of a firm's future benefits and obligations and are therefore more prone to subjectivity and estimation errors (Richardson et al., 2004, p. 5). Additionally, accruals include estimates of future cash flows and deferrals of past cash flows. Moreover, Sloan (1996, p. 294) demonstrates that the persistence of earnings depends on the relative composition of cash flow and accruals. Sloan (1996, p. 299) documents that accruals are less persistent than cash flows, suggesting that firms with relatively higher reported accruals tend to have lower earnings in the following period and thus may signal earnings management. The results of Sloan's (1996) study aligns with Rayburn's (1986, p. 131) argument that cash flow and accrual components exhibit different persistence and therefore have different implications for future firm performance. Richardson et al. (2004, p. 28 - 31) conclude that the lower persistence of accruals is largely due to transitory accrual estimation errors, stemming from the subjective and uncertain nature of accruals. These findings highlight the significance of differentiating between permanent and temporary accruals when evaluating a company's present and forecasting its future performance. In their follow-up study, Richardson et al. (2005, p. 438) assess three categories of accruals and evaluate the relation between their measurement reliability and earnings persistence. Unlike Sloan (1996), Richardson et al. (2005, p. 446) expand their analysis of accruals beyond non-cash working capital (WC) to also include non-current operating assets (NCO) and net financial assets (FIN) (2):

$$Accruals = \Delta WC + \Delta NCO + \Delta FIN \quad (2)$$

Thus, Richardson et al. (2005, p. 457) confirm the findings of prior research by evidencing that total accruals are less persistent than cash flows. Moreover, they demonstrate that accrual categories with high measurement reliability have higher earnings persistence than low reliability components. They show that working capital accruals and non-current operating accruals exhibit lower earnings persistence than financial accruals (Richardson et al., 2005, p. 461). However, they also show that the lower earnings persistence of working capital accruals is entirely attributable to operating asset accruals that are financed by debt, financial assets, or equity. When operating liabilities are used to finance operating asset accruals, earnings persistence is higher (Richardson et al., 2005, p. 473).

Sloan (1996, p. 305) also demonstrates that the market does not understand these different implications of the information contained in the accrual and cash flow components. Hence, the results of Sloan (1996, p. 306) suggest that using this information can generate abnormal returns, thereby confirming the findings of Abarbanell & Bushee (1998, p. 31) concerning the inability of market participants to comprehensively understand financial information. Bernard & Stober (1989, p. 30) and Richardson et al. (2005, p. 482) both confirm these findings and also provide evidence that stock prices do not reflect all available information from cash flow and accrual components. In addition, the study of Bradshaw et al. (2001, p. 65) demonstrate that even analysts, who specialize in analyzing accounting information, do not fully comprehend the implications of these two earning components and therefore fail to adequately inform market participants about future earnings implications.

2.3. DuPont analysis

2.3.1. Drivers of return on equity

The studies highlighted in the previous section examine the role of various financial statement components in forecasting future firm performance, albeit using different approaches. Accordingly, no clear structured approach for predicting future firm performance can be discerned. The DuPont analysis provides a systematic method through which to examine the drivers of profitability, a core determinant of a firm's value under the Residual Income Model (1) and thus a crucial indicator of future firm performance. The DuPont analysis formula decomposes return on equity as follows (3):

$$ROE = ATO\ x\ PM\ x\ Leverage \tag{3}$$

equivalent to:

$$ROE = \frac{Sales}{Average\ assets}\ x\ \frac{Net\ Income}{Sales}\ x\ \frac{Average\ assets}{Equity} \tag{4}$$

ATO captures asset utilization and the firm's efficiency in using its assets to generate sales. Changes in ATO (ΔATO) compare growth in sales relative to the growth of the assets used to generate those sales. ATO is driven by the company's specific assets & liabilities such as properties, plant and equipment, working capital components (accounts receivables, payables, inventories), and any changes in the related processes (Amir et al., 2011, p. 306; Soliman, 2007, p. 7 - 8). Consequently, Fairfield & Yohn (2001, p. 372) state that an increase in ATO reflects a more efficient use of a company's asset and should therefore imply higher future profitability. PM measures a company's ability to manage the costs associated with generating a company's sales. Specifically, it is driven by a firm's gross margin and various expense ratios. Moreover, subsidiaries or other income may also influence a firm's PM. The change in PM (ΔPM) can provide valuable insights into a company's operating income and sales growth. A decline in PM may suggest a disproportionate change in sales and related costs, which could be the result of unexpected drops in demand, inability to reduce selling expenses, or inability to pass cost changes to customers through sales prices. Conversely, an increase in PM may signify higher operating efficiency and could lead to increased future profitability. However, changes in PM may also stem from accounting conservatism (Amir et al., 2011, p. 306; Penman & Zhang, 2004, p. 17 - 18), in which case an increase in current PM may be due to deferred expenses and may imply a decrease in one-year-ahead profitability (Fairfield & Yohn, 2001, p. 372). Leverage reflects the ratio between a company's total assets and its equity, which

indicates the extent to which the company is financed by external sources. The DuPont formula (3) suggest that a company's profitability can be increased by a higher PM, a more efficient use of assets, or by increasing leverage. However, Penman (2013, p. 375) documents that the relative impact of ATO, PM, and leverage on overall return on equity varies greatly depending on the industry and type of company. Industries with low ATO tend to have higher PMs and vice versa. Moreover, the contribution of financial leverage is considerably high in industries like pipelines, utilities, and hotels, while industries like business services, printing and publishing, and chemicals use little financial leverage to improve their profitability.

2.3.2. Extended profitability analysis

In their study, Nissim & Penman (2001) demonstrate an extension of the DuPont formula (3)(4) by restructuring the breakdown of return on equity (ROE), allowing the separation of the effects of operating and financing activities on the overall return. They provide a structured framework designed to conduct a more thorough analysis of financial performance and gain a deeper understanding of the sources of value creation. The separation of operating and financing activities is based on the economic intuition introduced by Modigliani & Miller (1958, p. 268) and explained by Feltham & Ohlson (1995, p. 691)b that the value of a firm is not influenced by its financial activities. They argue that differentiating between operating and financing activities is helpful not only in identifying the transitory and persistent drivers of future firm performance, but also for gaining insights into the different leverage measures resulting from these activities. They outline the following decomposition scheme (5) – (9):

$$ROE = \frac{Comprehensive\ income}{Average\ equity} \tag{5}$$

$$ROE = \frac{Operating\ income - Net\ financial\ expenses}{Net\ operating\ assets\ (NOA) - Net\ financial\ obligations\ (NFO)} \tag{6}$$

$$ROE = \left(\frac{NOA}{equity}\ x\ RNOA\right) - \left(\frac{NFO}{equity}\ x\ NBC\right) \tag{7}$$

$$ROE = RNOA + \left[\frac{NFO}{CSE}\ x\ (RNOA - NBC)\right] \tag{8}$$

$$ROE = RNOA + (FLEV\ x\ SPREAD) \tag{9}$$

Accordingly, Nissim & Penman (2001) demonstrate that profitability can be viewed as a weighted average of returns from both operating activities and financing activities (7). Equation (9) thus suggests that ROE is influenced by the return on net operating assets, which results from a company's operating activities, along with an additional return from

the firm's financial activities. Figure 2 presents a graphical representation of the extended DuPont analysis framework, including its underlying drivers.

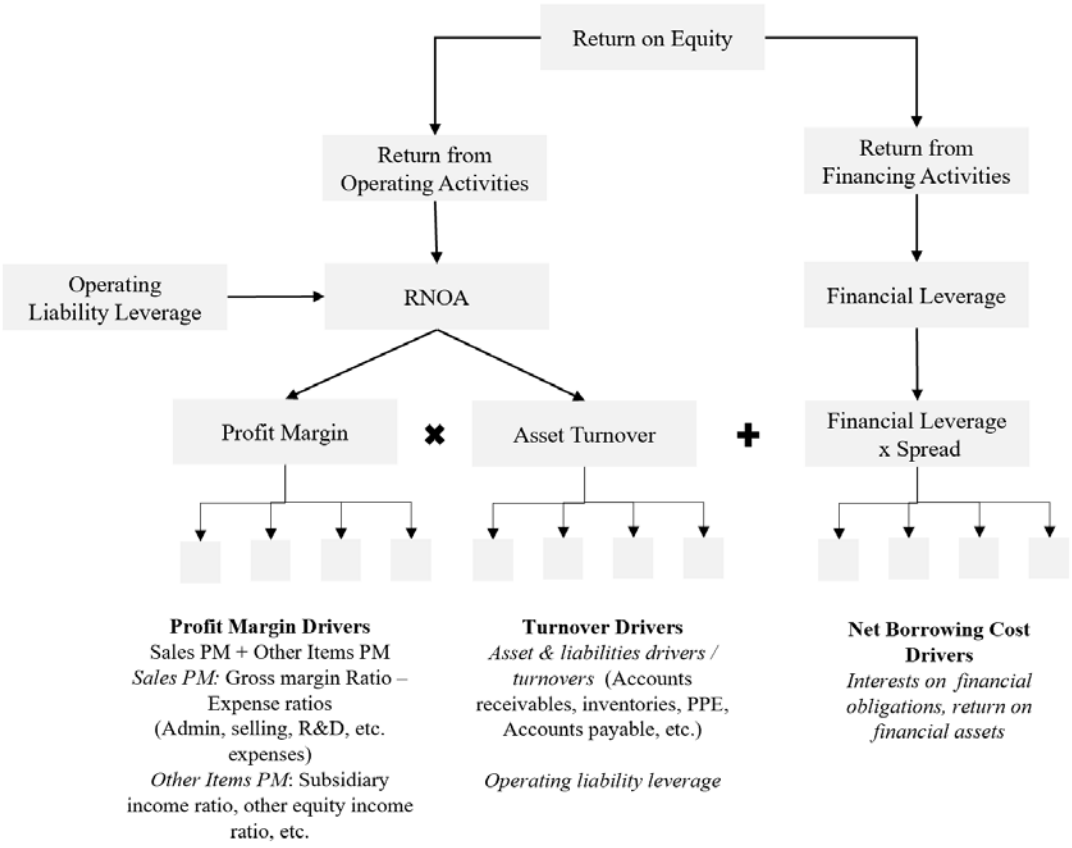

Figure 2: DuPont analysis framework based on Nissim & Penman (2001), Penman (2013), and Soliman (2007).

RNOA can be divided into its two drivers: ATO and PM. Contrary to the standard DuPont formula, Nissim und Penman (2001) outline an additional driver of RNOA: operating liability leverage (OLLEV). Operating liabilities reduce net operating assets, the denominator of RNOA, and can thereby lever up operating profitability (Nissim und Penman, 2001, p. 116). OLLEV arises in the operational part of a firm and is not part of financial leverage. The OLLEV also reflects the extent to which net operating assets are comprised of operating liabilities. Nissim & Penman (2003, p. 534) suggest that a company can increase its RNOA by obtaining credit for its operations without paying explicit interest. By doing so, the company can lower its investment in net operating assets, which reduces the amount of investment required from shareholders to run the business. However, it is important to note that interest-free credit may not be entirely free, as suppliers who offer such credit may charge higher prices for their goods and services compared to cash payments. Thus, although a company can lever its RNOA by obtaining operational credit, it faces a trade-off between lower investment and higher prices (Nissim & Penman, 2001,

p. 117 - 118; Penman, 2013, p. 368 - 369). RNOA can be reformulated, whereby ROOA reflects the unlevered return from operating activities and "io" reflects the implicit interest charge for operating liabilities:

$$RNOA = \left[ROOA\ x\ \frac{OA}{NOA}\right] - \left[\frac{io}{OL}\ x\ \frac{OL}{NOA}\right] = ROOA + \left[OLLEV\ x\ OLSPREAD\right] \quad (10)$$

where:

$$OLLEV = \frac{Operating\ liabilites\ (OL)}{NOA} \quad (11)$$

$$OLSPREAD = ROOA - \frac{io}{OL} \quad (12)$$

Operating leverage is favorable if the unlevered return on operating assets is larger than the implicit borrowing costs ($\frac{\text{io}}{\text{OL}}$), leading to a positive operating liability spread (OL-SPREAD). Here, it must be noted that the implicit borrowing costs are hardly observable. Nissim & Penman (2003, p. 536) suggest estimating *io* by the short-term market borrowing rate. Indeed, Nissim & Penman's (2001, p. 130) dataset analysis on companies listed on NYSE reveals that the median OLLEV and the median operating liability spread are both positive at 0.35% and 3.4%, respectively. This suggests that, on average, OLLEV is being utilized in a favorable manner, which contributes to a positive difference between average RNOA and ROOA.

