ISEG
LISBON SCHOOL OF ECONOMICS & MANAGEMENT

Universidade de Lisboa

MASTER THESIS

The Anna Karenina Principle Applied to Sustainable Finance

Characteristics of a Sustainable firm – an Exploratory Study

This dissertation is submitted for the degree of

Master of Science (M.Sc.) in Finance

Nadine Sumpmann

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Supervisor: Prof. Dr. TIAGO CRUZ GONÇALVES

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GLOSSARY

AKP – Anna Karenina Principle.

β – Beta.

CAPEX – Capital Expenditure.

CAPM – Capital Asset Pricing Model.

CCC – Cash Conversion Cycle.

CEO - Chief Executive Officer.

CSR – Corporate Social Responsibility.

D – Dispersion.

DCF – Discounted Cash Flow.

EBIT – Earnings Before Interest and Taxes.

ESG – Environment, Social, Government.

EU – European Union.

GDP – Gross Domestic Product.

IASB - International Accounting Standards Board.

IFRS – International Financial Reporting Standards.

GRI - Global Reporting Initiative.

KPI – Key Performance Indicators.

MFW – Master's Final Work.

MSCI - Morgan Stanley Capital International.

NASDAQ - National Association of Securities Dealers Automatic Quotation System.

NPV – Net present value.

PCA - Paris Climate Agreement.

R&D – Research and Development.

Re – Expected Return on an individual equity instrument.

Rf – Riskless Return.

RoA – Return on Assets.

RoE – Return on Equity.

SABS - Sustainability Accounting Standards Board.

SDG – Sustainable Development Goals.

Sd – Standard Deviation.

SRI – Social Responsibility Investment.

UNEP FI - United Nations Environment and Program Finance Initiative.

USD – US Dollar.

ABSTRACT, KEYWORDS AND JEL CODES

Factors that have an impact on the sustainability of a firm are oftentimes intertwined. This is why the Anna Karenina principle provides a different angle and a more holistic approach to the existing research in this field. Derived from the very first sentence of Tolstoy's novel "All happy families are alike; each unhappy family is unhappy in its own way", it translates to the overarching question of this paper: Is there a set of financially measurable prerequisites that are key to a sustainable firm and are all sustainable firms similar. Instead of analyzing the effects of isolated factors, a set of prerequisites are identified and analyzed individually and regarding their causal relations with one another. The identified prerequisites are lower tail risk, lower β-factor, higher dividend yield, higher RoE / RoA, and lower WCR. The first part of this question is approached by comparing the mean average of firms with high ESG ratings to firms with low ESG ratings for each prerequisite. Potential interconnections of characteristics are identified under the fsQCA. This methodology also gives way to further classify characteristics as necessary, sufficient and core or peripheral conditions. Under the comparison of the mean average, the results for the analysis of the tail risk are inconclusive. For all the other characteristics, the initial assumptions could be confirmed. Low WCR was identified as a necessary condition. Yet, there are no causal connections between conditions. The second part of the question is tackled by employing a dispersion analysis. The results were mixed. For the β-factor, RoA, and WCR the assumption that sustainable firms are more alike e.g. display lower dispersion could be confirmed. Concerning RoE, there is some evidence for the AKP, when adjusted for the effects of outliers. However, for dividend yields this assumption could not be verified, yet explained by volatility asymmetry. While dividends can, potentially, rise against infinity, they are floored at zero. However, the key finding of this paper, was that sustainable firms are generally more alike and distinct between high and low ESG ratings for certain factors, as described above. Yet, what is striking and remains to be explored in more detail is the key importance of the operational efficiency of a sustainable firm.

KEYWORDS: Sustainability, Anna Karenina Principle, ESG, Beta, Dividends, RoE, fsQCA

JEL CODES: 16; G32; G35; G12

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1. INTRODUCTION

"All happy families are alike; each unhappy family is unhappy in its own way." (Tolstoy, 2001) The very first sentence of Tolstoy's 1877 novel Anna Karenina reflects on the uniquely individual tragedy of human relationships, while at the same time happiness stems from commonly equal factors. Defining happy firms as sustainable firms poses the question of if there is a set of financially measurable prerequisites that are key to a sustainable firm, and if all sustainable firms are in fact similar.

At this point, sustainability has become vital to the success of a firm. Yet, oftentimes, it lacks a clear strategic approach (Ioannou & Serafeim, 2021). Moreover, there is a notable shift in investor behavior and preferences towards more sustainable financial instruments which has only been accelerated by the COVID-19 pandemic. (Tan & Moshinsky, 2020; Whelan, Atz, & Clark, 2021; Dam & Scholtens, 2015)[1] A deeper understanding of which drivers are prerequisites of a sustainable firm can place the management in a position to allocate resources more effectively. At the same time, investors can perform a corresponding analysis to confirm, beyond the common sustainability ratings, that the sustainability efforts of a firm are integrated into the firm's strategy and reflected in its financial key performance indicators. For that reason, potential prerequisites are derived from commonly used valuation methods such as the discounted cash flow (DCF) model also exploring causal connections in an ex-ante, ex-post approach. Research in this field can guide investors and managers to better navigate a firm's roadmap to become a sustainable firm, based on measurable and operatively known and available terms.

While the field of sustainable finance and its immediate relationship with single factors have been studied extensively, the relations between these factors are oftentimes more complex and intertwined. The Anna Karenina Principle (AKP) offers the opportunity to explore this question from a more holistic angle. Moreover, this study will be based on data from all ordinary shares traded at the Frankfurt stock exchange over a period of ten years (2012 – 2021). Since most of the literature is based on data from the US markets, this paper can also help to review if these generally accepted concepts from literature also translate to the European market.

[1]These days, it is not only observed among impact investors but instead, an increasing number of investors from the traditional investment space move towards more impact-driven investment including ESG investing. It has been proven empirically repeatedly by the majority of studies and presents today's ruling view in academia that firms scoring high Environment, Social, and Government (ESG) ratings oftentimes outperform firms with a lower score. (Tan & Moshinsky, 2020; Whelan, Atz, & Clark, 2021; Dam & Scholtens, 2015; Gonçalves, Pimentel & Gaio, 2021; Gonçalves, Dias & Barros, 2022; Madime & Gonçalves, 2022) In fact, Black Rock chairman and CEO Larry Fink (2021) recently stated that sustainable investment will be the new standard for a firm.

Originally, the AKP is a concept developed in the field of biology and social studies (Diamonds, 1997), and only appeared once in the literature in the context of finance (Baur, 2021). As such, it is still largely understudied in this field. Still, Baur (2021) based his research on only a single factor instead of finding a set of prerequisites all happy firms have in common. In this paper, his methodology is used as the foundation for analyzing the dispersion analysis. However, it also develops a new angle by extending the analysis to a set of potential prerequisites of a sustainable firm, which is more in line with the original idea of the AKP. By constructing an econometric model, it is examined if high ESG-rated firms on average perform better or worse regarding a set of prerequisites. Additionally, the dispersion of those prerequisites is analyzed. Defining happy firms as more alike, the underlying hypothesis in this regard states that more sustainable firms show lower dispersion for the selected prerequisites. These tests also explore potential differences depending on the economic cycle.

In order to test the robustness of the results from the dispersion analysis, potentially verified prerequisites are subject to a fuzzy set Qualitative Comparative Analysis QCA (fsQCA). First, necessary conditions are identified and separated from potentially sufficient conditions. Second, based on the results, the truth table is constructed and analyzed to separate core conditions from peripheral conditions. FsQCA is a relatively new research method, originally from the field of social studies (Ragin, 2008). By design, it gives further value to the results of the dispersion analysis since the dispersion analysis itself does not offer any significance level. Hence, the combination of the dispersion analysis with the fsQCA presents a suitable way to test for assumptions under the AKP.

The remainder of the paper is structured as follows. Section 2 presents the literature review, identifying potential prerequisites and developing the hypothesis. Section 3 describes the study's methodology, the dataset and the variables applied. In Section 4 the results are discussed. The final section concludes the paper and presents an overview of the results.

2. LITERATURE REVIEW

Identifying the set of potential prerequisites can be approached from two different angles. The first one assumes a perspective of efficient portfolio management, analyzing correlations, the alpha or Sharpe ratios while the second approach assumes a corporate finance point of view (Whelan, Atz, & Clark, 2021), (Ghoul, Guedhami, Kwok, & Mishra, 2011). Since this paper's sole focus is on the corporate finance perspective, only indicators from the corporate finance space that may be reflective of a sustainable firm are considered.

To analyse value creation, it is only intuitive to decompose common corporate finance valuation models such as the Discounted Cash Flow (DCF) model. Gregory, Tharayan, and Whittaker (2013) and Gonçalves, Dias and Barros (2022) have proven that the ESG profile of a firm has an impact on equity valuation, and it is reflected in both the nominator and the denominator. Accordingly, both the future cash flows of a firm, as well as, the discounting factor are affected by an enhanced ESG profile.

Companies are generally exposed to both systematic and non-systematic risks. While systematic risk represents the general macroeconomic market risk all organizations are subject to, non-systematic risk is indicative of the risk inherent to an organization's business model (Gregory, Tharyan, & Whittaker, 2013). In general, it is assumed that portfolio managers can diversify away non-systematic risk so that in a sufficiently diversified portfolio, the investor is only exposed to the systematic risk of a company. While the non-systematic risk may be of secondary importance for considerations regarding the cost of capital, the impact of non-systematic risk is non-negligible for the numerator in a DCF model e.g. the future cash flows.

Applying an ex-ante and ex-post approach, this study also attempts to capture the causalities of value creation. Moreover, reviewing the methodology of how ESG ratings are computed, it becomes evident that the agencies review the risk exposure of a certain firm in one of the dimensions such as human rights or environmental-friendliness after the risk mitigation efforts of the firm (MSCI ESG Research LLC, 2021). Thus, firms with high exposures to environmental, social or governance risks, are required to have a more elaborate risk management control system in place to score a high ESG rating (Giese, Lee, Mealas, Nagy, & Nishikawa, 2019). Firms with strong ESG ratings have above-average corporate governance integration which extends to both their internal conduct of business, as well as, the entire supply chain. Such firms also show stricter transparency and disclosure standards. This way, agency cost and information asymmetry are reduced (Giese, Lee, Mealas, Nagy, & Nishikawa, 2019); (Gregory, Tharyan, & Whittaker, 2013). Due to these more sophisticated risk management control systems, firms are less inclined to fall victim to severe incidents of fraud, embezzlement, corruption, and litigation. It follows that a strong corporate governance strategy reduces downside tail risks in stock prices – a market reaction to lower expected future free cash flows to the firm. This can be reflected in the stock's volatility and worst-case loss (Giese, Lee, Mealas, Nagy, & Nishikawa, 2019).

Hypothesis 1: The downside tail risk in terms of stock returns is distinct between firms with higher and lower ESG ratings.

As previously discussed, the systematic risk stems from exposure to macroeconomic factors and ESG ratings consider a firm's exposure to ESG-relevant risks. If these risks are mitigated well by a strong corporate governance strategy, so it is less exposed to systematic risk, it is assumed that a firm's β-factor is distinct between high and low ESG ratings. This becomes evident by decomposing the Capital Asset Pricing Model (CAPM) as seen in equation one. First introduced by Treynor in 1963, the degree as to which a firm is exposed to systematic risk is expressed by the β -factor (β). β, in turn, indicates the degree to which a stock's return follows the market risk premium. The market risk premium approximates the excess return of the market portfolio over the risk-free asset $(\overline{R}m - Rf)$. So, when added to the risk-free return (Rf), the formula returns the expected return of a stock ($\overline{R}e$). Consequently, the stock's β-factor is an immediate measure of systematic risk exposure. A lower β-factor translates into a lower expected rate of return and, therefore, a lower cost of equity. Depending on the debt-to-equity ratio this can lead to material effects on the overall cost of capital. (Gregory, Tharyan, & Whittaker, 2013); (Giese, Lee, Mealas, Nagy, & Nishikawa, 2019)

$$(1) \quad \overline{Re} = Rf + \beta e * (\overline{R}m - Rf)$$

In the literature, the shortcomings of the CAPM and its underlying assumptions to capture real-life scenarios are discussed extensively and it is widely agreed upon that they are considered unrealistic. Multifactor and Arbitrage Pricing Models were developed to better describe the market line under CAPM. However, in essence, they all concluded that systematic risk has no impact on portfolio performance (Mullins, 1982); (Gregory, Tharyan, & Whittaker, 2013). Hence, for further consideration and not least because of its broad usage in financial management, the CAPM in its original version will be applied.[2]

Previous studies have analyzed the correlation between higher ESG ratings and lower β-factors. Evidence varies depending on the underlying dataset regarding the period, country, industry, or methodology. Yet, there is a consensus in the literature, that in general there is a significant correlation between the β-factor and the ESG or CSR rating (Whelan, Atz, & Clark, 2021);

[2] Among the (unrealistic) assumptions of the CAPM are, first, all investable assets are included to approximate the capital market line and, second, all investors hold the portfolio where the efficiency curve is tangent to the capital market line. This in turn means that all investors hold a portfolio that is not subject to exclusion of certain stocks, which is the case in SRI and ESG investing. Hence, the benefits from diversification under CAPM may diminish. However, empirical evidence as to why a sufficient investor base has stepped away from what are considered sin investments is still outstanding (Gregory, Tharyan, & Whittaker, 2013).

