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EU Taxonomy and Stock Performance

Master Thesis

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Abstract

This thesis investigates the link between environmental, social, and corporate governance (ESG) performance and stock performance in Europe between 2012-2021. We apply ESG data from Refinitiv's Eikon database and construct our own framework based on the EU Taxonomy. In combination, we use the SASB (Sustainability Accounting Standards Board) framework to see if there is any coherence between the two. Furthermore, we are sorting portfolios into top-, medium-, and bottom-performance ESG portfolios. Our research finds no abnormal returns between the top-, and bottom-ranked ESG portfolios, suggesting a neutral relationship between ESG performance and stock performance. This implies that ESG performance neither creates nor destroys value and that the EU Taxonomy does not impact our portfolio returns.

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List of Abbreviations

CAPM	Capital Asset Pricing Model
CMA	Conservative minus aggressive
DNSH	Do no significant harm
ESG	Environmental, Social, and Governance
EU	European Union
EW	Equal Weighted
MMS	Meet minimum safeguard
MOM	Momentum
MRRF	Market return over the risk-free rate
MTB	Market-to-Book ratio
NACE	Nomenclature of Economic Activities
RMW	Robust minus weak
SASB	Sustainability Accounting Standards Board
SMB	Small minus big
TR	Taxonomy Regulation
VW	Value Weighted

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1. Introduction and motivation

Climate change and sustainability are two of the most pressing issues of today, potentially affecting practically everyone's health and well-being. Therefore, there is a broad agreement that climate challenges and sustainable development should be addressed. The Organization for Economic Co-operation and Development (OECD) estimates that EUR 6.35 trillion annually must be invested globally to achieve the goals of the Paris Agreement by 2030 (OECD Publishing, 2017). Thus, governments and investors probably must commit to reallocate their investments to achieve the Paris goal by 2030. The creation of sustainable initiatives and the focus on Environmental, Social, and Governance (ESG) have increased investors' willingness to invest sustainably (Lana Crowe, 2021).

Numerous research has been documented in the last years, analyzing the relationship between companies' ESG scores and financial performance. This relation has been investigated on stocks, funds, and indices. As the research has been so abundant, several meta-studies have been conducted. Research of over 1,000 reports suggests that the correlation between ESG characteristics and financial performance was inconclusive, finding both negative and positive correlations (Giese et al., 2019). The meta-equivocal study's results might be due to a variety of factors. One explanation might be that the ESG characteristics presented are incomplete. Another explanation is that ESG rating providers produce ambiguous findings regarding a company's actual ESG performance. Different ESG rating agencies disagree on what constitutes a sustainable business (Chatterji et al., 2016). Nobody truly knows what defines a sustainable operation, and there is currently no standard definition of what constitutes a sustainable activity (Berg et al., 2020).

To address the sustainability issue, the European Union (EU) has proposed the European Green Deal, a growth strategy with an overarching objective of making the EU the first climate-neutral continent by 2050. As part of the EU's effort to reach these objectives, they introduced the EU Taxonomy Regulation (TR) – a classification system for environmentally sustainable activities (European

Commission, 2021). Accordingly, the TR describes a green classification system that puts the EU's climatic and environmental goals into numerical values. This would help determine which economic activities substantially contribute to the Green Deal objectives (European Commission, 2021). These criteria can help companies and investors accelerate the transition to sustainability and could set a new gold standard for sustainable reporting (Peel & Khan, 2019).

The EU is not the first to attempt to define sustainable activities. The Sustainability Accounting Standards Board (SASB) has defined material factors that are financially material. These material factors are chosen based on an industrial perspective, with each industry focusing on different sustainable factors. "Corporate Sustainability: *First Evidence on Materiality*" (2016) by Mozaffar Khan, George Serafeim, and Aaron Yoon finds a positive relationship between high materiality performance and financial performance. They suggest that companies with high performance on material factors within their industry would deliver better financial performance.