Figure 2 presents that financial leverage also has an impact on a company's profitability. According to Nissim & Penman (2001, p. 114 - 116), the impact of financial activities and its favorability depends on two factors: the amount of leverage (FLEV) and a company's SPREAD, as illustrated in equation (9).

where:

$$FLEV = \frac{NFO}{Equity} \quad (13)$$

$$NBC = \frac{Net\ Financial\ Expense\ (NFE)}{NFO} \quad (14)$$

$$SPREAD = RNOA - NBC \quad (15)$$

FLEV indicates the extent to which a firm's assets are financed by net financial obligations rather than equity (13). A company may have a negative FLEV, implying it has more financial assets than liabilities. Penman (2013, p. 366) demonstrates that this ratio varies significantly depending on the firm's sector. The SPREAD (15) also provides

valuable insights into the favorability of financial leverage. As shown in equation (15), it compares a firm's return on net operating assets to its net borrowing cost. When RNOA is higher than NBC, financial leverage is favorable, thereby leveraging ROE over RNOA. However, financial leverage is unfavorable when the net borrowing costs are greater than the return from operating activities (Nissim & Penman, 2001, p. 118). As long as RNOA is above the NBC, financial leverage improves a firm's profitability. If NBC exceeds RNOA, ROE deteriorates.

Therefore, it is vital to note that leverage also introduces an important risk component. For this reason, it is crucial for companies to carefully consider the trade-off between the potential benefits and risks of financial leverage when making financing decisions (Penman, 2013, p. 450).

The decomposition framework proposed by Nissim & Penman (2001), displayed in Figure 2, highlights the impact of operating and financial leverage on a firm's profitability. Without any operating or financial leverage, ROE would equal ROOA. Operating leverage leads to leveraging RNOA over ROOA, whereby favorable financial leverage further leverages ROE over RNOA (Penman, 2013, p. 370), as illustrated in equation (16).

$$ROE = ROOA + (RNOA - ROOA) + (ROE - RNOA) \quad (16)$$

2.3.3. Explanatory power of DuPont components

Upon analyzing a further breakdown of ATO, PM, OLLEV, and FLEV, it becomes apparent that previous research has already examined the explanatory power of some of their drivers, such as gross margin, working capital accruals, or inventory changes. However, more recent studies have focused on investigating whether the DuPont components themselves provide useful information to predict future performance and whether they have incremental explanatory power beyond other accounting signals analyzed in previous literature. Indeed, Fairfield & Yohn (2001) were the first to address PM and ATO in a forecasting context. In their study, they examine whether future changes in return on net operating assets ($\Delta RNOA_{t+1}$) can be predicted by analyzing the relative contributions of ATO and PM to operating profitability. Additionally, they investigate if these components provide additional information beyond current changes in RNOA ($\Delta RNOA_t$).

To analyze the predictive abilities of the DuPont components, Fairfield & Yohn (2001, p. 375) decompose RNOA into three parts using the following equation:

$$\Delta RNOA_t = \Delta ATO_t \, x \, PM_{t-1} + \Delta PM_t \, x \, ATO_{t-1} + \Delta ATO_t \, x \, \Delta PM_t$$

This allows them to control for the differing compositions of ATO and PM on RNOA by multiplying the change in one component with the prior year's value of the other. While ΔATO_t represents the contribution of ATO to changes in return on net operating assets, ΔPM_t represents the contribution of PM. However, this approach results in the removal of $\Delta RNOA_t$ as a model variable due to perfect collinearity when adding ΔATO_t and ΔPM_t. to the regression model (Fairfield & Yohn, 2001, p. 376). In addition, observations with negative PMs in year t-1 must be removed, as an increase in ATO in year t would be misclassified as a decrease. While this disaggregation method effectively controls differences among firms, it also leads to a significant loss of data and a potential bias towards profitable firms.

Consequently, Fairfield & Yohn (2001) begin their analysis by testing a baseline model that only includes three control variables: current profitability ($RNOA_t$), growth in net operating assets (ΔNOA_t) and change in current profitability ($\Delta RNOA_t$). They discover that all three variables are significant (Fairfield & Yohn, 2001, p. 378). The positive coefficient for $\Delta RNOA_t$ implies a positive relation with changes in future profitability. Additionally, the baseline model results confirms prior literature findings, such as of Abarbanell & Bushee (1997, p. 6), which propose that asset investments (ΔNOA_t) lead to weaker firm performance one-year-ahead as it reduces a firm's operating profitability. Moreover, the results obtained by Fairfield & Yohn (2001, p. 378) confirm the phenomenon of mean-reverting profitability, which was proposed by Beaver (1970, p. 86) in a cross-sectional data sample. Mean reversion in RNOA suggest that highly profitable companies tend to experience lower profitability in the subsequent period, while companies with low profitability tend to experience higher profitability in the following period. Beaver (1970, p. 84 – 86) demonstrate that this effect is particularly significant for companies with extremely high profitability. Fairfield & Yohn (2001, p. 374) control for the mean-reverting effect by including $RNOA_t$ in all their regression models.

The results of their extended models, which incorporate the levels and change components of ATO and PM, suggest that decomposing $RNOA_t$ into the levels of ATO and PM may offer insights into a firm's strategy, but does not provide additional information about $\Delta RNOA_{t+1}$ beyond what is already known from $RNOA_t$ (Fairfield & Yohn, 2001, p. 378). This conclusion suggests that changes in future profitability are not linked to the current mix of ATO and PM levels, indicating no predictive ability. However, Fairfield & Yohn (2001, p, 378) find that decomposing $\Delta RNOA_t$ into ΔATO_t and ΔPM_t provides

incremental information about future profitability. While ΔATO_t has a positive and significant coefficient, the coefficient on ΔPM_t is not significant. Fairfield & Yohn (2001, p. 380) confirm their findings by conducting out-of-sample tests. Changes in asset utilization are still incrementally significant predictors of future profitability, while changes in PM alone do not provide significant predictive power. Moreover, they confirm their results by conducting a regression analysis using SIC codes, indicating that the results are robust across different operating environments (Fairfield & Yohn, 2001, p. 383).

Soliman (2007) builds on the study of Fairfield and Yohn (2001) by expanding their analysis and making some adjustments to improve predictions of future firm performance using DuPont components. He adopts a different approach to decompose RNOA and measures changes in PM and ATO as first differences, which reduces the number of observations that need to be removed (Soliman, 2007, p. 21). Moreover, $\Delta RNOA_t$ can be incorporated as an explanatory variable even when ΔPM_t and ΔATO_t are included in the regression model. Soliman (2007, p. 11-12) argues that the inclusion of $\Delta RNOA_t$ is important in distinguishing whether the explanatory power comes from ΔPM_t and ΔATO_t or from the omitted variable $\Delta RNOA_t$. Furthermore, Soliman (2007, p. 10 - 11) combines his research based on Fairfield & Yohn (2001) with additional previous studies. He includes the nine fundamental signals examined by Abarbanell & Bushee (1997) and the three accrual categories ($\Delta WC + \Delta NCO + \Delta FIN$) introduced by Richardson et al. (2005) into his regression models. He also tests whether the ATO & PM information provide additional insights (Soliman, 2007, S. 22).

Soliman's (2007, p. 23 - 24) regression results confirm that ΔATO_t is a positive and significant predictor of future changes in operating profitability. However, ATO, PM, and ΔPM_t remain insignificant, whilst $RNOA_t$ and ΔNOA_t exhibit negative coefficients. The inclusion of the nine fundamental signals and three accrual components examined by prior studies does not weaken the explanatory power of ΔATO_t (Soliman, 2007, S. 24), thereby demonstrating that the accounting signals previously examined by Abarbanell & Bushee (1997) and Richardson et al. (2005) may not fully capture the underlying information conveyed by changes in ATO. This finding suggests that market participants should consider incorporating the DuPont components into their decision-making processes to gain additional insights into a firm's performance.

As a result, Soliman (2007) extends preceding research on the ability of market participants to incorporate financial information. Indeed, Soliman (2007, p. 25) demonstrates

that both operating profitability ($RNOA_t$) and changes in current profitability ($\Delta RNOA_t$) provide valuable insights for stock market participants beyond earnings information. This highlights the importance of profitability as a key indicator of future firm performance. Surprisingly, Soliman (2007, p. 25 - 26) determines that the inclusion of ATO_t and PM_t in the regression model reveals a positive and significant relationship with stock returns. This contradicts previous findings by Fairfield & Yohn (2001, p. 378) and Soliman (2007, p. 23 - 24), both of whom found no predictive ability of ATO_t and PM_t regarding $\Delta RNOA_{t+1}$. Despite their lack of predictive ability, market participants still appear to find the information regarding the composition of ATO and PM informative. Similarly to future profitability, ΔATO_t exhibits a positive correlation with contemporaneous stock returns, while ΔPM_t remains insignificant (Soliman, 2007, p. 44). Market participants appear to price changes in ATO favorably, while they do not exhibit a significant market reaction to changes in PM. Interestingly, $\Delta RNOA_t$ loses its explanatory power when ΔATO_t is added, indicating that the predictive power of ΔRNOA in models without ΔATO and ΔPM is mainly driven by changes in ATO (Soliman, 2007, p. 26).

To analyze if market participants not only consider but also fully understand the future implications of the DuPont components, Soliman (2007) conducts cross-sectional regressions regarding future stock returns on the ranks of the DuPont components. Again, the results reveal a positive and significant coefficient for ΔATO_t, indicating that market participants do not fully comprehend the variables' future predictive power (Soliman, 2007, p. 47). Hence, these results confirm the growing evidence that market participants do not fully understand the future implications of current accounting information mapping on future firm performance, thereby confirming that markets are not fully efficient.

In their study, Baik et al. (2013, p. 1011) confirm that ΔATO has explanatory power regarding future profitability and a positive relation with contemporaneous stock returns, indicating that investors consider changes in ATO to be informative. Moreover, they demonstrate that ΔATO_t is predictive of future stock returns, confirming that investors also do not fully comprehend the predictive power of efficiency changes (Baik et al., 2013, p. 1015). These findings suggest that a trading strategy exploiting this information can earn abnormal returns.

Persistence asset turnover & profit margin

These results reflect the commonly held perception in the literature that ATO exhibits higher persistence than PM and therefore has greater explanatory power regarding future profitability and the market value of a firm (Fairfield & Yohn, 2001, p. 372; Soliman, 2007, p. 3 - 4; Baik et.al, 2013, p. 1011 - 1013; Nissim & Penman, 2001, p. 146 – 147, Penman & Zhang, 2004, p. 17 - 18). Furthermore, Soliman (2007, p. 3 - 4) attributes the higher persistence of ATO to the barriers of entry associated with movements of capital, which were introduced by Romer (1986). According to Romer (1986, p. 1033), knowledge can be easily spread throughout an economy, leading to a decrease in the value of knowledge-based assets over time. If a company's PMs rely on ideas that can be easily replicated by competitors, these margins are more likely to be short-lived. When profit margins are high, it is common for new players to enter the market or for established competitors to adopt new ideas. The resulting competition tends to revert profit margins to normal levels, indicating transitory benefits. In contrast, Romer (1986, p. 1033) suggests that capital investments tend to yield more enduring returns, as capital movements face greater barriers in an economy. While the competitive environment can challenge profit margins very easily, it may not necessarily impede the effective allocation of resources. This is because imitating a company's efficient deployment typically requires significant and expensive changes to its existing operations. Other research proposes that the lower persistence of changes in PM may be due to the ambiguity surrounding whether the changes reflect improvements in efficiency (i.e., improved ability to control the costs incurred to generate sales) or are simply the outcome of accounting conservatism or earnings management (Fairfield & Yohn, 2001, p. 372; Jansen et al., 2012, p. 222).