(Gregory, Tharyan, & Whittaker, 2013). Consequently, for the further proceeds of this paper, a lower cost of capital as an expression of a lower β-factor is a result of efficient risk management and corporate governance. However, this also proves that analyzing the correlation between stock returns and ESG ratings alone would be an oversimplification since risk and return cannot be separated from one another. Under the financial theorem of CAPM, a lower perceived risk factor in terms of the β-factor will automatically translate into a lower expected return on a stock (Gregory, Tharyan, & Whittaker, 2013). The same literature debates whether the β-factor is only a reflection of systematic risk, or if firm-specific risk factors and their mitigation strategies may also play into a lower β-factor. After all, a firm's specific strategies may also limit the exposure to major market movements, for instance in the oil market. If a firm assumes a strategy with a stronger focus on renewable energy, that specific firm is also less exposed to price volatility in the oil market, an inherently systematic risk (Gregory, Tharyan, & Whittaker, 2013):

Hypothesis 2: The β-factor of a firm is distinct between firms with higher and lower ESG ratings.

While the non-systematic risk may be of secondary importance for considerations regarding the cost of capital, the impact of non-systematic risk is non-negligible for the numerator in a DCF model e.g. the future cash flows. However, ex-post, among other aspects, this is also reflected in the numerator under the DCF model, e.g. the future free cash flows to the firm. According to Gergory, Tharyan, and Whittaker (2013), a sustainable firm with a high ESG rating has a competitive advantage which can be due to numerous reasons rooted in the concept of stakeholder theory. The main pillar stone of value creation through sustainability is an improved reputation of a firm (Lassala, Apetrei, & Sapena, 2017) (Clark, Feiner, & Michael, 2015). As discussed before, enhanced corporate governance reduces the risk of scandals and negative news. This kind of improved reputation, in turn, may have a multitude of positive outcomes. Firstly, human capital is considered key to the success of any modern corporation. Focusing on the internal operations of a firm, a positive reputation can attract superior human capital (Lech, 2013). Superior human capital can be levered to implement a more efficient allocation of resources, and/or enhanced innovation management (Gregory, Tharyan, & Whittaker, 2013). Furthermore, a sustainable firm tends to have better long-term business plans. Next to better streamlined internal management, the external perception of the firm may improve. Consumers express a preference for goods produced by a more sustainable firm, everything else is held equal (Luo & Bhattacharya, 2006). At this point, it is important to clarify that not all these drivers are identified as a prerequisite of a sustainable firm in the sense that they do not all need to be fulfilled cumulatively. The causality between a firm's societal behaviour and its financial profitability is complex and cannot be reduced to one single driver (Lassala, Apetrei, & Sapena, 2017). Hence, these drivers can, separately or in interaction, lead to a competitive advantage which, in turn, enhances the considered sustainability prerequisite: Higher profitability. Profitability can be measured by different Key Performance Indicators (KPIs).

As a forward-looking metric, dividends can be indicative of future expected profitability. Increased profitability may lead to increased expected future free cash flows to the firm which enable a firm to pay higher dividends (Giese, Lee, Mealas, Nagy, & Nishikawa, 2019). Generally, dividend policies are closely related to the, in part, contradictory concepts of agency theory and signaling theory. According to the agency theory, the management might be incentivized to keep dividends at a lower level. This way, free cash flows under managerial control remain at a higher level so that less external financing is required for future investments. This further limits capital market exposure for the management and provides another incentive to keep dividends at a lower level (Sheikh, 2022). Moreover, when presented with a set of positive net present value (NPV) projects, managers might be inclined to overinvest in both, traditional, as well as, sustainability projects, a concept well-researched in line with the theory of empire building. However, in a sustainable firm, risks arising from the concept of agency theory are generally already mitigated by the other prerequisite of a sustainable firm: Enhanced corporate governance. Yet, counteracting dividend policies can be an additional tool to increase the profitability of a firm by further mitigating the risk arising from agency theory (Harakehm, 2020), (Sheikh, 2022), (Matos, Barros, & Samento, 2020).

Signaling theory suggests that a dividend policy, declaring higher dividends in the future, sends an ambivalent message. One interpretation would be that higher future dividends translate to higher future cash flows to the firm. Contrarily, in some cases, this could also be interpreted as an indicator that a firm does not have any positive NPV projects in the pipeline. However, everything else is equal, levering the previously mentioned drivers, research suggests that in general, a sustainable firm is more profitable. Thus, a sustainable firm has higher free cash flows at its disposal that can be reallocated back to the investors. Additionally, the interplay between dividend payouts and investor preferences needs to be considered. Sustainability investors usually have a more long-term investment horizon, so higher dividends may be a critical indicator for a more sustainable firm (Giese, Lee, Mealas, Nagy, & Nishikawa, 2019). At the same time, hedge funds especially have a preference for short-term profitability.

Considering all of these factors, a study by Matos, Barros & Sarmento (2020) has shown that there is a significant correlation between the dividend payout stability and the sustainability of a firm, especially concerning the environment and governance components. The authors concluded that this indicates a stronger long-term alignment with shareholders and other stakeholders due to more proportional profit sharing:

Hypothesis 3: The dividend policy of a firm is distinct between firms with higher and lower ESG ratings.

Next to potentially higher dividend yields - a metric which is forward-looking by design - traditional profitability KPIs from the accounting space such as the Return on Equity (RoE) and the Return on Assets (RoA) are also tested for the AKP. There has been extensive research on the correlation between RoE/RoA and corporate sustainability, especially in the early 2000s. Most of the studies confirmed that there is a significant correlation between those two variables (Lassala, Apetrei, & Sapena, 2017); (Bahaaeddin & Hamdan, 2020); (Whelan, Atz, & Clark, 2021). Depending on the underlying methodology, some studies, suggest that there is no significant positive correlation between these two variables. This is due to the underlying data sets and methodologies applied (Dienes & Sassen, 2016). At the same time, accounting-based data is subject to a certain variance due to accounting policy choices (Lassala, Apetrei, & Sapena, 2017). Likewise, it is important to note that traditional accounting KPIs, in contrast to dividends, are based on historical data. This is a common shortfall in finance since historical evidence shows no guarantee for future performance. However, to capture a holistic image of a firm's profitability, both aspects, dividends and traditional profitability measures, are considered further down the line:

Hypothesis 4: The RoE and RoA of a firm are distinct between firms with higher and lower ESG ratings.

Furthermore, literature has explored the relationship between sustainability in terms of ESG ratings and the level of working capital requirements (WCR) (Barros, Falcao, & Sarmento, 2021). According to Jensen and Meckling (1976), the components of working capital are integral to a firm's objective to maximize shareholder value since it is essential to a firm's daily operating activities. Previous research has found that aggressively managed working capital requirements can be a competitive advantage and improve performance in general and specifically profitability measured in terms of RoE (Reason, 2002); (Windaus, Kortman, & Tebbett, 2018). However, at the same time, Nastiti, Atahau, & Supramono (2019) found that there is no significant correlation between working capital management and sustainable growth. This is curious given the existing relationship between profitability and working capital management (Boisjoly, Coinine, & McDonald, 2019). At heart, the theory of Jensen and Meckling (1976) states that the working capital items, current assets (less cash) minus current liabilities, are all highly correlated with one another, as well as, the cash conversion cycle (Boisjoly, Coinine, & McDonald, 2019). On the one hand, increased profitability may stem from a prolonged cash conversion cycle. This can push both sales and profitability by lowering the cost of supply, reducing lost sales, and decreasing production interruption. On the other hand, firms with a more aggressive cash conversion cycle may be able to reduce storage costs. Moreover, that funds otherwise would be invested in working capital are now available for other investments. This may lead to lower financing costs (Ukaegbu, 2014). Yet, such firms might be at risk of running into (short-term) financial constraints.

However, evidence on cash conversion cycles can easily be misleading since they vary strongly between industries. It has been found that firms with high individual cash flows also tend to have a long cash conversion cycle, independent of their overall profitability (Banos-Caballero, Garcia-Teruel, & Martinez-Solano, 2014). Yet, as described before, more sustainable firms tend to have a more efficient risk management system in place which also could allow a firm to take on more risk and operate at lower working capital and benefit from the advantages of lower WCR. A study by Barros, Falcao, & Sarmento (2021) offers evidence that firms with a higher ESG rating can operate with lower working capital. More sustainable firms tend to have a shorter cash conversion cycle than the industry average. The impact is mainly based on the environmental and social pillars. Governance does not seem to have a significant impact.

Hypothesis 5: The level of working capital requirements is distinct between firms with higher and lower ESG ratings.

3. RESEARCH DESIGN

3.1. Methodology

3.1.1. Dispersion Analysis Methodology

The Anna Karenina Principle (AKP) was first defined in 1997 by Jared Diamond in Guns, Germs and Steel: The Fates of Human Societies. The AKP was established on the assumption that to domesticate mammals, they must fulfil six essential prerequisites. Diamond argues if a potentially domesticable mammal does not show one or more of these prerequisites, it cannot be domesticated (Diamonds, 1997). Only if all criteria are fulfilled, the so-called happiness condition is satisfied. This poses a high barrier for researchers and a conservative stance for their empirical testing.[3] For Finance and business studies, the AKP is in and by large understudied. In scholars, the AKP only appeared once in the context of finance. The article was published in November 2021 by Dirk G. Baur, The Anna Karenina principle and stock prices. In his paper, Baur studies whether happy firms are more alike. For his hypothesis, Baur considers the AKP to be proven when negative return firms – unhappy firms - have lower return-correlation, higher cross-sectional return volatility and cross-sectional return dispersion, – since this would be evidence that causes of negative returns are more widespread and as such unhappy firms would be "unhappy in [their] own way" (Tolstoy, 2001). In his analysis, Baur (2021) argues that the AKP can be especially relevant to finance and investor decision-making, since it may indicate that the returns of unhappy firms are uncorrelated even in times of crisis. Ultimately, Baur's findings do not support the Anna Karenina principle in general for most indexes, except for NASDAQ. This is due to, predominantly, volatility asymmetry (Baur, 2021). However, Baur deviates from the original concept of the AKP in his analysis. He does not identify a set of prerequisites that all positive return stocks may have in common. Instead, he approaches the AKP from a more empirical and market-driven angle. He disproves the AKP by concluding that based on dispersion measures, unhappy firms are more alike than happy firms.

This paper will combine the two methodologies. Drawing from today's research in biology, tests will be performed for a set of identified potential prerequisites of a sustainable firm for the AKP. But instead of performing a regression analysis for each prerequisite, as seen in biology, this paper will follow the methodology of Baur (2021) by analyzing the dispersion of the identified potential prerequisites of a sustainable firm. For this paper, happy firms are defined as firms with an ESG rating of 50 or above, since the range of Thomson Reuters' Eikons ESG ratings ranges from 0 – 100. Again, following the methodology of Baur (2021), the AKP is tested in three dimensions, for each prerequisite individually. Data points are subdivided into panels of happy firms, unhappy firms, and all data. Tests are performed during good times, bad times, and all times. Further adding to Baur's methodology, the dispersion of the mean as well as the standard deviation will also be tested based on quartiles to avoid any noise factors from

[3] In today's research, the AKP is a common methodology in hypothesis testing with regression analysis in biology. Critics argue that the AKP can suffer from the theory-practice gap that occurs when theoretical statistics are applied to real-world data. It is especially prone to type I errors (Goh & L., 2018).

outliers. This leads to seven different models tested individually for each of the 5 prerequisites analyzed with 7 measurements.