It may be challenging for investors who wish to include ESG metrics in investment decisions because several research articles have been written on the phenomena of ESG on stock performance. Accordingly, we would add to the research in this area by employing the TR, a soon-to-be-regulatory definition of sustainability. This thesis concentrates on material corporate factors rather than ESG ratings. We build our own materiality framework based on the TR, with three portfolios (Fail, Low, and High) based on the TR's central concept. We will also use the SASB framework to create three SASB materiality portfolios (Low, Medium, and High). Using the two frameworks, we will also develop integrated portfolios to see if they are coherent with each other. Companies that perform High according to the TR and High according to the SASB framework are, for example, integrated into a single portfolio. Suitably, since the TR primarily focuses on the European continent, we apply the Europe STOXX 600 index as our sample data.

We use the Fama-French five-factor model and the five-factor model with momentum for our analysis. Our results show that the Low-performance materiality portfolio has the highest abnormal return of the three SASB portfolios. Using our own TR framework, we obtain varied findings, indicating that the High-performance TR portfolio yields the highest return when the portfolios are value-weighted (VW). In contrast, the Low-performance TR portfolio yields the highest return when the portfolios are equal-weighted (EW). However, we discover only insignificant alphas between the high and bottom-ranked portfolios. The only significant alpha we obtain is from the EW Medium-SASB and EW Low-TR portfolios. The Low-TR portfolio was also statically different from the High-TR portfolio when EW and VW. By combining the two frameworks, we discover that the portfolio which performs Low in terms of SASB and Fails in terms of TR has the highest return but is not statistically significant. Like the individual portfolios, the Low-TR-Medium-Materiality EW portfolio is the only significant combined portfolio. Additionally, comparing the difference in alpha between the combined portfolios, we see that the only significant difference is between the EW High-TR-High-Material and the Low-TR-Medium-Materiality portfolios. Thus, our results indicate a neutral relationship between ESG performance and stock performance.

The remaining part of the thesis is structured as follows. Chapter 2 outlines fundamental takeaways from academic research on ESG and ESG investing. In Chapter 3, we examine our theories in greater depth. We shall present our methodological approach and data sample in Chapter 4, and our findings will be presented in Chapter 5. In Chapter 6, we will examine our findings and compare them to other relevant studies, and in Chapter 7, we will wrap up our findings and provide recommendations for future studies.

1.1. Hypotheses

The foundation for our hypotheses and the purpose of the research question is to see if the TR has any bearing on how we will build ESG portfolios in the future. Our discussion aims to provide insight into the relevance of the TR by looking at ESG scores and their role in the financial markets. In combination, we aim to see if there is any coherence between the TR and materiality according to the framework from SASB. Therefore, we have postulated the following hypothesis:

1. Companies scoring high according to the TR have greater stock performance than companies that fail the TR.

2. Companies with high scores on material sustainability issues have greater stock performance than companies with low scores on these issues.

We expect companies with high materiality ESG scores to perform better than companies with low ESG scores due to the increased focus on sustainable investments. This is based on the results presented in Khan et al. (2016) paper. Furthermore, we aim to determine if firms have differences in return based on how well they operate in terms of the frameworks. Moreover, we will test and compare portfolios constructed based on the TR material scores, SASB material scores, and combined portfolios using both the TR- and SASB frameworks.

2. Literature review

The second chapter aims to provide an overview of the field of research and relevant literature. The chapter is divided into three sections: Sustainability investment as an introduction, ESG financial performance disagreement, and ESG rating disagreement.

2.1 Sustainability investment

Sustainable investment is an investment approach that considers ESG factors in portfolio selection and management (*GSIA*, n.d.). The global investing industry has seen a sharp surge in sustainable investments in the last few years. Governments are also imposing plenty of regulations to incentivize the incorporation of ESG factors into businesses. The term Sustainability investments are a relatively new form of corporate investment. However, many businesses see sustainability issues as strategically significant, and a rising number of investors see a considerable value in committing to incorporate ESG into their asset allocation decisions.