Additionally, Soliman (2007, p. 4) argues that different accounting measurement approaches may also lead to varying effects on the persistence of PM and ATO. ATO is calculated as the ratio of sales (income state variable) to net operating assets (a balance sheet item), both of which exhibit relatively low variance. On the other hand, PM is calculated by dividing operating income by sales, both of which are income statement variables with higher volatility when compared to net operating assets. According to Soliman (2007, p. 4) this higher volatility may contribute to a lower persistence of PM compared to ATO. Moreover, Curtis et al. (2015, p. 3) also contend that the higher persistence of ATO is partially attributable to measurement effects, explaining that while assets are measured at historical costs (balance sheet), sales are valued at current values, leading to higher ATOs as net operating assets tend to be lower. Curtis et al (2015, p. 5) state that

this creates the appearance of an entry barrier, which is not replicable, thereby contradicting Romer's (1986, p. 1033) argumentation. Additionally, Curtis et al. (2015, p. 3) find that the differential persistence of ATO and PM is particularly high for firms with older assets. Consequently, they conclude that measurement differences lead to a lower degree of usefulness of the DuPont components for forecasting future profitability than proposed by the prior literature (Curtis et al., 2015, p. 29).

In their study, Amir et al. (2011, p. 302) reevaluate these different propositions concerning the various time-series properties of ATO and PM by introducing a new concept of persistence determination. To conduct their investigation, they distinguish between unconditional persistence (autocorrelation coefficient to RNOA) and conditional persistence (the power of a variable's persistence to explain the persistence of a variable higher in the hierarchy, i.e., RNOA). They argue that previous studies have solely focused on unconditional persistence (Amir et al., 2011, p. 303). Whilst Amir et al. (2011, p. 304) confirm prior findings that ATO has a higher unconditional persistence than PM, they argue that this does not necessarily imply that ATO is more value-relevant than PM and a more important factor in explaining a firm's market value (Amir et. al, 2011, p. 306). Accordingly, they state that conditional persistence should determine the market's reaction in the context of valuation. They show that PM has a higher conditional persistence to RNOA and should therefore also elicit a more robust market reaction (Amir et al., 2011, p. 315). In fact, Amir et al. (2001, p. 321) find a stronger explanatory power for ΔPM, indicating that market participants value improvements in PM more than changes in asset utilization efficiency. This contradicts the findings of both Soliman (2007, p. 25 - 26) and Baik et al (2013, p. 1013), who argue that only ΔATO is significant in explaining contemporaneous returns. However, Amir et al. (2011, p. 325) agree with Soliman's (2007, p. 27) findings regarding the relation between ΔPM and ΔATO with future stock returns. Indeed, they confirm that market participants fail to fully react to unexpected changes in ATO but incorporate underlying information in changes in PM.

The study conducted by Bauman (2014, p. 196) provides evidence supporting the predictive ability of PM with respect to future firm performance. He demonstrates that ΔPM is significant when considering its directional change. According to Bauman (2014, p. 198), firms with increasing PMs are expected to witness a decline in one-year-ahead RNOA, while those with decreasing PMs are likely to experience an increase. By assessing forecast accuracy using out-of-sample tests, Bauman (2014, p. 199) verifies that considering

the direction of ΔPM significantly enhances its predictive power for future operating profitability.

These findings thus highlight the importance of understanding the distinct financial metrics and their potential impact on the variables being analyzed.

2.4. Leverage and its impact on valuation

Previously described studies omit the leverage components of the DuPont decomposition of ROE (9) in their analysis. Although the DuPont scheme suggests that a company's expected future performance regarding its profitability can be improved not only by changes in profit margin and asset utilization but also by favorable operating or financial leverage, numerous studies fail to consider the effects of leverage in the context of forecasting and valuation. Their approach refers to the economic theory proposed by Modigliani & Miller (1958, p. 268) and further elaborated upon by Feltham & Ohlson (1995, p. 691). These authors argue that in perfectly efficient capital markets with no taxes, transaction costs, and no information asymmetry, the value of a firm is solely determined by its operating and investing activities, not its financing activities. They contend that while financing activities are essential to run the company, they do not create value, thereby suggesting that the capital structure is irrelevant regarding a company's value. They state that although leverage can boost the ROE, it also amplifies financial risk, as leverage can turn unfavorable, leading to greater losses for shareholders when the SPREAD becomes negative. The increased risk raises the required ROE and consequently decreases the expected residual income through stronger discounting (Nissim & Penman, 2003, p. 538). Additionally, Penman (2013, p. 451) illustrates that this mechanism offsets the favorable effect of a higher ROE through leverage. For this reason, prior studies of Fairfield & Yohn (2001, p. 372); Penman & Zhang (2004, p. 11), or Soliman (2007, p. 9) focus on RNOA as the indicator of firm economic performance, without considering the effects of leverage. However, other studies, motivated by the desire to explore the effects of leverage with a particular focus on relaxing the economic assumptions made by the Modigliani & Miller (1958), demonstrate that leverage has significant implications for a firm's value that should not be disregarded.

Modigliani & Miller (1963, p. 438) state that in capital markets that include taxes, debt can be advantageous due to its tax shield. Financing with debt reduces taxable income, leading to higher after-tax income. Although risky debt still increases a firm's cost of capital, the tax advantage mitigates this effect to a certain extent, resulting in higher equity

value. This proposition is supported by Kemsley & Nissim (2002, p. 2071), who empirically investigate the value of the debt shield and confirm a positive relation between the debt shield and firm value.

However, when leverage increases beyond a certain level, the tax advantage of debt may be partially offset by an increased cost of debt, reflecting the greater likelihood of financial distress. The trade-off theory states that as soon as the benefit from the tax shield becomes smaller than the costs of financial distress, the value of the firm will decrease (Leland, 1994, p. 1213; Myers, 1984, p. 577). The cost of financial distress includes both bankruptcy costs and agency problems between shareholders and debtholders associated with risky debt. Bankruptcy costs include the costs associated with direct financial distress, such as legal expenses, as well as indirect costs such as the destruction of intangible assets, the threat of fire sales, or reduced flexibility when monitored by creditors (Altman, 1984, p. 1076 - 1077; Warner, 1977, p. 338 - 339). Agency costs refer to the costs incurred by a company when managers and shareholders have different objectives or interests (Jensen & Meckling, 2004, p. 164 - 165). In the context of debt financing, agency costs may arise because the use of debt creates a conflict of interest between shareholders and debtholders. Shareholders typically want to maximize the value of their investment, which may involve taking on more risks, pursuing growth opportunities, and making long-term investments. On the other hand, debtholders are interested in protecting their investment and ensuring that the company generates sufficient cash flows to repay the debt, including the applicable interest. If a company fails to meet its debt obligations, debtholders may suffer severe losses, particularly in cases of bankruptcy. In such a scenario, managers who are responsible for making decisions on behalf of shareholders may act in ways that benefit shareholders but increase the risk of financial distress for the company, thereby jeopardizing debtholders' interests. To manage this conflict, debtholders may impose restrictions on the company's operations, such as requiring a certain level of cash reserves or prohibiting the company from engaging in certain activities. Debtholders may also monitor the company's performance to ensure that it meets the terms of the debt agreement. These measures come at a cost, such as legal fees, monitoring costs, and higher interest rates to compensate debtholders for the additional risks, all of which are referred to as agency costs related to debt financing (Harris & Raviv, 1991, p. 301; Jensen & Meckling, 2004, p. 172; Titman & Wessels, 1988, p. 1243 - 1245). Myers (1976, p. 19) extends these propositions by stating that the lack of incentive for shareholders to provide new capital to a firm when it is likely to go bankrupt and invest in value-generating

projects is also an aspect of debt-related agency costs. Therefore, he concludes that debt financing may lead to the rejection of projects that would generate additional value.

On the other hand, some studies argue that debt financing can actually increase a firm's value, not only through tax shields but also by reducing transaction and contracting costs (Harris & Raviv, 1991, p. 332 - 333; Myers, 1984, p. 585). Additionally, debtholders can assume a monitoring role of management, which can lower the cost for shareholders. Debtholders may also provide standardized rating scales about a firm's financial reliability, which can benefit the market's perception of the firm (Nissim & Penman, 2003, p. 538). Indeed, the pecking order theory suggests that market participants have less information about a firm's health than its managers, indicating information asymmetry (Myers, 1984, p. 581 - 582). However, a firm's capital structure can provide fundamental signals of profitability and future prospects. For example, a highly profitable firm in a slow-growth industry may have less incentive to take on debt, ending up with a low leverage ratio. In contrast, an unprofitable firm in the same industry may not be able to use retained earnings and may end up with a high debt-to-equity ratio. The pecking order theory posits that debt financing is preferred over equity financing because issuing equity may signal problems with the company's financial health. The theory also suggests that managers prefer private debt to public debt and public debt over public equity (Myers, 1984, p. 581 - 582).

The contrasting views of the advantages and risks of debt thus indicate that the economic conditions proposed by Modigliani & Miller (1958, p. 268) are not realistic and that leverage has an impact on firm value. Therefore, leverage should not be neglected in the valuation context.

2.4.1. Explanatory power of leverage regarding future profitability

Hence, Jin (2017) extends the studies of Fairfield & Yohn (2001) and Soliman (2007) by focusing on forecasting ROE rather than RNOA. As a result, Jin (2017, p. 221) concludes that both the level and changes in PM and ATO have a strong relation with future ROE, supporting their favorable impact suggested by the DuPont model (9). Moreover, her results demonstrate that the amount of external financing a firm uses is also a significant predictor of profitability. According to Nissim & Penman (2003, p. 546), distinguishing between applied operating and financial leverage can enhance the predictive ability of a firm's financing choices regarding its future performance. This is similar to the findings of the study conducted by Richardson et al., 2005, p. 473), which propose that the

persistence of earnings depends on whether a company's asset are financed by financial or operating assets. Nissim and Penman (2003, p. 531) argue that because of the distinct pricing foundations and diverse contractual settings of operating and financial liabilities, they have different impacts on future firm performance and pricing in the stock market. Furthermore, Nissim and Penman (2003, p. 531) state that financial liabilities are traded in more efficiently functioning capital markets, in which issuers are regarded as price takers. In contrast, the operational environment, which involves trading in input and output markets, is considered to be less competitive. They further explain that in the operational environment firms may exercise monopoly power, which enables them to extract value from both suppliers and employees (Nissim & Penman, 2003, p. 539). Suppliers might therefore offer inexpensive implicit financing in exchange for information about the products and markets in which the company operates. They may also reap the rewards of efficiency within the company's supply and distribution chain and may offer credit to secure future business opportunities. According to Nissim and Penman (2003, p. 539), the less competitive environment may lead to operating liability leverage generating more value for a firm compared to financial leverage, which in turn could have distinct implications for the firm's future profitability. The study's findings confirm Nissim and Penman's expectations and demonstrate that, effectively, operating and financial liabilities have different implications for a firm's ROE (Nissim & Penman, 2003, p. 545 - 546). Nissim & Penman (2003, p. 541 – 542) also demonstrate that the median impact of operating leverage on current profitability is greater than that of financial leverage, despite operating leverage being, on average, smaller than financial leverage. The cross-sectional analysis reveals that RNOA is positively correlated with operating liability leverage and negatively correlated with financial leverage. Nissim & Penman (2003, p. 544) attribute this disparity to the fact that firms with profitable operating assets tend to have more operating liability leverage and less financial leverage. However, Nissim & Penman (2003, p. 546) also suggest that both leverage components are positive and significant predictors in forecasting future ROE.