(2) Mean $(x^{+}) > Mean\ (x^{-})$

Testing for the average mean over a period of ten years, Mean (x^{+}) denotes the mean of the respective prerequisite of all firms with an ESG rating of 50 or above. Mean (x^{-}) denotes the mean of the respective prerequisite of all firms with an ESG rating of below 50. The mean is calculated based on a ten-year period for each firm. However, it is important to note that the expected value can differ among the identified prerequisites. For instance, in the case of the β -factor, a lower value is expected for the group of happy firms. At the same time, for instance, for the Dividends, RoE/RoA and WCR, a higher value is expected in the group of happy firms.

(3) $Sd(x^{+}) < Sd(x^{-})$

Testing for the average standard deviation over a period of ten years Sd (x^{+}) denotes the standard deviation of the respective prerequisite of all firms with an ESG rating of 50 or above. Sd (x^{-}) denotes the standard deviation of the respective prerequisite of all firms with an ESG rating of below 50. Standard deviation is calculated based on a ten-year period of each firm.

(4) $D(Mean(x^{+})) < D(Mean(x^{-}))$

Testing for the cross-sectional dispersion of a firm's average score for each prerequisite over a period of ten years, $D\ (Mean\ (x^{+}))$ denotes the dispersion of the mean of the respective prerequisite of all firms with an ESG rating of 50 or above. $D(Mean(x^{-}))$ denotes the dispersion of the mean of the respective prerequisite of all firms with an ESG rating of below 50. The mean is calculated based on a ten-year period for each firm.

(5) $D(Sd(x^{+})) < D(Sd(x^{-}))$

Testing for the cross-sectional dispersion of a firm's standard deviation for each prerequisite over a period of ten years, $D(Sd\ (x^{+}))$ denotes the dispersion of the standard deviation of the respective prerequisite of all firms with an ESG rating of 50 or above. $D(Sd(x^{-}))$ denotes the dispersion of the standard deviation of the respective prerequisite of all firms with an ESG rating of below 50. Standard deviation is calculated based on a ten-year period of each firm.

(6) $\rho\ (x^{+}) > \rho(x^{-})$

Testing for the average correlation of the firm scores for each prerequisite, $\rho\ (x^{+})$ denotes the average pairwise correlation of the respective prerequisite of all firms with an ESG rating of 50 or above. $\rho(x^{-})$ denotes the dispersion of the standard deviation of the respective prerequisite of all firms with an ESG rating of below 50. The correlation is calculated based on a ten-year period for each firm.

(7) $Dq(Mean(x^{+})) < Dq(Mean(x^{-}))$

Adding to Baur's (2021) paper, and to avoid any noise factors arising from outliers, the AKP dispersion is further tested by the cross-sectional dispersion of a firm's average score for each prerequisite over a period of ten years based on quartiles. $Dq(Mean\ (x^{+}))$ denotes the dispersion of the mean of the respective prerequisite of all firms with an ESG rating of 50 or above. $Dq(Mean(x^{-}))$ denotes the dispersion of the mean of the respective prerequisite of all firms with an ESG rating of below 50. The dispersion is calculated based on the 25 % and 75 % quantile of that group. The mean is calculated based on the average over a ten-year period of each firm.

(8) $Dq(Sd(x^{+})) < Dq(Sd(x^{-}))$

Further adding to Baur's paper, the cross-sectional dispersion of a firm's standard deviation for each prerequisite over a period of ten years based on quartiles is tested. $Dq\ (Sd\ (x^{+}))$ denotes the dispersion of the standard deviation of the respective prerequisite of all firms with an ESG rating of 50 or above. $Dq(Sd(x^{-}))$ denotes the dispersion of the standard deviation of the respective prerequisite of all firms with an ESG rating of below 50. The dispersion is calculated based on the 25 % and 75 % quantile of that group. The standard deviation is calculated based on the average over a ten-year period of each firm.

2.1.2 Fuzzy Qualitative Comparative Analysis Methodology

The research method of Qualitative Comparative Analysis (QCA) was first introduced in the 1990s by Charles C. Ragin (Ragin, 2008). It is a form of comparative social research that can also be applied if only a limited number of observations are available. In that sense, QCA cannot be assigned to either the qualitative-comparative or the quantitative-statistical methodology. Ragin found that existing research methods of analysing single variables as an isolated effect on a dependent variable are insufficient since real-world phenomena are oftentimes much more complex (Gonçalves, Gaio & Costa, 2018; Gonçalves, Gaio & Silva, 2018; Gonçalves & Gaio, 2021; Gaio, Gonçalves & Venâncio, 2022; Saraiva & Gonçalves, 2022; Gonçalves & Gaio, 2023) (Thomann & Ege, 2021). At the same time, multiple regression analysis can easily suffer from multicollinearity when independent variables are correlated with each other. To bridge this gap, QCA combines case studies with a formalised comparison of data-set observations and approaches a research question from a set-theoretic angle (Wagemann & Buche, 2016). This means it describes a certain reality as memberships of cases, and relationships between, sets (Thomann & Ege, 2021). By doing so, it requires configuration to then assume causal complexity. QCA knows two different forms, crisp-set QCA (csQCA) and fuzzy-set QCA (fsQCA). Under the csQCA, conditions are defined in a binary set and can only assume 1 or 0. For fsQCA, variables can potentially be defined as any number between non-membership and full membership. However, data sets, then need to be configurated, so that they can assume any number between 1 and 0. For this work, the fsQCA approach will be applied.

FsQCA differentiates between necessary conditions and sufficient conditions. These two categories can be understood as a Venn diagram. A condition qualifies as a necessary condition if, within the set membership definition, the outcome can be verified when this condition can also be verified, within the set membership definition. A sufficient condition on the other hand is a subset of the outcome e.g. the outcome can be true, but the condition is not (Thomann & Ege, 2021).

The first step to a QCA is to set up a research design and identify a set of conditions that can be tested for the QCA (Thomann & Ege, 2021). Consequently, this paper will draw from the results of the literature review and dispersion analysis. Based on the ex-ante, ex-post approach, the hypothesis defined is that ex-ante, high corporate governance reflected predominantly in a low β-factor will ex-post lead to higher profitability reflected in higher dividend yields, or higher RoE/RoA, or lower WCR. Under this approach, a low β-factor is expected to be a necessary condition and a high dividend yield, RoE/RoA and WCR are enabling conditions e.g. sufficient conditions of a sustainable firm.

The software used for all analyses is fsQCA designed by Ragin. In the first step, necessary conditions are identified by analysing the consistency and coverage value of each condition separately. In the second step, a truth table is constructed and then minimised. The truth table shows the number of cases that occurred for each variance. The variances are the possible combinations of conditions that can occur and are denoted as 2^k. For, the 5 conditions analysed, there are 32 variances. The truth table is then minimised, excluding all variances that have an occurrence of less than 1. Further, the acceptable consistency level that leads to the defined outcome is determined. The literature recommends setting this value between 0,75 and 1. For at a consistency level of below 0,75, a variance can hardly be defined as being still a member of the group that leads to the defined outcome. At the same time, a perfect consistency of 1 is rarely found (Ragin, 2017). For this paper, accommodating for the large scale of case numbers, and adjusting for outliers, this cut-off value is set to 0,8. To test for the sensitivity of the results, an additional analysis with a consistency cut-off value of 0,85 is performed.

Under the standard analysis of the truth table, the fsQCA software returns three different types of solutions for the sufficiency analysis: the parsimonious, the intermediate, and the complex solution. The difference between those is the extent to which they include logical remainders in the analysis. There is a recommendation by Ragin (2009) and a preference by management research (Cheng 2013) (Hervas-Oliver, Sempere-Ripoll, & Arribas, 2015), to make the analysis based on the intermediate solution (Ragin, 2008). Yet, in this paper, the parsimonious and the intermediate solutions are also compared to identify causal core combinations and categorise variables (Rihoux & Ragin, 2009). This presents a way to identify and differentiate between peripheral and core conditions. A core condition is classified as a condition that is present in both solutions since this is indicative of a strong causal relation. It follows, that a peripheral solution is only found in the parsimonious solution for the causal relation is less pronounced (Ragin, 2008).

3.2. Data Set

3.2.1 Dispersion Analysis Data Set

The selected sample for this paper includes all the stocks traded at the Frankfurt stock exchange for ten years (2012 – 2021). The Frankfurt stock exchange is the most important stock exchange for financial instruments traded in euros. It includes a wide range of firms that operate in different industries and are of different sizes. For this reason, international firms, especially from the US, are also listed in Frankfurt to have better access to the European market (Börse Frankfurt , 2022). Hence, the Frankfurt stock exchange is largely diversified in the asset class of ordinary shares traded in euros.

The sample includes all ordinary shares traded on the Frankfurt stock exchange, which leads to an overall population of 12.000 instruments. This is considered a statistically representative baseline for exploratory analysis. All the data is retrieved from Refinitiv Thomson Reuters' Eikon or Thomson Reuters' Eikon DataStream. To avoid any noise factors financial institutions are excluded from the sample. This is because the business model of financial institutions differs in many aspects from the business model of non-financial firms. Moreover, firms with negative equity are also not representative of the overall behaviour of the market (Matos, Barros, & Samento, 2020) and are also excluded. Further eliminations include all small firms with assets of less than USD 400m.[4] Lastly, if no ESG rating or no specific data for that prerequisite was available for a certain firm in a certain year, this firm was dropped from the sample in that specific year (Matos, Barros, & Samento, 2020).

The firms are subdivided into three different panels, all times, good times, and bad times. Good times are defined as those years with an above-average German GDP growth rate. Those are the years 2021, 2019, 2018, 2017, 2016, 2015, and 2014. Accordingly, bad times include the years 2020, 2013, and 2012 (The World Bank, 2022). Furthermore, the data were subdivided into sub-panels of all data, happy firms and unhappy firms based on the ESG ratings. According to the subpanels, for each firm the mean and the standard deviation were calculated. A firm can move from the happy firm subpanel to the unhappy firm sub-panel over the course of the analysed period. Hence, the mean and standard deviation for one firm does not remain static. One firm's datapoints may be considered in one sub-panel but also be considered in the other sub-panel for data-points from a different year. Accordingly, even though it initially appears counterintuitive the mean of all data groups does not necessarily lie between the happy or unhappy group or the dispersion of the happy/unhappy group can be higher than the all data dispersion, due to the recalculation of the mean and the standard deviation.

3.2.2 Fuzzy-Set Qualitative Comparative Analysis Data Set

The Data Set used for the fsQCA is the same as the one applied to the dispersion analysis. The same is true for the selected variables. Membership scores should reflect external standards based on substantive knowledge and the existing literature (Ragin, 2008). When substantive knowledge or external standards are unavailable, calibration based on the percentiles of the sample is preferred and widely adopted by scholars (Wagemann & Buche, 2016). For this reason, the outcome (ESG) membership is defined based on the ESG bandwidth (full membership = 90, crossover = 50, full non-membership = 10). For these conditions, no clear standard is known, as they also vary among industries. Hence, full membership is defined as the top 95% percentile of a condition, the cross-over value is set as the median, and a full non-membership value is set as the bottom 5% percentile of the condition. WCR had 2 large outliers that were 10.000x bigger than the rest of the population. To be able to configure the data, those two cases were excluded from the overall population. Since for the β-factor, the expected value

[4] Large companies usually have greater availability of funds to invest. These resources allow them to benefit from economies of scale and learning and thus achieve better financial performance compared to small companies (Lassala, Apetrei, & Sapena, 2017).

for membership is low values, the original values for the β-factor are negated to accommodate for this effect. The literature recommends setting membership values between 75% and 100% depending on the individual data frame. Setting the full membership value at the 95% percentile can be considered a relatively conservative level (Ragin, 2017). With 3.329 observations, this is a large-size QCA. Just to adjust for outlier effects, the values for full membership and full non-membership level are set at a slightly lower level, also in mind that not one of the firms in the data panel has an ESG score of 100. The configuration anchors can be seen in appendix 3.