2.4.2. Explanatory power of leverage regarding stock returns

The study conducted by Masulis (1983, p. 125) provides evidence that leverage not only has explanatory power regarding future profitability but also impacts the market price of a firm. He demonstrates that market prices respond favorably to leverage changes, as evidenced by the positive relation between firm values and variations in debt levels and the significant association between changes in stock prices and leverage changes. In

addition, Masulis (1983, p. 125) concludes that companies that increase their debt levels tend to exhibit higher firm values, especially those who had lower debt levels before the change. These results suggest that changing a firm's capital structure can significantly impact its market price and may be advantageous, particularly for firms that are not highly leveraged.

Nissim & Penman (2003, p. 547) further support these findings, demonstrating that a firm's financing choices provide valuable information for investors in evaluating the prices they are willing to pay for a company's book value (P/B). However, they find a stronger impact of OLLEV on the P/B ratio (Nissim & Penman, 2003, p. 548). Indeed, Nissim and Penman (2003, p. 551) explain the weaker relation between financial leverage using its influence on a firm's cost of capital. Subsequently, Penman (2013, p. 450) explains that financial liabilities increase equity risk and partially offset the positive impact of higher profitability on a firm's value by increasing the cost of capital. Despite operating liabilities potentially also increasing equity risk, their impact on the cost of capital is likely to be less significant than that of financial liabilities (Nissim & Penman, 2003, p. 551). Most operating liabilities are either short-term or fluctuate with operations. If operating creditors perceive the firm's risk to be lower, they may even be willing to extend credit, which could lead to a negative relationship between operating liabilities and the cost of capital.

In conclusion, the studies outlined in Section 2.4. provide evidence that the economic assumptions underlying the capital structure irrelevance proposition of Modigliani & Miller (1958, 268) are not realistic. As a result, leverage has a significant impact on a firm's value, and should thus not be neglected when forecasting future firm performance. Additionally, the findings of Abarbanell & Bushee (1998, p. 31), Bernard & Stober (1989, p. 30), Richardson et al. (2005, p. 482), Sloan (1996, p. 305), and Soliman (2007, p. 27) indicate that market efficiency is not always guaranteed, and that excess returns can be achieved by exploiting accounting information. Indeed, if markets were efficient, asset prices would always fully reflect all available information (Fama, 1970, p. 383).

These conditions highlight the relevance of examining the explanatory power of the comprehensive DuPont analysis, including the leverage components, when predicting future firm performance and their impact on market value.

3. Empirical analysis

The literature review discloses numerous findings regarding the usefulness of financial information in forecasting future firm performance and the extent to which market participants incorporate this information. While previous studies primarily focus on analyzing the predictive ability of the operating DuPont components, namely ATO and PM, this thesis extends prior research by replicating previous findings using more recent data. It also conducts a more comprehensive analysis incorporating a firm's financial activities following the extended DuPont analysis framework introduced by Nissim & Penman (2001). Specifically, the thesis aims to explore the explanatory power of the leverage DuPont components, namely FLEV and OLLEV, with respect to a firm's future comprehensive profitability (ΔROE_{t+1}), rather than solely focusing on operating profitability ($\Delta RNOA_{t+1}$). Additionally, the study analyzes whether the information contained in these components is informative for market participants and therefore reflected in market prices. Furthermore, the empirical analysis investigates whether the market fully appreciates the predictive power of the components. Thus, the thesis explores the usefulness of incorporating the leverage DuPont components in predicting future profitability and stock returns. It examines whether a firm's capital structure choice is truly irrelevant in its market value. This master's thesis is expected to provide further insight into the effectiveness of the DuPont analysis framework when forecasting a firm's future performance.

The research question for this master's thesis is:

To what extent do the DuPont components have explanatory power regarding a firm's future profitability and its market value?

The following subsections outline the four analysis sections and the corresponding hypotheses formulated to address the research question.

3.1. Predictions of future profitability

The first section of the analysis focuses on examining the predictive ability of the DuPont components regarding a firm's one-year-ahead profitability. It aims to replicate previous literature findings about the forecasting power of the operating DuPont components and to extend prior research by including a firm's financial leverage into the analysis. Thus, the first regression analysis examines whether the disaggregation of ROE according to the DuPont framework (9) provides useful information regarding ΔROE_{t+1}. As equation (9) suggests that a firm can improve its profitability by increasing its ATO and PM, and

favorable financial leverage, the first hypothesis states that there is a significant positive relation between ΔATO_t, ΔPM_t, $\Delta FLEV_t$, and one-year-ahead ROE. NBC_t is expected to show a negative coefficient as higher costs reduce the SPREAD. This would indicate that higher ATO, PM, and FLEV are favorable for a firm's profitability, and that the decomposition of ROE according to the DuPont analysis provides incremental explanatory power beyond what is known from ΔROE_t.

H0	*The decomposition of current return on equity according to the DuPont framework does not provide any additional explanatory power for a firm's future profitability.*
H1	There is a significant positive relation between the DuPont components ΔATO_t, ΔPM_t, $\Delta FLEV_t$, and a firm's future profitability, indicating that the decomposition of return on equity according to the DuPont framework brings incremental explanatory power beyond current return on equity.

The hypothesis will be analyzed using the following regression analysis of future profitability ranked on the model's explanatory variables.

$$\Delta ROE_{t+1} = \gamma_0 + \gamma_1 ROE_t + \gamma_2 \Delta ROE_t + \gamma_3 ATO_t + \gamma_4 PM_t + \gamma_5 FLEV_t + \gamma_6 NBC_t + \gamma_7 \Delta ATO_t + \gamma_8 \Delta PM_t + \gamma_9 \Delta FLEV_t + \gamma_{10} \Delta NBC_t + \varepsilon_t \quad (17)$$

3.2. Contemporaneous stock returns

The focus of the second section is on examining the relation between contemporaneous stock returns and the DuPont components. If a significant association can be identified, market participants appear to consider the information contained in these components to be informative and thus have an impact on a firm's market value. This section specifically aims to address the contrasting views regarding the impact of a firm's capital structure, particularly its financial leverage, on its value. For this section, two hypotheses will be tested. Based on previous literature findings, the first H1 proposes that changes in the operating DuPont components are significantly and positively associated with contemporaneous stock returns, indicating that they deliver information that is value-relevant for market participants. Moreover, it suggests that the market price improvements in asset utilization and better cost offer favorable control.

H0	*There is no significant relation between ΔATO_t and ΔPM_t and contemporaneous stock returns, indicating that they are not informative.*
H1	ΔATO_t and ΔPM_t are significantly associated with contemporaneous stock returns, indicating that they provide important information for market participants.

The second hypothesis aims to refute the capital irrelevance theory proposed by Modigliani & Miller (1958, p. 268). Specifically, the second H1 is that leverage is significantly correlated with contemporaneous stock returns, indicating that leverage has an impact on a firm's market value and should be considered in the forecasting and valuation context. If the corresponding null hypothesis can be rejected, it can be shown that the capital structure choice effectively affects a firm's value.

H0	*Financial leverage does not affect equity value and is therefore not reflected in market prices.*
H1	Financial leverage is significantly correlated with contemporaneous stock returns, indicating that leverage impacts a firm's market value.

The two hypotheses will be analyzed by the subsequent regression of contemporaneous excess returns based on the ranks of the included DuPont components.

$$R_t = \gamma_0 + \gamma_1 EPS_t + \gamma_2 ROE_t + \gamma_3 \Delta ROE_t + \gamma_4 ATO_t + \gamma_5 PM_t + \gamma_6 FLEV_t + \gamma_7 NBC_t + \gamma_8 \Delta ATO_t + \gamma_9 \Delta PM_t + \gamma_{10} \Delta FLEV_t + \gamma_{11} \Delta NBC_t + \varepsilon_t \quad (18)$$

In comparison to the first section, the earnings per share (EPS_t) variable is included as an explanatory variable to additionally investigate whether the information contained in the DuPont components is incrementally informative for market participants, beyond earnings.

3.3. Test on future stock returns

The third section analyzes the ability of market participants to not only incorporate but also fully comprehend the implications of the DuPont components when forecasting the future performance of a firm. This section aims to explore whether an investment strategy that fully incorporates the underlying information of changes in ATO, PM, and financial leverage can generate abnormal returns, which would suggest that market reactions are not complete. If markets are efficient and investors fully appreciate the predictive power of all DuPont variables, then all regression coefficients would be equal to zero. However, as demonstrated by Soliman (2007, p. 27), Baik et al. (2013, p. 1015), and Amir et al.

(2011, p. 323), ΔATO_t is expected to show a significant relation with future stock returns, indicating that investors fail to fully comprehend the implications of efficiency changes in a firm's asset utilization. As previous studies show, ΔPM_t is not expected to be significant, indicating that investors are fully able to appreciate its underlying information. Since no literature findings exist on the relation between financial leverage and future stock returns, no predictions can be made for $\Delta FLEV_t$.

H0	*Market participants fully acknowledge the predictive power of all DuPont variables, including changes in asset utilization, implying efficient capital markets.*
H1	Market participants fail to fully appreciate the implications of changes in asset turnover. This suggests that a potential opportunity is created to generate abnormal returns as the market does not appear to be completely efficient.

The hypothesis will be analyzed using the following regression of future excess returns based on the ranks of the DuPont components.

$$R_{t+1} = \gamma_0 + \gamma_1 EPS_t + \gamma_2 ROE_t + \gamma_3 \Delta ROE_t + \gamma_4 \Delta ATO_t + \gamma_5 \Delta PM_t + \gamma_6 \Delta FLEV_t + \gamma_7 ATO_t + \gamma_8 PM_t + \gamma_9 FLEV_t + \varepsilon_t \quad (19)$$

3.4. Examinations on operating liability leverage

The fourth section of the master's thesis aims to examine the relation between a firm's profitability, market value, and its operating leverage. To address any potential model bias arising from the correlation between OLLEV and other DuPont components, the predictive ability of OLLEV is examined separately. This section seeks to determine whether analyzing operating liabilities separately from financial liabilities provides additional predictive power regarding a firm's future performance. Thus, this section aims to investigate whether the two leverage types have different implications for a company's one-year-ahead profitability and market value. The regression models used in this section include both total leverage ($TLEV_t$) and operating liability leverage ($OLLEV_t$) as explanatory variables. $TLEV_t$ is influenced by financial and operating liability leverage. Therefore, $OLLEV_t$ represents the differential implications of operating liabilities compared to financial liabilities for a firm. H1 of the fourth section is that operating liability leverage should be considered separately from financial leverage as it exhibits incremental significant predictive power regarding a firm's future profitability and market value.

H0	*Differentiating between operating and financial leverage provides no additional insights into a firm's future performance.*
H1	Operating liability leverage should be considered separately from financial leverage, as it provides additional explanatory power regarding a firm's future profitability and its market value.

The two subsequent regression analyses will examine the usefulness of OLLEV in a forecasting context:

$$\Delta ROE_{t+1} = \gamma_0 + \gamma_1 ROE_t + \gamma_2 TLEV_t + \gamma_3 OLLEV_t + \gamma_4 \Delta TLEV_t + \gamma_5 \Delta OLLEV_t + \varepsilon_t \quad (20)$$

$$R_t = \gamma_0 + \gamma_1 ROE_t + \gamma_2 \Delta NOA_t + \gamma_3 NBC_t + \gamma_4 TLEV_t + \gamma_5 OLLEV_t + \gamma_6 \Delta TLEV_t + \gamma_7 \Delta OLLEV_t + \varepsilon_t \quad (21)$$

The second regression analysis includes the explanatory variables of net borrowing costs (NBC_t) and growth in net operating assets (ΔNOA_t) to partially capture the risk and growth parameters. Based on the DuPont analysis framework, $OLLEV_t$ is expected to be significantly and positively associated with a firm's profitability. Additionally, the study expects it to generate a price premium and have a stronger influence on a firm's market value compared to $TLEV_t$. This assumption is based on the explanations provided in Section 2.3.2. and introduced by Nissim & Penman (2003, p. 521), which highlight the differential pricing foundations and diverse contractual settings of operating and financial liabilities. Specifically, Nissim and Penman (2003, p. 551) suggest that operating leverage increases the cost of capital to a lesser extent than financial leverage. Therefore, if H0 is rejected, the thesis can confirm that 1) operating liabilities should be considered separately from financial liabilities in a forecasting context, and 2) the capital irrelevance proposition does not apply in real markets as leverage is related to market prices.

4. Data sample & research design

4.1. Description data sample & variables

The constituents of the two stock indices S&P500 (.SPX) and the NASDAQ Composite Index (.IXIC) form the basis of the data sample for the analysis of the hypotheses. The stocks of the final data sample were selected based on different criteria. First, consistent with prior studies, finance, insurance, and real estate companies are excluded from the analysis. Soliman (2007, p. 20) states that the DuPont analysis is not compatible with these sectors. For the purposes of simplification, only companies with a fiscal year beginning in January and ending in December are included. Furthermore, companies with an IPO after January 1, 2010, are not incorporated to avoid data gaps. For all companies, annual data from the 10K reports for the fiscal years between 2010 and 2022 were collected, whereby all data was obtained from the Refinitiv database. Stocks with insufficient data points are excluded from the final data sample. The final data sample thus comprises financial information from a total of 482 firms listed on the New York Stock Exchange and the NASDAQ, including 180 firms that are part of the S&P 500 index and 302 firms in the NASDAQ Composite index. The average market capitalization of the included firms is 28 billion USD, as of March 2023. The median market value amounts to 4.3 billion USD. Table 1 shows that the data sample consists of companies of different SIC divisions, with firms from the manufacturing sector representing the largest group, accounting for around 50% of the total sample.

TABLE 1

SIC division	abs. freq.	rel. freq.
Manufacturing	254	52.70%
Services	94	19.50%
Transportation, Communications, Electric, Gas, and Sanitary Services	93	19.30%
Wholesale Trade	7	1.45%
Retail Trade	18	3.73%
Mining	11	2.28%
Construction	5	1.04%

Table 1: Companies by SIC division

For all companies, the financial data from the 10K reports are used to calculate the model variables and corresponding financial ratios. Table 2 presents the variables used in the empirical analysis and their measurements.

TABLE 2

Variable	*Measurement*
Net operating assets (NOA_t)	Operating assets - operating liabilities: *Operating assets (OA):* total assets - financial assets *Operating liabilities (OL):* operating assets - net operating assets
Net financial obligation (NFO_t)	Financial liabilities – financial assets. *Financial liabilities (FL):* total debt incl. preferred equity & minority interests *Financial assets (FA):* cash & short-term investments If a firm has more *FA* than *FL,* the firm is considered as a net creditor rather than a net debtor.
Average NOA ($\emptyset NOA_t$)	($NOA_t + NOA_{t-1}$) / 2
Growth in NOA (ΔNOA_t)	($NOA_t - NOA_{t-1}$) / NOA_{t-1}
Return on equity (ROE_t)	*Current fiscal year return on equity:* Income before discontinued operations & extraordinary items / equity_t
ROE_{t+1}	*One fiscal year ahead return on equity:* Income before discontinued operations & extraordinary items / equity_{t+1}
ΔROE_t	ROE_t - ROE_{t-1}
ΔROE_{t+1}	ROE_{t+1} - ROE_t
Return on net operating assets ($RNOA_t$)	*Current fiscal year return on net operating assets:* Operating profit before non-recurring income & expenses / $\emptyset NOA_t$
$\Delta RNOA_{t+1}$	$RNOA_{t+1}$ - $RNOA_t$
Profit margin (PM_t)	Operating profit before non-recurring income and expenses / revenue from business activities
ΔPM_t	PM_t - PM_{t-1}
Asset turnover (ATO_t)	Revenue from business activities / $\emptyset NOA_t$
ΔATO_t	ATO_t - ATO_{t-1}
Net financial expenses (NFE_t)	(Interest expenses – net of interest income) + short term debt & current portion of long-term debt *Total debt service* (interest + principal payments) *on outstanding debt*. If a firm has a higher interest income than total debt expenses, NFE can be interpreted as the return on financial assets rather than costs.
Financial leverage ($FLEV_t$)	NFO_t / $equity_t$
$\Delta FLEV_t$	$FLEV_t$ - $FLEV_{t-1}$
Net borrowing costs (NBC_t)	NFE_t / NFO_t
ΔNBC_t	NBC_t - NBC_{t-1}
Spread ($SPREAD_t$)	$RNOA_t$ - NBC_t
Operating liability leverage ($OLLEV_t$)	OL_t / NOA_t
$\Delta OLLEV_t$	$OLLEV_t$ - $OLLEV_{t-1}$
Total leverage ($TLEV_t$)	($NFO_t + OL_t$) / $equity_t$

$\Delta TLEV_t$	$TLEV_t$ - $TLEV_{t-1}$
Earnings per share (EPS_t)	(Income before discontinued operations & extraordinary items / total outstanding shares end of FY_t) / P_{t-1}
Excess Return (R_t)	*Excess return = stock total return – market index total return* Excess returns are measured by subtracting the respective index return (S&P500 / NASDAQ Composite Index) of a stock's compounded buy-hold total return. All returns considered are inclusive of dividends over the 12 months of a firm's fiscal year.
Future Excess Return (R_{t+1})	*Future Excess return = Future stock total return – Future market index total return* Future excess returns are measured by subtracting the respective index return (S&P500 / NASDAQ Composite Index) from a stock's compounded buy-hold total future return. Future returns are calculated beginning three months after the end of the fiscal year and continuing for one year.

Table 2: Variable measurements

The ΔATO_t and ΔPM_t variables are measured as first differences, following the approach used in the studies of Soliman (2007, p. 38) and Bauman (2014, p. 195). In contrast to the profitability decomposition approach applied by Fairfield & Yohn (2001, p. 375), this method allows for the retention of ΔROE_t in the regression models. Soliman (2007, p. 11 - 12) argues that this method facilitates the differentiation of whether the explanatory power comes from the ΔATO_t and ΔPM_t variables or from the ΔROE_t comprehensive profitability measure. Furthermore, measuring ΔATO_t and ΔPM_t as first differences allows for the inclusion of observations with negative PMs in the dataset. Hence, the results of this master's thesis are also applicable to firms with negative profits, unlike the findings of Soliman (2007) or Fairfield & Yohn (2001), as they focus on analyzing profitable firms. However, as in prior literature, firm-year observations with negative net operating assets and negative equity are not included in the final data sample. This leads to a loss of 1,101 observations. Incomplete firm-year observations are also removed. To account for outliers, the variables used in the regression analysis are winsorized at the 1% and 99% levels. The Augmented-Dickey-Fuller test confirms that all variables are stationary. After implementing all criteria, the final data sample consists of 4,280 observations.

4.2. Research design & statistical examinations

The Shapiro-Wilk test (Shapiro & Wilk, 1965) indicates that the explanatory variables do not follow a normal distribution. To address the non-normal distribution and reduce the impact of outliers, the hypotheses are tested by conducting rank regressions, following the method used by Soliman (2007) in his analysis of the relation between stock returns and the operating DuPont components. The independent variables are annually ranked into deciles. As a result, rank regressions are less vulnerable to non-normally distributed

data and more robust against outliers (Chen et al., 2014, p. 311). To account for potential cross-sectional correlations in the model residuals, regressions are conducted for each fiscal year separately. Subsequently, coefficients are averaged across the years. The significance of the coefficients is assessed using t-statistics, as proposed by Fama & MacBeth (1973, p. 619). The t-statistics ($t\left(\bar{\hat{\gamma}}\right)$) are calculated as follows:

$$t\left(\bar{\hat{\gamma}}\right) = \frac{\bar{\hat{\gamma}}}{\frac{s\left(\bar{\hat{\gamma}}\right)}{\sqrt{n}}} \tag{22}$$

where:

$\bar{\hat{\gamma}}$ = average annual coefficient
$s\left(\bar{\hat{\gamma}}\right)$ = standard deviation of annual coefficients
$\sqrt{n}$ = root of number of fiscal year regressions

As the executed Breusch-Pagan and Durbin-Watson tests reveal the presence of heteroscedasticity and autocorrelation in the error terms, the standard errors of the variables are adjusted by using the Newey & West technique to enhance model robustness (Newey & West, 1987). By implementing robust standard errors, the effects of heteroscedasticity and autocorrelation are mitigated, which could otherwise lead to biased coefficient estimates and incorrect statistical inferences.

5. Empirical results

5.1. Descriptive statistics

Table 3 presents the descriptive statistics of the model variables. The average ROE is higher than the average return on net operating assets, indicating a positive effect of leverage on average. The average FLEV amounts to 57%, which is slightly higher than the average financial leverage of the firms analyzed in the study of Jin (2017, p. 217), who found an average financial leverage of 39%. Penman (2013, p. 375) documents that financial leverage is more commonly used by firms in heavy industries. The majority of the data sample used in this analysis stems from the manufacturing or transportation sectors, thus possibly explaining the higher leverage ratio used by the companies under analysis. In 37% of the observations, a firm holds more financial assets than financial liabilities, meaning they are a net financial creditor instead of a net debtor in that respective fiscal year. Both average and median OLLEV are above those of FLEV, implying that firms prefer to hold operating leverage rather than financial leverage. The average NBC is about 6%, which is slightly higher than the 4.5% reported by Jin (2017, p. 217) and the 5.4% reported by Nissim & Penman (2003, p. 541). The difference may arise from different economic conditions, different risk characteristics of the included companies, or from slightly different calculation methods. Table 3 illustrates that, on average, the stock returns of the firms in the dataset are slightly better than their corresponding index performance. Nevertheless, in 56% of the observations, the individual stock return is lower than the total market return, which is reflected in the negative median excess return. The statistical characteristics of ATO are very similar to those of previous studies. Indeed, as noted by Fairfield & Yohn (2001, p. 377), Baik et al. (2013, p. 1007), and Soliman (2007, p. 37), ATO has an average value over 2 and the highest standard deviation among all variables. This supports Penman's (2013, p. 375) assertion that ATO varies significantly across different business sectors. The average ATO is higher than its median, which indicates positive skewness. In contrast to the findings of Fairfield & Yohn (2001, p. 377) and Soliman (2007, p. 22 - 23), the distributions of PM and RNOA show negative skewness and negative average values. Furthermore, the standard deviations of these two variables are slightly higher. This deviation from previous research can be explained by the fact that, unlike Fairfield & Yohn (2001, p. 376) and Soliman (2007, p. 22 - 23), this analysis also includes unprofitable firms.

TABLE 3

	mean	std	25%	median	75%
ROE_t	0.056	0.382	0.004	0.098	0.178
ΔROE_{t+1}	0.012	0.524	-0.050	0.001	0.054
$RNOA_t$	-0.036	1.141	0.049	0.116	0.224
ATO_t	2.105	2.876	0.674	1.301	2.396
PM_t	-0.053	0.991	0.035	0.104	0.185
ΔATO_t	0.108	1.929	-0.151	-0.013	0.102
ΔPM_t	0.005	0.316	-0.021	0.002	0.024
$FLEV_t$	0.565	1.452	-0.222	0.245	0.897
NBC_t	0.063	0.814	0.000	0.074	0.178
$SPREAD_t$	-0.124	1.634	-0.153	0.002	0.192
$OLLEV_t$	0.742	0.956	0.310	0.477	0.756
$TLEV_t$	1.552	2.650	0.205	0.898	1.945
$\Delta FLEV_t$	0.087	0.897	-0.107	0.006	0.131
ΔNBC_t	-0.028	1.469	-0.033	0.000	0.038
$\Delta OLLEV_t$	0.003	1.044	-0.054	0.001	0.061
$\Delta TLEV_t$	0.189	1.920	-0.139	0.010	0.194
R_t	0.005	0.438	-0.246	-0.045	0.179
R_{t+1}	0.031	0.550	-0.240	-0.015	0.202

Table 3: Descriptive statistics

Table 4 displays the Spearman correlation matrix of the model variables. Due to their non-normal distribution, only the Spearman coefficients are presented in this thesis, thereby omitting the Pearson correlation coefficients. The correlation matrix reveals that ROE has a strong positive correlation with RNOA, and a positive correlation with both PM and ATO. This confirms the association highlighted by the DuPont framework in Figure 2, namely that the return from operating activities contributes favorably to a firm's ROE. In addition, ATO and PM exhibit a negative correlation with each other, consistent with the findings of prior studies (Fairfield & Yohn, 2001, p. 377; Nissim & Penman, 2001, p. 132; Soliman, 2007, p. 39). This negative association indicates that firms with lower ATO tend to have higher PMs and vice versa. SPREAD is strongly correlated with both RNOA and ROE, which is why the regression analysis includes NBC as an explanatory variable. NBC correlates positively with financial leverage, which confirms that higher leverage results in higher costs. FLEV exhibits a slightly positive correlation with

ROE, in line with the DuPont framework's suggestion that leverage can increase ROE as long as it remains favorable. Since the favorability depends on the level of the leverage and its associated financing costs, it is intuitive that FLEV and ROE are not perfectly multicollinear. Interestingly, FLEV is negatively correlated with RNOA, indicating that profitable firms tend to have lower financial liabilities, although they also possess lower risk and thus lower expected bankruptcy costs and can take on more leverage. Nissim & Penman (2003, p. 543) justify this correlation by believing that leverage is partly an ex-post phenomenon and that firms that generate high positive cash flows use them to repay financial debt or acquire financial assets. OLLEV correlates positively with both ROE and RNOA, thereby supporting the suggestion of the DuPont framework that operating leverage favorably regards a company's ROE. Moreover, Table 4 reveals that OLLEV correlates negatively with FLEV, implying that companies with high OLLEV need to take on less financial leverage to finance their operations and vice versa.