3.3. Variables

Today, sustainable investing is understood almost synonymously with ESG investing. Behind this term stands the concept of best-in-class ratings. The societal impact, as well as, the sustainability of a firm, are then expressed in ratings for the three name-giving dimensions Environmental, Social and Government.[5] Agencies such as MSCI, Thomson Reuters' Eikon or Bloomberg draw from reported data to develop ESG ratings. Additional information is taken from corporate websites, annual reports, CSR reports, bylaws, codes of conduct, and stock exchange filings (Refinitiv, 2022). Methodologies among agencies differ. MSCI for instance evaluates the remaining risk exposure of a firm after its mitigation efforts (MSCI ESG Research LLC, 2021). Thomson Reuters' Eikon applied an approach which allocates respective ratings for each of the three dimensions Environmental, Social and Governance ranging between 0 and 100. These categories are then divided into subgroups such as Emissions, Human Rights, or CSR strategy. For further information refer to Appendix 1. These scores are determined on a best-in-class approach. The score of a firm is measured against a peer group of more than 630 public firms' reported data. However, data points are only included if they are deemed material for the specific industry, so they are measured against the most comparable subset of firms with up to 186 data points. For this paper, ESG ratings will be retrieved from Thomson Reuters' Eikon. This is because Thomson Reuters' Eikon has a strong focus on ESG ratings and is further advanced in the process of developing ESG ratings, with ESG ratings available for more than 12.000 public and private companies globally, compared to for instance Bloomberg. Moreover,

[5] Different institutions have developed different frameworks that firms use to report their CSR efforts. Among those are the Global Reporting Initiative (GRI), globally this is the most used standard, the Sustainability Accounting Standards Board (SABS), which is associated with the International Accounting Standards Board (IASB) which oversees developing the International Financial Reporting Standards (IFRS) and the United Nations Environment and Program Finance Initiative (UNEP FI) (Vecchi, Casalini, & Cusumano, 2021).

all data for the other variables are also retrieved from Thomson Reuters' Eikon so that all data are sourced from the same platform.

For tail risk, there are multiple measures discussed in the literature. Hoepner, Rezec, & Siegl (2013) measured downside tail risk in terms of the standard deviation as a measure of volatility, semi-standard deviation to better capture downside swings, and worst-case losses in terms of the bottom 5 % loss. Giese, Lee, Mealas, Nagy, & Nishikawa (2019) measure downside tail risk by analysing firms that have had a drawdown of more than 95 % or went bankrupt. For this paper, distressed firms were eliminated from the sample so downside tail risk is measured in terms of the kurtosis and skewness as seen by Long, Jiang, & Zhu (2018); Agarwalla, Varma, & Virmani (2021); and Hoepner, Rezec, & Siegl (2013). Calculations are based on the daily closing prices. Skewness is a measure of asymmetry. It shows the deviation of the distribution form the mean. A negatively skewed distribution is indicative of a left-tailed distribution. On the other hand, a positively skewed distribution indicates that the tail is on the right side. Translating this to the concept of stock returns, a positive skew entails a higher accumulation of negative returns. Similarly, kurtosis is also a measure of asymmetry. But unlike skewness, kurtosis is not a measure of location. Instead, kurtosis measures how pronounced the diversion from normality is. Negative kurtosis indicates a flatter distribution compared to the normal z-distribution. Positive kurtosis on the other hand suggests a more peaked distribution with longer tails. Combining these two measures, the hypothesis under the AKP states that returns of happy firms are less positively skewed when compared to unhappy firms and have a kurtosis of around zero. Especially when skewness is positive, the kurtosis should be less negative and approach zero. Otherwise, this would indicate a stronger emphasis on negative returns.

The β-factor is a statistical measure that compares the volatility of a stock against the volatility of the broader market, which is measured by a reference market index and as such considered a measure of systemic risk (Giese, Lee, Mealas, Nagy, & Nishikawa, 2019) (Ghoul, Guedhami, Kwok, & Mishra, 2011) (Gregory, Tharyan, & Whittaker, 2013). Since data for the β-factor are only available back until 2015, there is only one year left in the bad times' subsample, 2020. Hence, both the metrics' standard deviation, as well as correlation, could not be calculated for this panel.

Dividends, as a measure of higher free cash flow to the firm, are captured in terms of dividend yields. This is to account for noise factors arising from size factors or outliers because of the effects of penny stocks (Barros, Falcao, & Sarmento, 2021). The dividend yield is calculated as the annual dividends per share over the share price.

Return on Equity (RoE) and Return on Assets (RoA) are both measures of productivity. There is extensive research on the correlation between RoE / RoA and CSR and by extension ESG (Lassala, Apetrei, & Sapena, 2017), (Bahaaeddin & Hamdan, 2020), (Whelan, Atz, & Clark, 2021). RoE is calculated as net income over shareholders' equity. RoA is calculated as net income over total assets.

Existing literature oftentimes measures WCR in terms of the cash conversion cycle (Barros, Falcao, & Sarmento, 2021); (Gonçalves, Gaio, & Robles, 2018). For this paper, WCR is calculated as current assets less cash and less current liabilities. To control for the size of the firm, it is divided by sales.

TABLE 1: ESTIMATION RESULTS FOR THE DISPERSION ANALYSIS

Estimation Results for the Dispersion Analysis Part l

	Average (Mean)			**Dispersion (Max. - Min.)**		**Dispersion Stability (75% q - 25% q)**		**N**
	Mean	Standard Deviation	Correlation	Mean	Standard Deviation	Mean	Standard Deviation	
Estimation Results for Tail Risk calculate based on Skewness								
Panel A: All times								
all	0,1514	0,1514	0,0422	16,2448	16,2448	0,3724	0,3724	4.102
happy	0,1830	0,2998	0,0741	8,4784	7,6376	0,5386	0,4925	3.213
unhappy	0,1743	0,3448	0,0308	16,2448	7,7478	0,4849	0,5260	3.513
Panel B: Good times								
all	0,1025	0,3992	0,0189	16,2448	8,3123	0,3946	0,3071	4.102
happy	0,0708	0,3177	0,0303	10,7848	8,3123	0,4430	0,4827	2.407
unhappy	0,1247	0,3350	0,0216	16,2448	7,7478	0,4693	0,4952	3.014
Panel C: Bad times								
all	0,2924	0,4878	0,0390	16,2448	7,6376	0,3724	0,2658	3.783
happy	0,3045	0,1346	0,0272	9,2923	7,5279	0,8564	0,1389	2.469
unhappy	0,2588	0,1625	0,0745	9,0413	3,9930	0,7717	0,2604	2.318
Estimation Results for Tail Risk calculate based on Kurtosis								
Panel A: All times								
all	- 0,0815	1,0391	0,8294	167,0112	117,5679	0,4899	0,4227	4.102
happy	- 0,1042	0,6677	0,7659	88,7371	118,7982	0,6820	0,6242	3.213
unhappy	- 0,1008	0,6916	0,4760	167,0565	124,5587	0,6381	0,6887	3.513
Panel B: Good times								
all	- 0,1405	0,8735	0,8001	167,0565	124,5587	0,5137	0,4660	4.102
happy	- 0,2374	0,6826	0,6080	131,8294	124,8965	0,5610	0,6423	2.407
unhappy	- 0,1354	0,7258	0,7597	167,0565	124,5587	0,5978	0,6714	3.014
Panel C: Bad times								
all	- 0,0815	1,0391	0,8655	167,0112	117,5679	0,4899	0,4227	3.783
happy	0,1160	0,3855	0,5857	116,2723	119,8079	0,9664	0,1878	2.469
unhappy	- 0,0494	0,2476	0,5410	60,0395	42,7804	0,9102	0,3109	2.318
Estimation Results for the Beta-Factor								
Panel A: All times								
all	1,1183	0,2601	0,5404	5,5057	2,2913	0,5695	0,2208	4.386
happy	1,1055	0,1721	0,8415	4,7443	1,4817	0,5587	0,1900	2.593
unhappy	1,1244	0,2285	0,7809	5,8839	2,2913	0,6237	0,2550	3.244
Panel B: Good times								
all	1,0975	0,2461	0,7634	5,4166	2,4599	0,5422	0,2181	4.385
happy	1,0831	0,1596	0,8362	4,3429	1,5426	0,5422	0,2307	2.558
unhappy	1,1068	0,2145	0,7918	5,4166	2,4599	0,5882	0,2732	3.201
Panel C: Bad times								
all	1,2320	N/A	N/A	8,5693	N/A	0,7960	N/A	4.172
happy	1,1777	N/A	N/A	5,6329	N/A	0,7511	N/A	2.118
unhappy	1,2879	N/A	N/A	8,5693	N/A	0,8524	N/A	2.054
Estimation Results for Dividend Yields								
Panel A: All times								
all	5,7600	10,2491	0,0485	8.139,1967	18.191,4119	2,5825	3,3050	3.958
happy	12,7614	19,3079	0,0789	16.274,6733	23.010,4969	2,8200	3,7200	2.379
unhappy	1,9114	0,7335	0,0370	163,9700	298,4231	2,0575	2,5550	3.001
Panel B: Good times								
all	4,1275	5,8566	0,0565	4.271,3243	10.133,6608	2,5825	3,4300	3.955
happy	6,8429	10,0953	0,0815	5.979,8540	11.556,4162	2,8200	3,9100	2.341
unhappy	1,8141	0,5898	0,0350	243,8200	298,4231	2,0575	2,8300	2.874
Panel C: Bad times								
all	15,9339	0,9245	0,0106	48.816,4300	1.298,1114	3,3050	3,3200	3.631
happy	28,7851	0,6200	0,0218	48.816,4300	180,0400	3,7200	3,6300	1.976
unhappy	1,9973	0,2482	0,0138	138,4200	12,1057	2,5550	2,9700	2.308

Estimation Results for the Dispersion Analysis Part ll

	Average (Mean)			**Dispersion (Max. - Min.)**		**Dispersion Stability (75% q - 25% q)**		**N**
	Mean	Standard Deviation	Correlation	Mean	Standard Deviation	Mean	Standard Deviation	
Estimation Results for RoE								
Panel A: All times								
all	6,9352	28,4141	0,0633	11.806,2100	10.951,2400	13,7442	11,8784	4.321
happy	16,9985	26,6635	0,0897	7.507,3570	10.951,2400	13,1362	9,5045	2.519
unhappy	2,6025	18,5091	0,0392	7.882,7400	1.717,0640	15,1640	10,8663	3.387
Panel B: Good times								
all	12,5240	18,8871	0,6685	14.810,8600	14.772,4300	13,3186	9,4823	4.316
happy	18,6761	21,9201	0,2794	12.225,4300	13.554,4100	13,3732	8,4664	2.461
unhappy	4,3955	16,1106	0,0130	8.393,1500	2.004,0900	14,8196	9,6394	3.242
Panel C: Bad times								
all	4,8719	10,2863	0,7517	7.381,5500	6.614,1440	16,6092	5,8248	4.111
happy	13,9024	12,8166	0,8882	5.865,5000	6.614,1440	14,7817	4,6639	2.143
unhappy	- 0,6926	3,7028	0,5726	2.687,7600	527,1550	17,8300	2,1437	2.729
Estimation Results for RoA								
Panel A: All times								
all	4,3432	4,3985	0,1215	182,6500	99,7125	5,7104	3,9490	4.357
happy	5,5169	3,0452	0,1030	149,5000	86,0763	5,4400	3,1908	2.590
unhappy	4,1058	3,8841	0,0448	182,6500	99,7125	6,2093	3,9269	3.432
Panel B: Good times								
all	4,7220	3,7050	0,0112	182,6500	102,7375	5,6893	3,5569	4.356
happy	6,1242	2,3062	0,0108	149,5000	93,5800	5,6090	2,9487	2.544
unhappy	4,2654	3,2505	0,0127	189,1800	102,7375	6,2665	3,5976	3.288
Panel C: Bad times								
all	3,3553	1,8505	0,0245	157,5500	52,6176	6,4367	2,2377	4.190
happy	4,0840	1,3227	0,0659	167,7100	28,1350	5,8225	1,5858	2.173
unhappy	3,2204	1,2457	0,0276	141,4400	52,6176	7,1367	0,9150	2.800
Estimation Results for WCR								
Panel A: All times								
all	4,5692	2,1921	0,0528	10.574,7300	1.206,9020	0,3316	0,1126	4.149
happy	0,2446	0,0996	0,0285	25,9150	15,0103	0,3012	0,0811	2.489
unhappy	5,8060	2,7450	0,0124	10.574,7300	1.206,9020	0,3606	0,1096	1.594
Panel B: Good times								
all	4,2913	1,6004	0,0227	10.566,9700	1.191,3550	0,3305	0,0960	4.149
happy	0,2428	0,0761	0,0164	21,3176	9,9132	0,3043	2,9487	2.447
unhappy	5,6683	2,0768	0,0091	10.566,9700	1.191,3550	0,3658	0,0968	3.117
Panel C: Bad times								
all	1,8740	0,1107	0,0015	2.642,6380	96,8047	0,3460	0,0550	3.966
happy	0,2199	0,0328	0,0103	42,3554	1,2195	0,2995	0,0353	2.035
unhappy	2,7290	0,1225	0,0079	2.642,6380	96,8047	0,3864	0,0231	2.625