TABLE 4

	ROE_t	ΔROE_{t+1}	$RNOA_t$	$\Delta RNOA_{t+1}$	ATO_t	PM_t	ΔATO_t	ΔPM_t	$FLEV_t$	NBC_t	$SPREAD_t$	$OLLEV_t$	$TLEV_t$	$\Delta FLEV_t$	ΔNBC_t	$\Delta OLLEV_t$	$\Delta TLEV_t$	R_t	R_{t+1}
ROE_t	1 00000	0 69651	0 83523	-0 17834	0 18256	0 67321	0 00424	0 19124	0 16534	0 08837	0 50260	0 07096	0 21329	-0 07814	-0 02084	-0 08742	-0 13340	0 24678	0 10798
ΔROE_{t+1}	0 69651	1 00000	0 66909	0 18045	0 16500	0 53181	0 04650	0 15033	0 17083	0 10333	0 38823	0 10673	0 23579	-0 04019	-0 02351	0 00295	-0 04426	0 24836	0 20466
$RNOA_t$	0 83523	0 66909	1 00000	-0 20608	0 35315	0 67000	0 01197	0 19135	-0 07856	-0 05612	0 66760	0 12542	-0 00128	-0 04785	-0 00716	-0 03774	-0 08742	0 24658	0 12873
$\Delta RNOA_{t+1}$	-0 17834	0 18045	-0 20608	1 00000	0 00124	-0 17990	0 10225	-0 01021	0 02264	0 03131	-0 16101	0 04252	0 04683	-0 02102	0 01777	0 13777	0 05110	0 06063	0 13431
ATO_t	0 18256	0 16500	0 35315	0 00124	1 00000	-0 29508	0 08207	0 10947	-0 44231	-0 26182	0 29189	0 49883	-0 22431	-0 01305	-0 00620	0 05985	0 01124	0 09702	0 05401
PM_t	0 67321	0 53181	0 67000	-0 17990	-0 29508	1 00000	-0 00063	0 16528	0 24693	0 12182	0 42223	-0 16925	0 17648	-0 03298	-0 01107	-0 07992	-0 07690	0 18546	0 08703
ΔATO_t	0 00424	0 04650	0 01197	0 10225	0 08207	-0 00063	1 00000	0 32289	-0 10507	-0 06780	0 01142	0 09209	-0 06349	-0 22770	0 00497	0 32178	-0 11491	0 15114	0 08729
ΔPM_t	0 19124	0 15033	0 19135	-0 01021	0 10947	0 16528	0 32289	1 00000	-0 04538	-0 02409	0 11415	0 06037	-0 02684	-0 14362	0 00362	0 02775	-0 15108	0 22575	0 07170
$FLEV_t$	0 16534	0 17083	-0 07856	0 02264	-0 44231	0 24693	-0 10507	-0 04538	1 00000	0 57990	-0 20197	-0 20154	0 90201	0 16533	-0 02284	-0 10301	0 13438	-0 04945	-0 02861
NBC_t	0 08837	0 10333	-0 05612	0 03131	-0 26182	0 12182	-0 06780	-0 02409	0 57990	1 00000	-0 61360	-0 09122	0 51869	0 03808	0 26775	-0 05218	0 01809	-0 04414	-0 04041
$SPREAD_t$	0 50260	0 38823	0 66760	-0 16101	0 29189	0 42223	0 01142	0 11415	-0 20197	-0 61360	1 00000	0 04086	-0 14385	-0 01014	-0 22050	-0 02088	-0 02957	0 15668	0 09218
$OLLEV_t$	0 07096	0 10673	0 12542	0 04252	0 49883	-0 16925	0 09209	0 06037	-0 20154	-0 09122	0 04086	1 00000	0 12683	-0 00499	-0 01867	0 21752	0 04613	0 03343	0 02607
$TLEV_t$	0 21329	0 23579	-0 00128	0 04683	-0 22431	0 17648	-0 06349	-0 02684	0 90201	0 51869	-0 14385	0 12683	1 00000	0 14777	-0 03119	-0 03815	0 15248	-0 02933	-0 01075
$\Delta FLEV_t$	-0 07814	-0 04019	-0 04785	-0 02102	-0 01305	-0 03298	-0 22770	-0 14362	0 16533	0 03808	-0 01014	-0 00499	0 14777	1 00000	-0 16558	-0 22649	0 85774	-0 11332	-0 02714
ΔNBC_t	-0 02084	-0 02351	-0 00716	0 01777	-0 00620	-0 01107	0 00497	0 00362	-0 02284	0 26775	-0 22050	-0 01867	-0 03119	-0 16558	1 00000	0 07529	-0 15586	0 00345	0 00336
$\Delta OLLEV_t$	-0 08742	0 00295	-0 03774	0 13777	0 05985	-0 07992	0 32178	0 02775	-0 10301	-0 05218	-0 02088	0 21752	-0 03815	-0 22649	0 07529	1 00000	0 08983	0 04506	0 00348
$\Delta TLEV_t$	-0 13340	-0 04426	-0 08742	0 05110	0 01124	-0 07690	-0 11491	-0 15108	0 13438	0 01809	-0 02957	0 04613	0 15248	0 85774	-0 15586	0 08983	1 00000	-0 10879	-0 04027
R_t	0 24678	0 24836	0 24658	0 06063	0 09702	0 18546	0 15114	0 22575	-0 04945	-0 04414	0 15668	0 03343	-0 02933	-0 11332	0 00345	0 04506	-0 10879	1 00000	0 22463
R_{t+1}	0 10798	0 20466	0 12873	0 13431	0 05401	0 08703	0 08729	0 07170	-0 02861	-0 04041	0 09218	0 02607	-0 01075	-0 02714	0 00336	0 00348	-0 04027	0 22463	1 00000

Table 4: Spearman correlation matrix

5.2. Predictions of future profitability

H0	*The decomposition of current return on equity according to the DuPont framework does not provide any additional explanatory power for a firm's future profitability.*
H1	There is a significant positive relation between the DuPont components ΔATO_t, ΔPM_t, $\Delta FLEV_t$, and a firm's future profitability, indicating that the decomposition of return on equity according to the DuPont framework brings incremental explanatory power beyond current return on equity.

Table 5 thus presents the results of the regression analysis on ΔROE_{t+1} using the DuPont analysis components (17). Across all four models tested, ROE_t exhibits a significant negative coefficient, confirming the mean-reverting tendency of profitability in the cross-section shown by Beaver (1970, p. 86). The results of Models 2, 3, and 4, which include the DuPont components in addition to ROE_t and ΔROE_t, demonstrate that the corresponding null hypothesis can be rejected as the components reveal predictive ability. ATO_t, PM_t, and $FLEV_t$ all exhibit significant and positive coefficients, indicating that the current levels of these components provide important information for predicting future firm performance. Additionally, NBC is found to be insignificant. Furthermore, Model 3 shows that both ΔPM_t and ΔATO_t are significant indicators of future profitability. Therefore, the results of the regression analysis (17) indicate that it is not only a more efficient asset utilization that has a significant impact on the future profitability of a firm but also an improvement in a company's ability to control its costs to generate sales. Moreover, the results confirm the predictive ability of $FLEV_t$ and $\Delta FLEV_t$ on a firm's one-year-ahead ROE. Model 4, which includes level and change components as explanatory variables, confirms these results and the rejection of H0.

In summary, the findings indicate that higher ATO, PM, and FLEV have a favorable impact on a firm's future profitability. Moreover, the results highlight that the DuPont framework's decomposition of ROE provides incremental explanatory power beyond what is already known from current ROE. Additionally, the results suggests that it is not only operating components that should be considered when forecasting future profitability, but also a firm's financial activities.

TABLE 5

$\Delta ROE_{t+1} = \gamma_0 + \gamma_1 ROE_t + \gamma_2 \Delta ROE_t + \varepsilon_t$
$\Delta ROE_{t+1} = \gamma_0 + \gamma_1 ROE_t + \gamma_2 \Delta ROE_t + \gamma_3 ATO_t + \gamma_4 PM_t + \gamma_5 FLEV_t + \gamma_6 NBC_t + \varepsilon_t$
$\Delta ROE_{t+1} = \gamma_0 + \gamma_1 ROE_t + \gamma_2 \Delta ROE_t + \gamma_3 \Delta ATO_t + \gamma_4 \Delta PM_t + \gamma_5 \Delta FLEV_t + \gamma_6 \Delta NBC_t + \varepsilon_t$
$\Delta ROE_{t+1} = \gamma_0 + \gamma_1 ROE_t + \gamma_2 \Delta ROE_t + \gamma_3 ATO_t + \gamma_4 PM_t + \gamma_5 FLEV_t + \gamma_6 NBC_t + \gamma_7 \Delta ATO_t + \gamma_8 \Delta PM_t + \gamma_9 \Delta FLEV_t + \gamma_{10} \Delta NBC_t + \varepsilon_t$

Ind. variable	Model 1	Model 2	Model 3	Model 4
Intercept	0.2516*** *(4.6454)*	0.0259 *(0.5749)*	0.0553 *(0.9770)*	-0.0983* *(-1.8002)*
ROE_t	-0.0046*** *(-3.2201)*	-0.0092*** *(-4.6120)*	-0.0040*** *(-2.7716)*	-0.0076*** *(-3.7658)*
ΔROE_t	-0.0055*** *(-5.7727)*	-0.0049*** *(-6.0614)*	-0.0087*** *(-6.3670)*	-0.0080*** *(-6.1318)*
ATO_t		0.0051*** *(5.4401)*		0.0037*** *(3.4016)*
PM_t		0.0043*** *(4.2172)*		0.0031*** *(2.8332)*
$FLEV_t$		0.0042*** *(6.2551)*		0.0042*** *(7.1584)*
NBC_t		-0.0000 *(-0.0553)*		-0.0007 *(-1.0975)*
ΔATO_t			0.0029*** *(3.5142)*	0.0031*** *(3.2181)*
ΔPM_t			0.0045*** *(3.7344)*	0.0039*** *(2.9120)*
$\Delta FLEV_t$			0.0024*** *(3.4909)*	0.0017** *(2.5221)*
ΔNBC_t			0.0011** *(2.0405)*	0.0011* *(1.9041)*
R^2	*6.575%*	*8.645%*	*9.956%*	*11.825%*
Adjusted R^2	*6.135%*	*7.342%*	*8.673%*	*9.710%*

***significant at 1% level
**significant at 5% level
*significant at 10% level

Table 5: Results from annual cross-sectional regressions of future profitability

5.3. Contemporaneous stock returns

H0	*There is no significant relation between ΔATO_t and ΔPM_t and contemporaneous stock returns, indicating that they are not informative.*
H1	ΔATO_t and ΔPM_t are significantly associated with contemporaneous stock returns, indicating that they provide important information for market participants.

The results of the analysis of the association between the DuPont components and contemporaneous stock returns (18) are presented in Table 6. The positive and significant coefficient of EPS_t in all Models confirms prior research by Lev & Thiagarajan (1993, p. 201), demonstrating that earnings are a significant driver of a firm's value and that market investors price higher earnings favorably. Model 2, which additionally includes ROE_t and ΔROE_t, reveals that a firm's profitability is incrementally informative over earnings, as it almost doubles the R^2 and shows a positive and highly significant coefficient for ΔROE_t. Model 4, which also incorporates the level of DuPont components, reveals that the aforementioned null hypothesis about the relationship between changes in operating DuPont components and current stock returns can be rejected. Specifically, ΔATO_t and ΔPM_t are significantly positively associated with current returns, thereby confirming H1, which states that changes in these components provide important information for market participants beyond what is already known from ΔROE_t. Higher ATO and increased PM are priced favorably by the market. Surprisingly, both Model 3 and Model 4 reveal that PM_t has no explanatory power regarding a firm's current market value, while it was found to be a significant predictor of a firm's future profitability. ATO_t remains significant at a 1% level.

H0	*Financial leverage does not affect equity value and is therefore not reflected in market prices.*
H1	Financial leverage is significantly correlated with contemporaneous stock returns, indicating that leverage impacts a firm's market value.

The $FLEV_t$, NBC_t, and $\Delta FLEV_t$ model variables show significant coefficients, thereby demonstrating that the second null hypothesis of the second analysis section can also be rejected. This confirms H1, ascertaining that leverage has an impact on a firm's market value, thus refuting the capital irrelevance proposition of Modigliani & Miller (1958, p. 268). However, the regression results suggest that although $FLEV_t$, and $\Delta FLEV_t$ are positively associated with a firm's future profitability, the market appears to price higher

financial leverage negatively. Model 5, which includes all variables, confirms the explained results.

TABLE 6

$R_t = \gamma_0 + \gamma_1 EPS_t + \varepsilon_t$
$R_t = \gamma_0 + \gamma_1 EPS_t + \gamma_2 ROE_t + \gamma_3 \Delta ROE_t + \varepsilon_t$
$R_t = \gamma_0 + \gamma_1 EPS_t + \gamma_2 ROE_t + \gamma_3 \Delta ROE_t + \gamma_4 ATO_t + \gamma_5 PM_t + \gamma_6 FLEV_t + \gamma_7 NBC_t + \varepsilon_t$
$R_t = \gamma_0 + \gamma_1 EPS_t + \gamma_2 ROE_t + \gamma_3 \Delta ROE_t + \gamma_4 \Delta ATO_t + \gamma_5 \Delta PM_t + \gamma_6 \Delta FLEV_t + \gamma_7 \Delta NBC_t + \varepsilon_t$
$R_t = \gamma_0 + \gamma_1 EPS_t + \gamma_2 ROE_t + \gamma_3 \Delta ROE_t + \gamma_4 ATO_t + \gamma_5 PM_t + \gamma_6 FLEV_t + \gamma_7 NBC_t + \gamma_8 \Delta ATO_t + \gamma_9 \Delta PM_t + \gamma_{10} \Delta FLEV_t + \gamma_{11} \Delta NBC_t + \varepsilon_t$

Ind. variable	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	-15.5678*** *(-4.5313)*	-24.6419*** *(-7.3604)*	-22.1922*** *(-5.3551)*	-25.8624*** *(-5.8564)*	-23.1430*** *(-5.2019)*
EPS_t	0.6775*** *(7.3807)*	0.4836*** *(3.3922)*	0.5468*** *(3.9430)*	0.4312*** *(3.0000)*	0.4942*** *(3.5808)*
ROE_t		0.0177 *(0.1291)*	-0.0911 *(-0.5351)*	0.0600 *(0.4492)*	0.0299 *(0.1631)*
ΔROE_t		0.5566*** *(7.7318)*	0.5215*** *(8.3046)*	0.2783*** *(4.7544)*	0.2639*** *(4.3459)*
ATO_t			0.2042*** *(2.6279)*		0.1501** *(1.9622)*
PM_t			0.1053 *(1.1649)*		-0.0030 *(-0.0298)*
$FLEV_t$			-0.2182*** *(-3.0942)*		-0.1443* *(-1.8149)*
NBC			-0.1116** *(-1.9939)*		-0.1462*** *(-2.8215)*
ΔATO_t				0.2159*** *(5.9770)*	0.1809*** *(6.5409)*
ΔPM_t				0.3455*** *(6.2579)*	0.3250*** *(4.8262)*
$\Delta FLEV_t$				-0.2100*** *(-3.2098)*	-0.1890*** *(-2.6723)*
ΔNBC_t				-0.0104 *(-0.2240)*	0.0361 *(1.0611)*
R^2	*5.768%*	*9.306%*	*12.152%*	*12.188%*	*14.542%*
Adjusted R^2	*5.547%*	*8.665%*	*10.687%*	*10.724%*	*12.281%*

***significant at 1% level
**significant at 5% level
*significant at 10% level

Table 6: Results from annual cross-sectional regressions of contemporaneous stock returns

5.4. Test on future stock returns

H0	*Market participants fully acknowledge the predictive power of all DuPont variables, including changes in asset utilization, implying efficient capital markets.*
H1	Market participants fail to fully appreciate the implications of changes in asset turnover. This suggests that a potential opportunity is created to generate abnormal returns as the market does not appear to be completely efficient.

Table 7 presents the results of the regression equation (19). As expected, not all coefficients are zero, thereby supporting the suggested inability of market participants to fully incorporate the underlying financial data and expected market inefficiency information. All models show a significant coefficient of EPS_t, indicating that the market underreacts to information contained in earnings, which is consistent with the results of numerous previous studies described in Section 2.2. (Abarbanell & Bushee, 1998, p. 31; Bernard & Stober, 1989, p. 30; Richardson et al., 2005, p. 482). Moreover, Model 2 reveals that ΔATO_t is significantly related to future stock returns, whereas ΔPM_t is not significant. Notably, the significance of ΔATO_t persists even after including all levels of DuPont components. Hence, the significance of ΔATO_t confirms the findings of Amir et al. (2011, p. 325), Baik et al. (2013, p. 1015), and Soliman, 2007, p. 47).

Consequently, H0 can be rejected, indicating that the market is not fully efficient. The results confirm H1, indicating that fully exploiting the information of changes in ATO would result in the generation of abnormal returns after controlling for the other model variables. Indeed, the positive and significant coefficient of EPS_t confirms that the market does not reflect all available information from financial data. The market's failure to fully react to certain information may be partially explained by the findings of Abarbanell & Bushee (1997, p. 9) and Bradshaw et al. (2001, p. 65), who suggest that even professional analysts may be unable to fully comprehend the implications of all financial data. This lack of understanding may result in market investors not being adequately informed and could contribute to the market's failure to fully react to certain information.

TABLE 7

$R_{t+1} = \gamma_0 + \gamma_1 EPS_t + \gamma_2 ROE_t + \gamma_3 \Delta ROE_t + \varepsilon_t$
$R_{t+1} = \gamma_0 + \gamma_1 EPS_t + \gamma_2 ROE_t + \gamma_3 \Delta ROE_t + \gamma_4 \Delta ATO_t + \gamma_5 \Delta PM_t + \gamma_6 \Delta FLEV_t + \varepsilon_t$
$R_{t+1} = \gamma_0 + \gamma_1 EPS_t + \gamma_2 ROE_t + \gamma_3 \Delta ROE_t + \gamma_4 \Delta ATO_t + \gamma_5 \Delta PM_t + \gamma_6 \Delta FLEV_t + \gamma_7 ATO_t + \gamma_8 PM_t + \gamma_9 FLEV_t + \varepsilon_t$

Ind. variable	**Model 1**	**Model 2**	**Model 3**
Intercept	-4.2472 *(-0.6037)*	-7.63012 *(-0.8650)*	-11.29691 *(-1.3489)*
$\boldsymbol{EPS_t}$	**0.1667**** ***(2.0794)***	**0.15707**** ***(2.2345)***	**0.21037***** ***(2.9400)***
ROE_t	-0.0702 *(-0.3078)*	-0.04382 *(-0.1918)*	-0.12994 *(-0.6692)*
ΔROE_t	0.2112** *(2.0855)*	0.09707 *(0.9563)*	0.11540 *(1.1613)*
$\boldsymbol{\Delta ATO_t}$		**0.19302***** ***(2.6809)***	**0.15297**** ***(2.2410)***
ΔPM_t		0.07756 *(1.1987)*	0.05720 *(0.8588)*
$\Delta FLEV_t$		-0.02936 *(-0.3566)*	-0.01609 *(-0.2139)*
ATO_t			0.26119*** *(2.8754)*
PM_t			0.02635 *(0.2518)*
$FLEV_t$			-0.07426 *(-0.8467)*
R^2	*2.392%*	*3.574%*	*5.361%*
Adjusted R^2	*1.701%*	*2.199%*	*3.322%*

***significant at 1% level
**significant at 5% level
*significant at 10% level

Table 7: Results from annual cross-sectional regressions of future stock returns

5.5. Implications of operating liability leverage

H0	*Differentiating between operating and financial leverage provides no additional insights into a firm's future performance.*
H1	Operating liability leverage should be considered separately from financial leverage, as it provides additional explanatory power regarding a firm's future profitability and its market value.

Table 8 displays the results of the analysis of the relation between a company's one-year-ahead ROE and OLLEV (20). Model 1 shows positive coefficients for both $\mathrm{OLLEV_t}$ and $\mathrm{TLEV_t}$, indicating that both financial ratios are informative regarding the future profitability of a firm. Furthermore, the statistical significance of $\mathrm{OLLEV_t}$ suggests that operating liabilities have different implications on a firm's future profitability than those of financial liabilities. The R^2 of Model 2 demonstrates that incorporating change components instead of level components improves the model's performance and predictive ability. Both $\mathrm{\Delta OLLEV_t}$ and $\mathrm{\Delta TLEV_t}$ are positive and highly significant, thereby confirming that they provide additional explanatory power beyond what is already known from $\mathrm{ROE_t}$. Consistent with the findings of the study of Nissim & Penman (2003, p. 546), financial and operating liabilities exhibit similar explanatory power regarding future profitability.

TABLE 8

$\Delta ROE_{t+1} = \gamma_0 + \gamma_1 ROE_t + \gamma_2 TLEV_t + \gamma_3 OLLEV_t + \varepsilon_t$
$\Delta ROE_{t+1} = \gamma_0 + \gamma_1 ROE_t + \gamma_2 \Delta TLEV_t + \gamma_3 \Delta OLLEV_t + \varepsilon_t$
$\Delta ROE_{t+1} = \gamma_0 + \gamma_1 ROE_t + \gamma_2 TLEV_t + \gamma_3 OLLEV_t + \gamma_4 \Delta TLEV_t + \gamma_5 \Delta OLLEV_t + \varepsilon_t$

Ind. variable	**Model 1**	**Model 2**	**Model 3**
Intercept	0.0428 *(1.2254)*	0.0448 *(1.1214)*	-0.0345 *(0.9733)*
ROE_t	-0.0072*** *(-4.4948)*	-0.0057*** *(-3.7934)*	-0.0067*** *(-4.3814)*
$TLEV_t$	0.0045*** *(6.6577)*		0.0043*** *(7.0659)*
$OLLEV_t$	0.0014* *(1.9433)*		0.0006 *(0.7921)*
$\Delta TLEV_t$		0.0023*** *(3.5956)*	0.0015** *(2.5771)*
$\Delta OLLEV_t$		0.0021*** *(2.6599)*	0.0022*** *(3.0815)*
R^2	*6.43%*	*5.52%*	*7.39%*
Adjusted R^2	*5.77%*	*4.85%*	*6.30%*

***significant at 1% level
**significant at 5% level
*significant at 10% level

Table 8: Regression results on future profitability and leverage

Table 9 presents the outcomes of the regression analysis conducted to investigate the association between a firm's market value and its leverage components (21). In contrast to a firm's future profitability, operating and financial leverage have different explanatory powers concerning a company's market value, as anticipated. The significant coefficient of $\mathrm{OLLEV_t}$ supports the notion that market participants consider a firm's OLLEV to be incrementally informative compared to total leverage. Moreover, the results suggest that changes in total leverage ($\Delta\mathrm{TLEV_t}$), which are driven by financial and operating liabilities, are priced negatively, while market participants price changes in OLLEV ($\Delta\mathrm{OLLEV_t}$) favorably. This finding is related to those described in Section 5.3., in which FLEV is also negatively priced, despite having a positive impact on a firm's one-year-ahead profitability. In addition, Table 9 reveals a negative and significant coefficient for NBC, indicating that a firm's market value decreases with higher financing costs. The significantly positive coefficient of $\Delta\mathrm{NOA_t}$ reflects the proposition of the Residual Income model (1), which states that a company may increase its value through growth in its assets. Model 3, which includes all variables, confirms the findings of Models 1 and 2.