This table presents the results of the dispersion analysis for each identified prerequisite. Tests are performed based on the average of the mean, the average standard deviation, the average correlation among all firms, the overall dispersion, the dispersion of the standard deviation, and the dispersion of the prerequisite based on the 75 % and 25 % quartile. N denotes the number of firms considered as observations in each panel. The database is subdivided into all times, good times, and bad times. For each of these panels, data points are differentiated by happy and unhappy firms, based on the ESG score and then compared to the all data panel. The AKP is supported when, the standard deviation, the dispersion, and the average correlation is lower for happy firms than it is for unhappy firms. The AKP is further supported when the average mean for skewness, kurtosis, dividend yield, RoE, and RoA is higher among happy firms compared to unhappy firms and the average mean is lower for the β-factor and WCR among happy firms compared to unhappy firms.

3.4. Results

3.4.1. Dispersion Analysis Results

Table 1 presents the average of the mean of each respective prerequisite over the period of ten years, the average standard deviation, the average correlation among all firms, the dispersion, the mean dispersion, the dispersion of the standard deviation, the dispersion of the prerequisite based on the 75 % and 25 % quartile, as well as the number of firms considered as observations in each panel. The database is subdivided into all times, good times, and bad times. For each of these panels, data points are differentiated by happy and unhappy, based on the ESG score.

Analysing the results for the tail risk, skewness and kurtosis, there is no clear evidence neither in favour nor strongly contradicting the assumptions under the AKP. Analysing skewness, it becomes evident that for mean skewness ($Mean\ (Skewness)$), the results are always slightly positive across all panels for happy and unhappy firms. However, there is no significant deviation from normality of over 0,5 reported for any of the subgroups. Hence, there is no significant distinction between happy and unhappy firms.

The same is true for the dispersion measures. There is no significant distinction between happy and unhappy firms. The only exception would be the dispersion of the mean ($D(Mean(Skweness)$) at good times and the dispersion of the standard deviation ($D(Sd(Skweness)$) at bad times. The first one would support the assumptions under the AKP while the latter contradicts it. However, both effects are down to outliers since when the dispersion is measured based on quartiles ($Dq(Mean(Skweness)$), ($Dq(Sd(Skweness)$), the distinction does not remain. Similarly, to the results of the analysis of skewness, the results for the analysis of kurtosis are inconclusive. On average ($Mean\ (Kurtosis)$), there is little deviation from the normal distribution. All the results range within the normality bracket of -0,5 to 0,5. There appears to be some evidence for the AKP regarding the dispersion of the mean ($D(Mean(Kurtosis)$) at all times and good times. At bad times, the evidence contradicts the assumption under the AKP. However, these effects are also all due to outliers. Again, when the dispersion is measured based on quartiles, the effects neutralize.

Summing up, there is no significant evidence for the AKP concerning tail risk measured based on skewness and kurtosis. This may be due to the way the sample was chosen. To stabilize the results, distressed firms, or firms that went bankrupt were eliminated from the sample. Hence, if the sample was selected differently, the results may look different. Other measures to capture tail risk include drawdowns on stock prices of more than 95 %, firms that went bankrupt or bottom 5 % loss. However, that would require structuring the entire sample differently, also for the other characteristics.

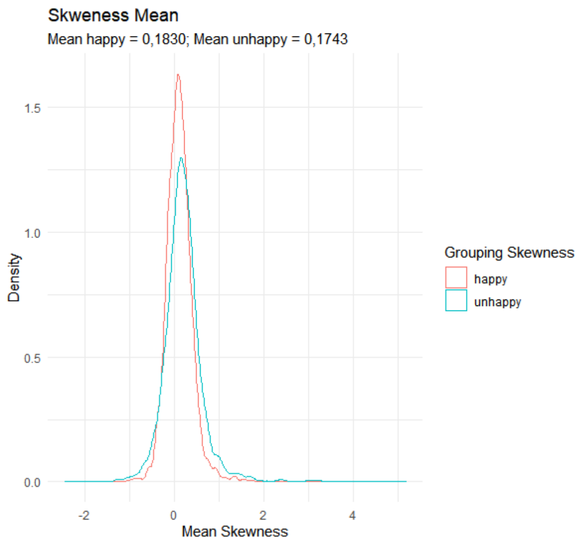

Figure 1 – The graph compares the densities of the mean skewness and shows whether happy firms are more alike (less dispersed) than unhappy firms (more dispersed). To provide more detailed information in the high-density areas, outliers are eliminated. The filter is Mean Skewness` >= -2.8 & `Mean Skewness` <= 11.

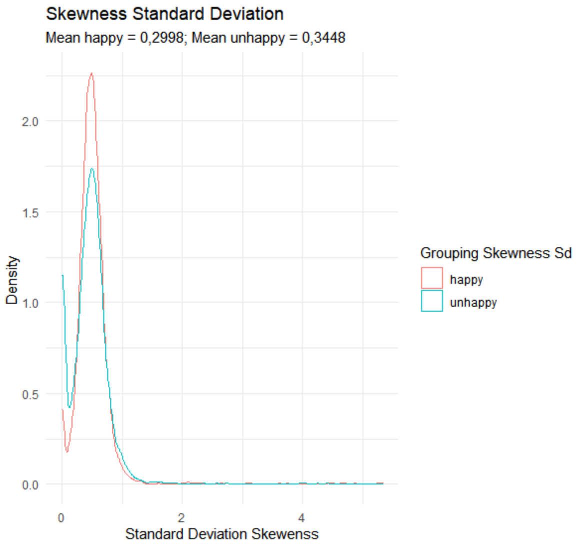

Figure 1 - The graph compares the densities of the standard deviation of the skewness and shows whether happy firms are more alike (less dispersed) than unhappy firms (more dispersed). To provide more detailed information in the high-density areas, outliers are eliminated. The filter is Mean Skewness` >= -3.8 & `Mean Skewness` <= 5.2.

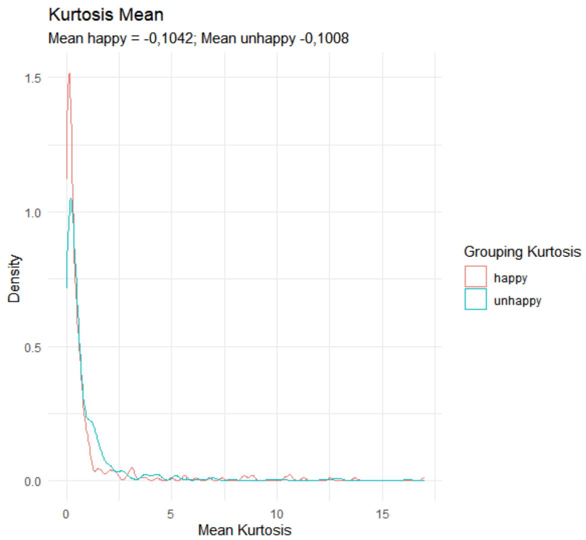

Figure 3 – The graph compares the densities of the mean kurtosis and shows whether happy firms are more alike (less dispersed) than unhappy firms (more dispersed). To provide more detailed information in the high-density areas, outliers are eliminated. The filter is Mean Kurtosis >= 0L Mean Kurtosis <= 18L.

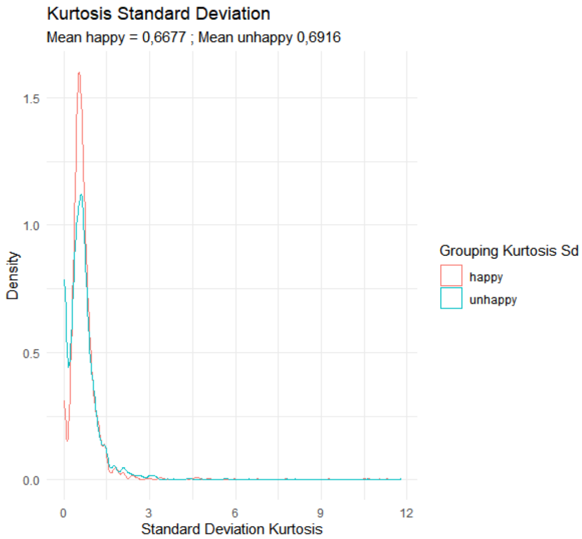

Figure 4 – The graph compares the densities of the standard deviation of the kurtosis and shows whether happy firms are more alike (less dispersed) than unhappy firms (more dispersed). To provide more detailed information in the high-density areas, outliers are eliminated. The filter is Sd Kurtosis >= 0L & Sd Kurtosis <= 12L.

Figures 1 and 2 present the mean skewness and the skewness standard deviation by comparing happy and unhappy firms. It is a graphic illustration of the estimates presented in table 1 for skewness. The graphs compare the densities of the mean skewness, respectively the skewness standard deviation, and show whether happy firms are more alike (less dispersed) than unhappy firms (more dispersed). To provide more detailed information in high-density areas, outliers are eliminated. For the mean skewness, it becomes evident that there is no significant difference between happy and unhappy firms. Filters are set extremely narrow to see some slight differences, suggesting a lower degree of dispersion among happy firms, for both measures, mean and standard deviation. The same is true for Figures 3 and 4. Again, filters are chosen in an extremely narrow bracket to make some differences at all visible. Yet, those are not significant.

Results for the β-factor display strong evidence of the Anna Karenina Principle (AKP) for the β-factor across the boards. The first measure to distinguish between happy and unhappy firms ($Mean\ (\beta)$), confirms the expectations. Happy firms, on average, show a lower β-factor. This is due to corporate governance and risk mitigation strategies shielding themselves from systematic risk factors. The average standard deviation $Sd\,(\beta)$ is lower among happy firms. This is further confirmed by the lower dispersion of the mean β-factor ($D(Mean(\beta))$ in the bracket of happy firms. Since the results remain stable even when the dispersion is measured in terms of the quantiles between the 75 % and 25 % quartile ($Dq(Mean(\beta))$, ($Dq(Sd(\beta))$, it can be concluded that this is not just an outliers effect. These findings are in line with the existing literature suggesting that sustainable firms are subject to lower costs of capital due to enhanced risk management of systematic risk (Ghoul, Guedhami, Kwok, & Mishra, 2011) (Gregory, Tharyan, & Whittaker, 2013) (Giese, Lee, Mealas, Nagy, & Nishikawa, 2019).

Yet, there is a certain degree of asymmetry for the β-factor. While hypothetically, certain companies may have a negative β-factor, it is still unlikely. This would imply that a stock market price is detached from all market movements and show an inverse relation to market movements. Hence, the β-factor is floored at around zero or slightly below. While extremely high β-factors also appear implausible, there is still a slightly wider upward range up until 3 or 4. This is further confirmed by a higher correlation in the happy bracket during both good times and all times ($\rho\ (\beta)$).

Figures 5 and 6 support the estimates presented in table 3 graphically. Among happy firms, lower mean β-factors occur more often. Regarding the standard deviation of the β-factors, measured over the years, happy firms show a lower standard deviation compared to unhappy firms. Hence, this is further evidence that the β-factor can be understood as a prerequisite under the AKP.

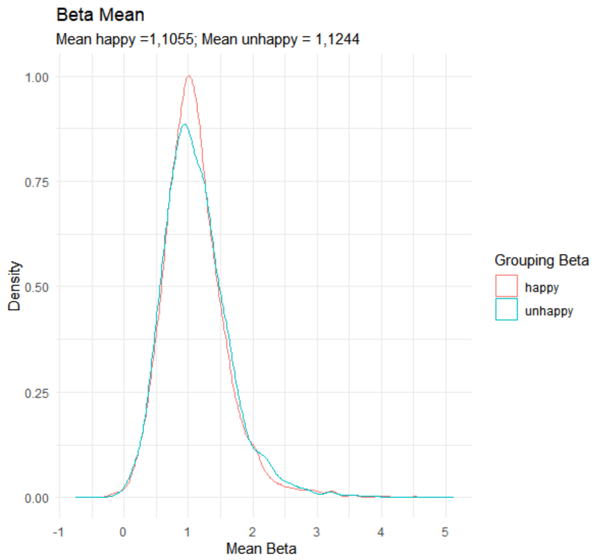

Figure 5 – The graph compares the densities of the mean β and shows whether happy firms are more alike (less dispersed) than unhappy firms (more dispersed). (No filter)

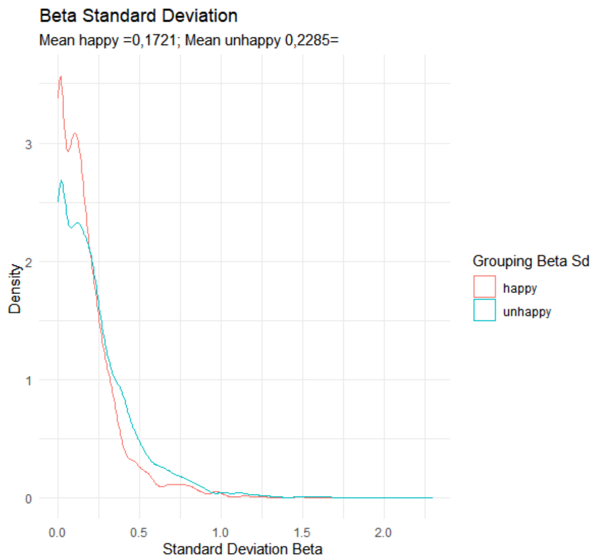

Figure 6 - The graph compares the densities of the standard deviation of the β and shows whether it is more alike (less dispersed) for happy firms than unhappy firms (more dispersed). (No filter)

For the results of the dividend yield, and it becomes clear that there is little evidence for the AKP. Only the hypothesis that the mean dividend yield ($Mean\ (Div.Yield)$) is higher among happy firms could be confirmed. However, it seems curious that the dividend yield is higher for both happy and unhappy firms at times of lower economic performance compared to times of economic boom. At first, these results appear to be counterintuitive. One possible explanation could be that the dividend yield is calculated based on the dividends paid over the share price. From the literature, it is known that dividends are sticky (Sheikh, 2022). If, on average, the share price decreases, but the dividends paid remain stable, the dividend yield increases. Combining the evidence from the signalling theory and sticky dividends with the assumption that sustainable firms are, on average, more profitable, especially during times of economic slowdown, this could mean that on average, happy firms experience a less severe decrease in stock prices compared to unhappy firms. The dividend yield increases for unhappy firms at times of economic slowdown a little more rapidly. Moreover, considering all the other measures of dispersion, the AKP does not hold. The dividend yield appears to be more dispersed among sustainable firms than it is among unsustainable firms. $Sd\ (Div.yield)$, $Sd\ (Div.Yield)$, $(D(Mean(Div.Yield))$, $(Dq(Mean(Div.Yield))$, $(Dq(Sd(Div.Yield))$ This is in line with the findings of Baur (2021) for stock returns and can be explained by the asymmetry of the dividend yield. While firms could potentially pay infinitely high dividends, dividends are floored at zero. Consequently, the dividend policy of a firm is distinct between firms with higher and lower ESG ratings in the sense, that sustainable firms show a higher dividend yield, but not in terms of dispersion.

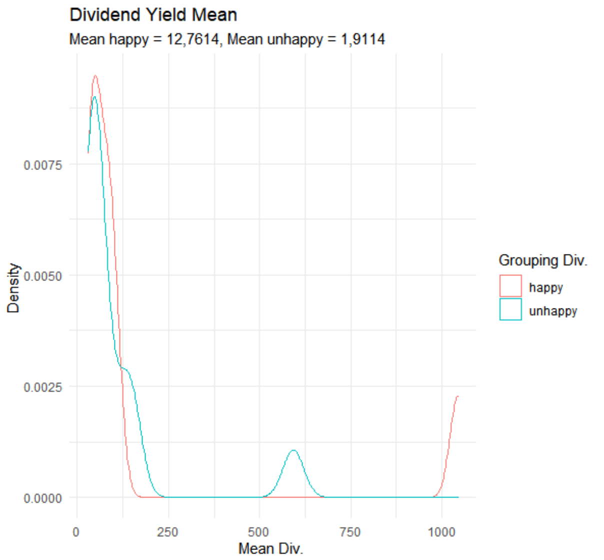

Figure 7 – The graph compares the densities of the mean of the dividend yield and shows whether it is more alike (less dispersed) for happy firms than unhappy firms (more dispersed). To provide more detailed information in the high-density areas, outliers are eliminated. The filter is: Mean >= 30L & Mean <= 1050L.

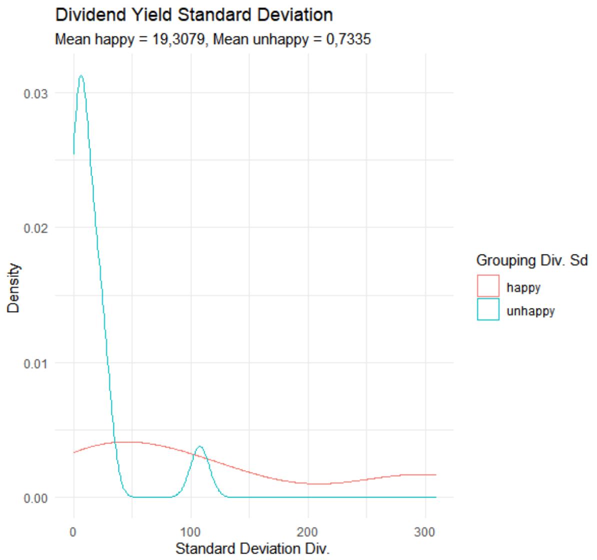

Figure 8 - The graph compares the densities of the standard deviation of the dividend yield and shows whether it is more alike (less dispersed) for happy firms than unhappy firms (more dispersed). To provide more detailed information in the high-density areas, outliers are eliminated. The filter is: Mean >= 30L & Mean <= 1050L.

Reviewing the graphical results in Figures 7 and 8, they offer further confirmation of the results presented in table 1 for dividend yields. There is no conclusive evidence for the AKP regarding dividend yields. While dividends, and as such dividend yields are floored at zero, there is still a high occurrence of dividends around zero or slightly above. Hence, there is a high occurrence of firms with a dividend yield of zero or slightly above among both happy and unhappy firms. Yet, some firms show significantly higher dividend yields in the happy bracket. So, the assumptions under the AKP can be partially confirmed. This is also in line with the fact that the standard deviation appears far more widespread among happy firms. Of course, this is the result of the fact that dividends are floored at zero and happy firms tend to pay higher dividends on average.

Tabel 1 shows mixed results for the AKP for the RoE. Reviewing the ($Mean\ (RoE)$) it is expected that happy firms, on average, show a higher RoE. This expectation can be confirmed. The distinction between the mean RoE of happy firms and unhappy firms is especially stark at bad times. While the RoE decreases at bad times for the happy firms as well, unhappy firms are disproportionately affected. The average RoE for unhappy firms even turns negative at bad times. This is also in line with previous research (Gonçalves, Gaio, & Robles, 2018). Since distressed firms with negative equity were already eliminated from the sample, the reported negative RoE stems from the nominator in the RoE formula only. It implies that unhappy firms, at bad times, on average, accounted for a net loss. However, the dispersion measures that do not account for outliers did not confirm the initial hypothesis under the AKP. The standard deviation of the RoE $Sd(RoE)$, and the dispersion of the mean RoE ($D(Mean(RoE)$), as well as the dispersion of the standard deviation ($D(Sd(RoE)$) suggest a higher dispersion among happy firms compared to unhappy firms. Yet, this can be understood as an effect of outliers. Considering the dispersion among happy firms compared to unhappy firms based on the 75 % and 25 % quartile $Dq(Mean(RoE))$, ($Dq(Sd(RoE))$, it becomes evident that this effect does not remain when outliers are eliminated. The dispersion of the RoE among unhappy firms is higher than among happy firms for all panels except for the dispersion of the standard deviation ($Dq(Sd(RoE)$) at bad times. The dispersion of the standard deviation remains lower, for unhappy firms compared to happy firms. It not only shows that the reported RoE values ($Mean$ (RoE)) at bad times are significantly lower but also appears to be stable and subject to little variation at that lower level. This could suggest that at times of economic slowdown, less sustainable firms are not only less profitable, but also limited in their ability to increase profitability again.

Figures 9 and 10 visualise the results in table 1 for the RoE graphically. The mean RoE of happy firms is slightly moved to the right. Hence, there is a higher occurrence of slightly higher RoEs among happy firms. At the same time, happy firms have outliers, both at the upper end and at the lower end. When those are eliminated, the dispersion is lower among happy firms (table 1 RoE Quartiles). Yet, as a cross-section of all firms, unhappy firms have a higher occurrence of lower standard deviation over the years.

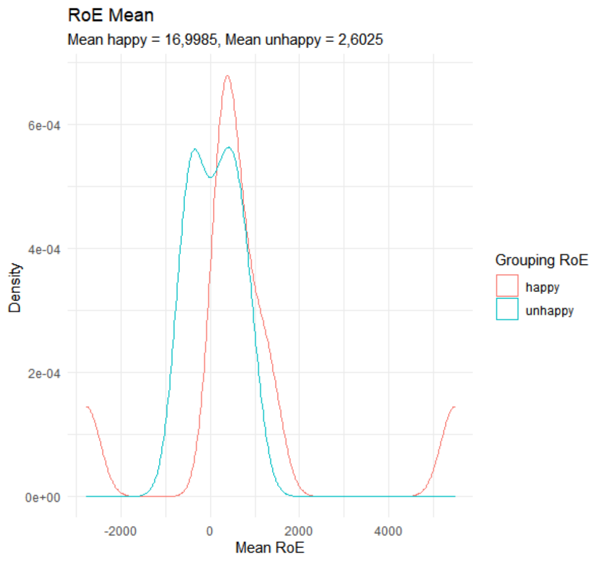

Figure 9 – The graph compares the densities of the mean of the RoE and shows whether it is more alike (less dispersed) for happy firms than unhappy firms (more dispersed). To provide more detailed information in the high-density areas, outliers are eliminated. The filter is: Standard Deviation RoE >= 400L & Standard Deviation RoE <= 11700L.