Thus, the results in Tables 8 and 9 suggest that the null hypothesis can be rejected. The results indicate that analyzing operating liabilities separately from financial liabilities provides additional information in the forecasting and valuation contexts. In addition, the findings imply that Modigliani and Miller's (1958, p. 268) proposition does not apply in real markets, as leverage is significantly associated with market prices.

TABLE 9

$R_t = \gamma_0 + \gamma_1 ROE_t + \gamma_2 \Delta NOA_t + \gamma_3 NBC_t + \gamma_4 TLEV_t + \gamma_5 OLLEV_t + \varepsilon_t$
$R_t = \gamma_0 + \gamma_1 ROE_t + \gamma_2 \Delta NOA_t + \gamma_3 NBC_t + \gamma_4 \Delta TLEV_t + \gamma_5 \Delta OLLEV_t + \varepsilon_t$
$R_t = \gamma_0 + \gamma_1 ROE_t + \gamma_2 \Delta NOA_t + \gamma_3 NBC_t + \gamma_4 TLEV_t + \gamma_5 OLLEV_t + \gamma_6 \Delta TLEV_t + \gamma_7 \Delta OLLEV_t + \varepsilon_t$

Ind. variable	**Model 1**	**Model 2**	**Model 3**
Intercept	-12.2957*** *(-2.6336)*	-20.4828*** *(-3.8792)*	-21.7834*** *(-4.2434)*
ROE_t	0.5568*** *(6.2783)*	0.4172*** *(4.6595)*	0.4315*** *(4.6574)*
ΔNOA_t	0.1489** *(2.4122)*	0.5821*** *(7.1800)*	0.5697*** *(7.3112)*
NBC_t	-0.1137* *(-1.6729)*	-0.2027** *(-2.4182)*	-0.1212** *(-2.0811)*
$TLEV_t$	-0.2581*** *(-2.9660)*		-0.1444* *(-1.9006)*
$OLLEV_t$	0.2064 *** *(3.3253)*		0.1312** *(2.1393)*
$\Delta TLEV_t$		-0.5006*** *(-6.2187)*	-0.4807*** *(-6.3922)*
$\Delta OLLEV_t$		0.5881*** *(11.5499)*	0.5527*** *(11.1392)*
R^2	*7.48%*	*9.69%*	*10.74%*
Adjusted R^2	*6.39%*	*8.62%*	*9.25%*

***significant at 1% level
**significant at 5% level
*significant at 10% level

Table 9: Regression results on market values and leverage

6. Discussion & concluding remarks

This master thesis aimed to build upon the existing literature by providing further evidence on how a firm's financial information can be utilized to predict its future performance and impact its market value. Specifically, five hypotheses have been tested to explore the usefulness of the comprehensive DuPont analysis framework, including information on a firm's financial activities, and to answer the following research question:

«To what extent do the DuPont components have explanatory power regarding a firm's future profitability and its market value?»

The thesis contributes to prior research by extending the focus from primarily analyzing the predictive ability of the operating DuPont components to conducting a more comprehensive profitability analysis that also incorporates the leverage DuPont components, namely operating and financial liability leverage. In summary, the study demonstrates that the decomposition of ROE according to the extended DuPont analysis framework provides valuable insights when forecasting a firm's performance and determining its value. Moreover, the findings of this thesis emphasize the importance of incorporating information on a firm's financial activities by showing that they have significant predictive ability in forecasting future profitability and stock returns. The following subsections summarize and compare the main findings presented in Chapter 5 with prior research in order to conclusively answer the research question. Finally, limitations and recommendations for potential future research are provided.

Earnings & asset turnover

The results of the regression analyses confirm the findings of Lev & Thiagarajan (1993, p. 201), which suggest that earnings are a significant driver of a firm's value and so market investors price higher earnings favorably. However, adding ROE_t and $\Delta\mathrm{ROE}_t$ into the regression model reveals that a firm's profitability and its variation are incrementally informative beyond earnings for market participants, thereby supporting the findings of Soliman (2007, p. 25). Moreover, the analysis determines that $\Delta\mathrm{ATO}_t$ is a significant predictor of a firm's future profitability, consistent with prior research (Baik et al., 2013, p. 1011; Fairfield & Yohn, 2001, p. 378; Jin, 2017, p. 221; Soliman, 2007, p. 42). Additionally, the results indicate that $\Delta\mathrm{ATO}_t$ is significantly and positively related with contemporaneous returns, implying that the market considers changes in a firm's efficiency in using its assets to generate sales to be informative and prices it favorably. Thus,

improvements in asset utilization have a positive impact on a firm's future profitability and increase its market value. However, despite market participants appearing to incorporate the information contained in ATO in their investment decisions, the positive relation between ΔATO_t and future stock returns suggests that they do not fully appreciate its predictive power, as proposed by Amir et al. (2011, p. 325), Baik et al. (2013, p. 1015), and Soliman (2007, p. 47). The analysis on future stock returns further implies that the market also fails to fully appreciate the information contained in EPS_t. These findings are consistent with the suggestions of prior studies that market participants are unable to fully comprehend the implications of financial data (Abarbanell & Bushee, 1998, p. 31; Bernard & Stober, 1989, p. 30; Richardson et al., 2005, p. 482). As a result, fully exploiting the information of ΔATO_t and EPS_t may result in yielding abnormal returns after controlling for the other DuPont components, indicating that markets are not fully efficient.

Profit margin

Furthermore, the thesis's results provide evidence that ΔPM_t also has significant explanatory power regarding a firm's future profitability and market value. These findings highlight that a company's ability to manage the costs associated with generating its sales provides valuable insights for a firm's future performance, which is considered relevant for the market. These findings contradict Fairfield & Yohn (2001, p. 378) and Soliman (2007, p. 42), who suggest that PM has a lower persistence compared to ATO and is therefore not a useful predictor for a firm's future profitability and its market value. Instead, our findings support the propositions made by Amir et al. (2011, p. 321) and Jin (2017, p. 221), which show that both variables are informative regarding a firm's future performance and its value. Additionally, the study conducted by Lev & Thiagarajan (1993, p. 201) supports the explanatory power of ΔPM_t by demonstrating that gross margin, a key driver of PM, is a significant predictor of future firm performance. Hence, these findings indicate that the propositions made by previous research regarding the differential persistence between ATO and PM due to various measurement approaches, barriers of entry, or earnings management issues have no practical implications. Indeed, both variables have significant explanatory power in predicting a firm's future profitability and stock returns. ΔPM_t is also not related to subsequent stock returns, implying that market participants appear to fully understand the variable's implications.

Leverage

The study not only illustrates the explanatory power of the two operating components but also provides evidence that DuPont components associated with a firm's leverage enhance predictions of future firm performance and are useful in determining a firm's value. The data sample analysis reveals that, on average, ROE exceeds RNOA, indicating a positive effect of financial leverage. Additionally, it can be noted that OLLEV is above financial leverage, implying that firms prefer to hold operating rather than financial leverage. Operating and financial leverage correlate negatively with each other, implying that companies with higher OLLEV need to take on less financial leverage. Moreover, the sample analysis shows that financial leverage correlates negatively with RNOA, suggesting that profitable firms tend to have lower financial liabilities, despite having lower risk and the ability to take on more leverage than unprofitable firms.

The regression analysis reveals that $\mathrm{FLEV_t}$ and $\Delta\mathrm{FLEV_t}$ are significantly positively related to one-year-ahead ROE, indicating that financial leverage can have a favorable impact on a firm's future profitability. This finding supports the proposition of the DuPont analysis framework introduced by Nissim & Penman (2001), namely that financial leverage can lever a company's overall profitability (ROE) over its operational profitability (RNOA). In addition, the analysis on contemporaneous stock returns shows that both variables are also significantly related to a firm's market value, confirming the findings of Masulis (1983, p. 125). Market participants appear to consider the amount of leverage and any associated changes as informative. These findings refute the capital irrelevance proposition of Modigliani & Miller (1958, p. 268), demonstrating that leverage has an impact on a firm's market value. However, interestingly, the empirical analysis reveals that although financial leverage is positively related with a firm's future profitability, it has a negative impact on a firm's market value.

The investigation on OLLEV reveals that considering operating liabilities separately from financial leverage provides additional explanatory power in predicting future profitability and stock returns. The thesis's results confirm Nissim & Penman's (2003, p. 548) suggestion that a firm's OLLEV provides incremental information to the market and has different implications than financial leverage on a firm's value. The study shows that, in contrast to financial leverage, market participants price higher levels of operating leverage favorably.

Limitations & future research

It should be noted that the thesis results refer to the firms included in the dataset. No conclusions can be made regarding the usefulness of the DuPont analysis framework to companies from the banking, insurance, and real estate sectors. Furthermore, there are no insights on the application of the framework in markets other than the United States.

Future research may employ further investigations on the contrasting implications of the financial leverage ratio on market prices found in this master thesis compared to prior studies. While previous research proposes debt-related advantages such as tax shields (Kemsley & Nissim, 2002, p. 2071; Modigliani & Miller, 1963, p. 438) or lower transaction and contracting costs (Harris & Raviv, 1991, p. 332 - 333; Myers, 1984, p. 585), it also explains the negative implications of leverage such as a greater likelikhood of financial distress, including associated bankruptcy costs or agency problems (Altman, 1984, p. 1076 - 1077; Jensen & Meckling, 2004, p. 164 - 165; Leland, 1994, p. 1213). However, the thesis's regression analysis results demonstrate that the market appears to negatively price increases in financial leverage, while the previous literature reports a positive impact on value on average (Masulis, 1983, p. 125). Thus, we recommend further investigations to identify whether the inconsistent effects are due to different economic times, differing underlying data, or other factors. Moreover, the propositions of Lev & Thiagarajan (1993, p. 206) regarding the enhanced predictive ability of financial information when conditioned on macroeconomic variables suggest that incorporating such variables into the regression analysis may help to explain these inconsistent effects and further improve the model's performance.

In addition, future research may analyze whether a third-level breakdown of the ATO, PM, FLEV, and OLLEV DuPont components provide incremental valuable insights regarding a firm's future profitability and its market value. Additionally, the existing literature provides evidence that some of their drivers, such as gross margin for PM or working capital accruals and inventory changes for ATO, have significant explanatory power regarding a firm's future performance (Abarbanell & Bushee, 1997, p. 5 ; Lev & Thiagarajan, 1993, p. 202). Further investigations may thus provide more detailed insights into their usefulness.

7. Literature overview

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8. Annex

8.1. Independence declaration

I hereby declare that this master thesis, entitled «DuPont analysis, future firm performance, and stock returns», is my original work. All sources used in the study are cited in accordance with the conventions of the ZHAW School of Management and Law.

I affirm that the research presented in this thesis has been conducted under my personal supervision. I take full responsibility for any errors or omissions that may be found in this thesis.

Signature:

Andrina Detzel

8.2. Proofreading

The thesis has been professionally proofread by PRS:

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