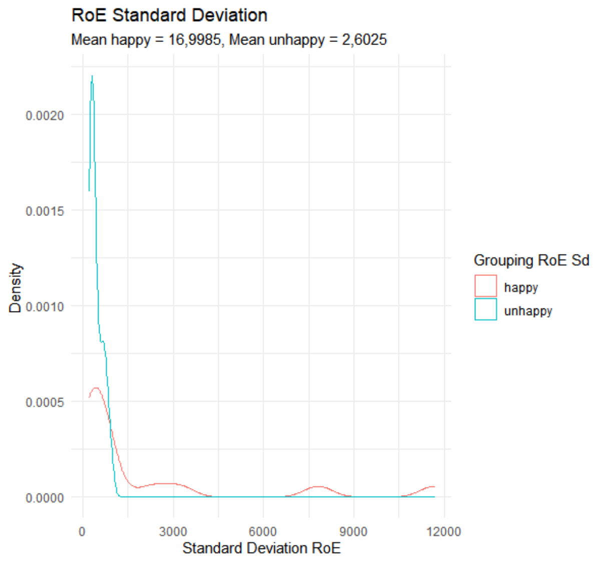

Figure 10 - The graph compares the densities of the standard deviation of the RoE and shows whether it is more alike (less dispersed) for happy firms than unhappy firms (more dispersed). To provide more detailed information in the high-density areas, outliers are eliminated. The filter is: Standard Deviation RoE >= 200L & Standard Deviation RoE <= 11700L.

Reviewing the results of table 1 for the RoA, there is some evidence for the AKP regarding the RoA. Similarly, to the results of the RoE, there is evidence that the RoA of a firm is distinct between firms with higher and lower ESG ratings. More precisely, the mean RoA ($Mean\ (RoA)$), is higher for firms with a high ESG rating. However, in bad times the difference between happy and unhappy firms is not as pronounced as it is for the RoE. As for the average correlation (ρ (RoE)), the results confirm the assumptions of the AKP to a certain degree. At all times and bad times, unhappy firms are less correlated and as such more dispersed and less alike. At good times, the results are approximately level, showing no real distinction. Regarding the other dispersion measures, the results also show strong evidence for the AKP. Only at bad times, the dispersion of the mean ($D(Mean(RoA)$) breaks with the initial assumption according to which unhappy firms should be more dispersed. Yet, this is the result of outliers in the happy firms' bracket. The effect is no longer evident when the dispersion is measured based on quartiles $Dq(Mean(RoA))$. However, similarly to the findings for the RoE, the dispersion of the standard deviation, based on quartiles, at bad times is less dispersed among unhappy firms than it is among happy firms. This suggests that when outliers are omitted, on average, unsustainable firms have low variation at a comparatively lower level of profitability.

Figure 11 and 12 both confirm that there is strong evidence that RoA is a prerequisite of a sustainable firm under the AKP. Similarly, to the RoE, happy firms almost mirror the graph of unhappy firms only that is moved slightly to the right. As such, this illustrates that happy firms have a slightly higher RoA than unhappy firms. Unlike the RoE, there is even strong evidence for the AKP regarding the standard deviation of the RoA. The standard deviation appears to be far less dispersed among happy firms than among unhappy firms for the RoA.

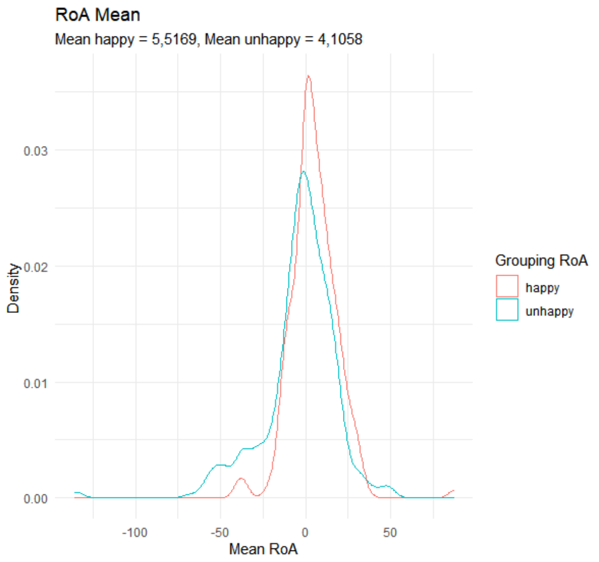

Figure 11 - The graph compares the densities of the mean of the RoA and shows whether it is more alike (less dispersed) for happy firms than unhappy firms (more dispersed). To provide more detailed information in the high-density areas, outliers are eliminated. The filter is: Standard Deviation RoA >= 9L & Standard Deviation RoA <= 100L.

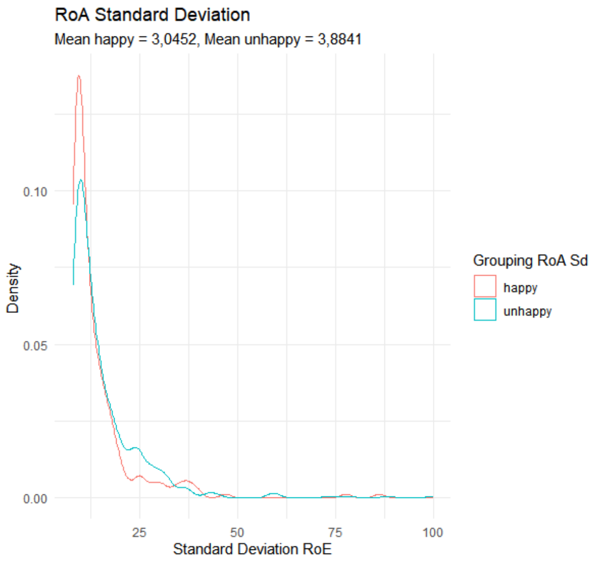

Figure 12 - The graph compares the densities of the standard deviation of the RoA and shows whether it is more alike (less dispersed) for happy firms than unhappy firms (more dispersed). To provide more detailed information in the high-density areas, outliers are eliminated. The filter is: Standard Deviation RoA >= 8L & Standard Deviation RoA <= 100L.

Looking at the results for the WCR, it becomes evident that the results are in line with the expectations under the AKP across the boards. On average ($Mean\ (WCR)$), happy firms report a lower WCR compared to unhappy firms at all times, good times, and bad times. Curiously, when comparing the good times and bad times panels, at good times, happy firms are able to continue to operate at a lower level of WCR. On the other hand, while unhappy firms have to provide a higher safety cushion at both good times and bad times to avoid liquidity constraints, the gap between happy firms and unhappy firms is less pronounced at bad times. This is unexpected.

WCR can be understood as another measure of firm profitability and efficient business operations which takes an adverse hit during times of economic slowdown (Gonçalves, Gaio, & Robles, 2018). Hence, while there is strong evidence for the initial assumption, happy firms are more operationally efficient which is expressed in lower levels of WCR, can be confirmed, the added assumption that this contrast will be especially stark when the economic cycle takes a hit, could not be confirmed.

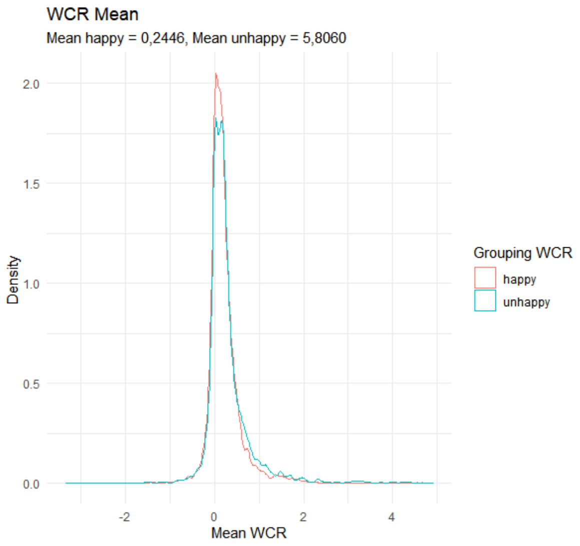

Figure 13 - The graph compares the densities of the mean of the RoA and shows whether it is more alike (less dispersed) for happy firms than unhappy firms (more dispersed To provide more detailed information in the high-density areas, outliers are eliminated. The filter is: Mean >= -5L & Mean <= 5L. Given the narrow filter, it does not become visible, that the unhappy firms bracket has significant outliers especially on the upper end.

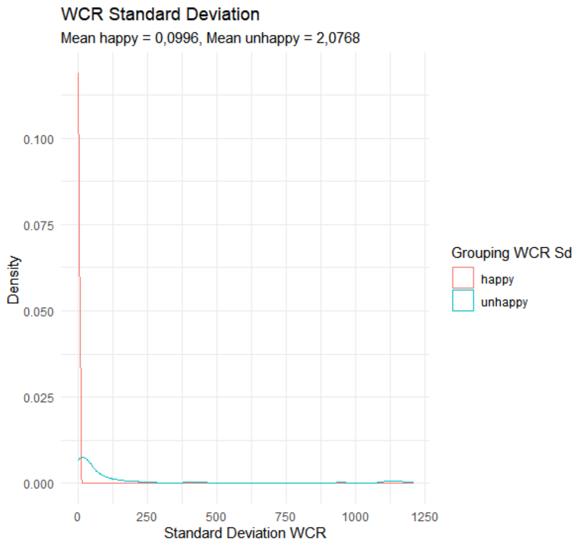

Figure 14 - The graph compares the densities of the standard deviation of the WCR and shows whether it is more alike (less dispersed) for happy firms than unhappy firms (more dispersed). To provide more detailed information in the high-density areas, outliers are eliminated. The filter is: Mean >= 10L & Mean <= 10600L

As for the dispersion measures, the initial hypothesis can be confirmed. The dispersion of the mean ($D(Mean(WCR))$, as well as, the standard deviation ($D(Sd(WCR))$ of WCR, show strong evidence for the AKP. The only exception to that is the dispersion of the standard deviation based on quartiles at good times and bad times $Dq(Sd(WCR))$. This means that the strong results are, in part, also supported by strong, and significant outliers.

When reviewing Figures 13 and 14, the results first appear counterintuitive when analysed in combination with table 1 for WCR. Since the results appear to be virtually the same, also in mind the extremely narrow filters to make slight differences at all visible. Yet, on average, the WCR of happy firms is materially lower. While the results for unhappy firms are more widespread and subject to some large outliers. This effect is further confirmed by figure 14. Unhappy firms also show higher standard deviation while happy firms maintain relatively low levels of WCR at a constant level. Hence, the standard deviation is at around zero for happy firms which is in line with the results presented in table 1 for WCR. This means that happy firms show a stable lower level of WCR. In other words, this means happy firms are stable at a more efficient and more profitable level of lower WCR.

3.4.2. Results Robustness Test - Fuzzy Set Qualitative Comparative Analysis

Building on the evidence from the dispersion analysis, the identified prerequisites of low β-factor, high Dividend Yields, high RoE/RoA and low WCR are tested for the AKP. The results for tail risk are inconclusive. Therefore, tail risk is not considered for further analysis.

TABLE 2: NECESSARY CONDITION FOR A HIGH ESG FIRM

Necessary Condition for a high ESG firm

Conditions tested:	**Consistency**	**Coverage**
~Beta1	0,750233	0,644258
Div1	0,648727	0,695605
RoE1	0,785407	0,679208
RoA1	0,774933	0,660399
~WCR2	0.981917	0,828141

This table presents the results of the necessary condition analysis. Under this setup, only the negated WCR presents a necessary condition.

Before the fuzzy set truth table is constructed, necessary conditions are identified. “A necessary condition is a condition that must be present for the outcome to occur, but its presence does not guarantee that occurrence” (Ragin, 2009). A single condition is considered to be necessary if the consistency score exceeds the threshold of 0.90 (Schneider & Wagemann, 2012). For this reason, only WCR could be identified as a necessary condition with a consistency score, of 0,9819 approaching 1. While this contradicts the initial hypothesis that a low β-factor is a necessary condition it shows instead that operational efficiency is a key factor in a sustainable firm. This finding is also in line with the findings of the dispersion analysis. The difference between happy and unhappy firms suggested a stark difference already.

For the construction of the truth table (table 3), necessary conditions do not need to be considered. Hence, WCR, as an identified necessary condition, is not included in the set-up of the truth table. Reviewing the results from the truth table, it becomes evident that across all variances, the raw consistency value is relatively high. The literature considers a consistency score of 0,75 to be the minimum score to classify a variance as true in the sense that it leads to the expected outcome (Thomann & Ege, 2021). In this case, an outcome that is defined as true is a happy firm in the sense that it is a firm with a higher ESG score. At this lowest consistency level, only one variance would be classified as not true, meaning that the outcome would not be a happy firm. Taking a closer look, this variance shows high β-scores being present, and high dividend yields, high RoE and RoA being absent e.g., contradicting all the initial assumptions under the AKP. Yet, this finding supports the AKP. Collecting the relatively highest number of cases under the only variance that contradicts all the assumptions made in this paper and leads to an outcome that is not true, is strong evidence for the AKP. Especially since the variance with the second highest number of cases presents the exact opposite of this variance (591 cases). It shows high β-factors are absent, and high dividend yields, high RoE and RoA are present, and the outcome is true at a raw consistency score of 0,842236.

TABLE 3: TRUTH TABLE

Truth table

Beta1	Div1	RoE1	RoA1	number	ESG1	raw consist.	PRI consist	SYM consist
1	1	1	0	54	1	0,907136	0,541818	0,542026
1	1	0	1	35	1	0,899311	0,500877	0,50156
0	1	1	0	86	1	0,898568	0,552776	0,553075
0	1	0	1	50	1	0,890102	0,507999	0,50806
0	0	1	0	31	1	0,873642	0,370087	0,370377
1	1	0	0	293	1	0,86737	0,485878	0,491889
0	1	0	0	332	1	0,867014	0,500914	0,507459
1	0	1	0	43	1	0,866153	0,347516	0,348191
0	0	0	1	68	1	0,862938	0,342741	0,343008
1	0	0	1	48	1	0,857321	0,315031	0,316724
1	1	1	1	405	1	0,854074	0,486154	0,501135
0	1	1	1	591	1	0,842236	0,533383	0,554196
0	0	1	1	331	1	0,811531	0,329095	0,343291
1	0	1	1	322	1	0,801819	0,288149	0,296908
0	0	0	0	356	0	0,797947	0,281212	0,291927
1	0	0	0	668	0	0,721982	0,238232	0,258934

The table shows the results from the truth table. The cut-off value is set as 0.8. Variances with less than 1 case are not considered. B is defined as absent. Div., RoE and RoA are defined as present.

The results of the truth table analysis are visualised in table 4. It includes all meaningful combinations at a cut-off level of 0,8. The coverage of all solutions is 0.878282. Hence, 87,8282% of the cases are jointly explained by these three solutions. This presents the waste majority of the cases. The raw coverage value measures the degree to which a causal combination exclusively justifies a specific result. (Gonçalves, Gaio, & Silva, 2018) RoE and RoA display a raw coverage of over 0,75, the minimum cut-off level to be considered empirically relevant. However, dividend yields do not. Thus, the dividend yield is not a sufficient condition for a sustainable firm. Unique coverage values range between 0,015 and 0,065. This is an indicator of how much of the membership in the outcome is covered by the membership of the corresponding path. Unlike raw coverage, unique coverage is not floored at a certain threshold. The unique coverage measures how much a single path uniquely covers so that low unique coverage paths can also be relevant. All unique coverages are > 0. thus, no logically redundant path is included in the solution (Schneider & Wagemann, 2012) and they all contribute to explaining the outcome (Böhm, 2017).

Comparing the parsimonious solution to the intermediate solution shows that both solutions present the same results. This is evidence that all solutions are core, the presence of high dividend yields, high RoE and high RoA. Though, as mentioned before, the high dividend yield is considered to be not empirically relevant for both solutions. An aspect that appears curious is that there is not a single solution that requires a logical conjunction of two variables. So in fact, variables have an isolated effect on the sustainability of a firm at this cut-off level.

TABLE 4: FSQCA RESULTS: CONFIGURATION FOR HIGH ESG SCORE CUT-OFF 0,8

FsQCA results: Configuration for High ESG Score Cut-off 0,8

	Soloutions		
	1	2	3
Div1	●		
RoE1		●	
RoA1			●
raw coverage	0,648727	0,785407	0,774933
unique coverage	0,0653049	0,0177424	0,0154195
consistency	0,695605	0,679208	0,660399
Solution Coverage	0,878282		
Solution Consistency	0,610685		

Legend: ● = core causal condition present; ○ = core causal condition absent;
● = peripheral causal condition present; ○ = peripheral causal condition absent.

The table compares the results of the parsimonious solution to the results of the intermediate solution at a cut-off level of 0,8.

To test the sensitivity of the results, the truth table analysis was also performed at a cut-off level of 0,85. While all five solutions are found core, meaning that the parsimonious solution and the intermediate solution are identical, each solution has a raw coverage value of below 0,75. Hence none of these solutions is empirically relevant. However, this is unsurprising. As mentioned before, the variance confirming the assumptions made under the AKP shows a raw consistency of 0,842236. Consequently, at a cut-off level of 0,85 for this variance, the outcome is considered to be not true. This is also reflected in the results. While at the cut-off value of 0,8, all solutions were expressed by an individual condition, at a cut-off value of 0,85 the solutions are expressed by a conjunction of conditions. Yet, there is no logical explanation for the results under the hypothesis made under the AKP.

It follows that the results are stable at a cut-off level of 0,8 but not at a cut-off level of 0,85.

TABLE 5: FSQCA RESULTS: CONFIGURATION FOR HIGH ESG SCORE CUT-OFF 0,85

FsQCA results: Configuration for High ESG Score Cut-off 0,85

	Soloutions				
	1	2	3	4	5
Beta			●	●	
Div1			●		●
RoE1	●	○			
RoA1	○	●		○	○
raw coverage	0,565924	0,569827	0,447429	0,468279	0,470515
unique coverage	0,0212703	0,0256576	0,0587441	0,00254148	0,000437915
consistency	0,830495	0,815781	0,804712	0,818196	0,81219
Solution Coverage	0,732744				
Solution Consistency	0,752045				

Legend: ● = core causal condition present; ○ = core causal condition absent;
● = peripheral causal condition present; ○ = peripheral causal condition absent.

The table compares the results of the parsimonious solution to the results of the intermediate solution at a cut-off level of 0,85.

4. CONCLUSION

Overall, the question of whether there is a set of financially measurable prerequisites that are key to a sustainable firm, and if all sustainable firms are in fact similar, could, in part, be confirmed. This overarching question was derived from the concept of the Anna Karenina Principle. On the one hand, the mean average was compared and set in relation to the expectations of the literature. These findings were, in a later step, tested for stability under the fsQCA. On the other hand, the dispersion of a characteristic was analyzed to explore if all firms are similar.

For this, the sample was drawn from the Frankfurt stock exchange, the largest market for financial instruments traded in the EU (Börse Frankfurt , 2022). Since the majority of the studies, in and around sustainable finance, are based on data from the US stock market, this paper can confirm that certain finds are largely transferable to the European market.

The question of whether there is a set of financially measurable prerequisites that are key to a sustainable firm is answered first. There is strong evidence that happy firms show lower β-factors, higher dividend yields, higher RoE / RoA and lower WCR. As such, this confirmed the assumptions made in the literature review. For the tail risk, the findings were inconclusive. This could in part be due to the way the sample was selected. Distressed firms were eliminated, and different measures (drawdowns on stock prices of more than 95 % or firms that went bankrupt, bottom 5 % loss) may have led to different results.

Beyond that, findings, considering the economic cycle are also largely in line with existing literature. As expressed by the results from the RoE / RoA analysis, at times of economic slowdown, happy firms can withstand the negative effects and remain more profitable. For dividend yields, this effect did not materialise itself. There is a significant number of firms that have, even though they are sustainable and profitable, a low dividend yield. The effects are especially stark at times of economic slowdown. One possible explanation for this is that there is a multitude of other considerations that play into setting the dividend policy, such as sticky dividends, an effect related to signalling theory. Also, for WCR, even though it is an immediate contradiction to the existing literature, at bad times the difference between happy and unhappy firms is not, as expected, especially pronounced. However, WCR could be identified as a necessary condition under the fsQCA. Consequently, a firm needs to achieve operational efficiency to become a sustainable firm. Moreover, at a consistency level of 0,8, high RoE and high RoA are considered empirically relevant core conditions. It follows that operational efficiency and productivity are key factors to a sustainable firm. However, the considerations under the ex-ante, ex-post hypothesis under which a low β-factor is considered a necessary condition was not confirmed. Curiously, a low β-factor was not even included as a solution under the sufficient condition analysis. Moreover, no solution, at this cut-off level suggested that there is a specific interdependence of factors. Yet, it is worth noting that there is a distinction between β-factors and dividend yields between firms with a higher and lower ESG factor.

Concerning the question of whether all happy firms are similar, results are mixed. Again, for tail risk, findings are inclusive. For the β-factor, RoA and WCR the assumptions are confirmed across the boards. The dispersion for these factors is lower among happy firms than it is among unhappy firms. For the RoE, the results are slightly more mixed. The dispersion among happy firms is higher than it is among unhappy firms. Yet, this is due to outlier effects. As for dividend yields, happy firms show much higher dispersion. However, this is not unexpected as this is due to the same effects, the original author Baur (2021) witnessed in his paper, volatility asymmetry. While dividends and as an extension of that dividend yields can potentially grow till infinity, they are floored at zero. (A brief summary of all the results can be found in the appendix.)

This is another key takeaway from this paper. Potential characteristics need to be symmetrical. Specifically, this means that they need to be equally volatile in both directions. Otherwise, it always leads to inconsistent results that suffer from volatility asymmetry.

However, under these conditions, the AKP adds to the existing literature by offering a more holistic angle to a research question. The combination of the fsQCA to enhance and confirm the finding of the mean average, identify causal connections of variables and the dispersion analysis present a great toolkit to approach research questions under the AKP. Especially so since the dispersion analysis alone does not offer any significance levels, this is a way to score attributes and distinguish between necessary and sufficient conditions.

In fact, for future research, there might be even more characteristics of a sustainable firm that were not subject to this paper. Moreover, the importance of operational efficiency in a sustainable firm can be explored further.

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APPENDICES

TABLE 6: REFINITV EIKON'S ESG RATING METHODOLOGY

Pillar	Category	Category weights	Category weights	Sum of category weights
Environmental	Emissions	0,98	0,15	
Environmental	Resoures use	0,97	0,15	0,44
Environmental	Innovation	0,85	0,13	
Social	Community	0,89	0,09	
Social	Human rights	0,95	0,05	0,31
Social	Product resposibility	0,92	0,04	
Social	Workforce	0,98	0,13	
Corporate Governance	Shareholders	0,73	0,05	
Corporate Governance	CSR strategy	0,34	0,03	0,26
Corporate Governance	Management	0,19	0,17	

The table shows the different dimensions of Refinitv Eikon's ESG rating methodology. ESG pillar scores are the relative sum of the category weights. Source: (Refinitiv, 2022)

TABLE 7: CALIBRATION ANCHORS

Calibration anchors for each fuzzy set

Set	Calibration Anchors		
	Fully in	**Crossover**	**Fully out**
Beta-factor*	1,98	1,06	0,43
Dividend Yield	2,07	0,18	0,00
RoE	38,90	9,14	- 27,30
RoA	15,10	4,66	- 7,18
WCR turnover*	11,30	1,16	- 0,52
ESG score	90,00	50,00	10,00

* Scores are negated, to adjust for the lower expected value.

The table displays the used calibration anchors for each condition.

TABLE 8: RESULTS MEAN AVERAGE AND DISPERSION ANALYSIS

Summary of the Results for the Dispersion Analysis

	Average (Mean)			**Dispersion (Max. -**		**Dispersion**		**Explaination**
	Mean	Standard Deviation	Correlation	Skewness	Standard Deviation	Mean	Standard Deviation	
Characteristic								
Tail Risk	-	-	-	-	-	-	-	Distressed firms were eliminated, different measures (drawdowns on stock prices of more than 95 % or frims that went bankrupt, bottom 5 % loss) may would have led to different results. However, it would require a different overall population
Beta	✓	✓	✓	✓	✓	✓	✓	In line with the expectations, also benefitted slightly from the asymmetry of the measurment
Dividend Yield	✓	×	×	×	×	×	×	Asymmetry of meausrement
RoE	✓	×	×	×	×	✓	✓	In line with the expectations.
RoA	✓	✓	✓	✓	✓	✓	✓	In line with the expectations.
WCR Turnover	✓	✓	✓	✓	✓	✓	×	In line with the expectations.

Legend: - = inconclusive, ✓ = positve evidence, × = negative evidence

The table provides an overview of the dispersion measures under the AKP.