Several studies have investigated the relationship between sustainability investments and financial value, finding empirical evidence linking ESG rating and important variables, like the stock market and accounting performance. Eccles et al. (2014) identified a group of companies that adopted environmental and social policies before they were widely accepted and found outperformance of their peers in terms of the stock market and accounting performance in the future. Borgers et al. (2012) document that firms that in the future have better sustainability performance also have higher risk-adjusted returns. However, firms with better sustainability performance have had lower alphas in recent years. Some argue that sustainable initiatives also disproportionately raise a firm's costs, placing them at a competitive disadvantage in a competitive market. Consequently, prior literature gives mixed signals. Some studies also argue a lack of guidance on materiality regarding sustainable issues. The TR will be used to add to this literature and find evidence of this relationship.

2.2 ESG Financial performance disagreement

Pastor, L., R. F. Stambaugh, and L. A. Taylor (2019) show that agents' preferences for green investments impact asset prices. Agents are willing to pay more for greener businesses, decreasing their capital costs. CAPM alphas are negative for green assets and positive for brown assets. As a result, agents with higher ESG preferences, whose portfolios lean more toward green assets and away from brown assets, are likely to generate poorer returns. According to prior evidence, brown investments have greater climate betas than green assets (Choi et al., 2020; Engle et al., 2020). The model from Pastor et al. (2019) raises the predicted returns for brown assets, and the assumption is that investors abhor sudden changes in the weather. If the climate unexpectedly worsens, brown assets lose value compared to green ones (e.g., new government regulation that penalizes brown firms). Brown firms are riskier because they lose value in parts of the world that investors dislike. Therefore, they must give higher expected returns. Brown companies exhibit positive CAPM alphas not only because investors dislike brown stocks but also because brown stocks have higher climate risk exposures. Despite the higher predicted returns on Brown assets, we may witness outperformance of green assets if ESG investing becomes more popular or green technology becomes more widely used.

Another example from Hong and Kacperczyk (2009) shows that 'sin' stocks, such as those in the tobacco, alcohol, and gambling industries, achieve greater returns than equivalent equities in other areas. They argue that institutions that are more vulnerable to public opinions, such as endowments and pension funds, avoid sin stocks. They offer evidence indicating these investment groups are underrepresented among sin stockholders.

Even after adjusting for size and other influences, Bolton and Kacperczyk (2020) demonstrate that companies with more significant total carbon dioxide emissions earn higher returns or equivalently have higher discount rates in equity markets. A variety of studies use different asset classes, such as real estate (Bernstein et al., 2019) or municipal bonds, to isolate the influence of climate change on asset values (Painter, 2020). These studies also show that assets with a higher vulnerability to climate change risks, such as rising sea levels, are related to lower prices. When investing in green assets, an investor is effectively paying a premium for climate change protection, to the extent that there exists some evidence that market pricing integrates knowledge about climate risks.

More recent research has found results more consistent with the risk-return trade-off, which states that the expected returns increase with higher risk. Norges Bank Investment Management's Discussion Note (2021) highlights that investors incorporating ESG into their portfolios as non-financial considerations lead to a lower expected return on high ESG scoring firms and higher expected return on low ESG scoring firms. They model many investors with varying ESG preferences and assume that investors allocate their money to one of three stocks: green, neutral, or brown. Apart from their ESG scores, the three equities are equal in that they have the same return volatility (30% per year) and are uncorrelated. ESG-motivated investors' portfolio choices imply they are willing to accept a deterioration in their portfolio's risk-return characteristics. The non-ESG portfolio is towards the top of the efficient frontier, achieving the best-expected return feasible given the portfolio's volatility. Given the increased allocation to the green asset, the ESG portfolio has lower predicted returns. As a result of their preference for the green asset, the ESG investor accepts a lower Sharpe ratio.

2.3. ESG Rating disagreement

The increasing interest in sustainable investing has opened a new market for ESG rating agencies. The rating agencies provide due diligence on all types of firms to see if they are compliant with the agency's ESG methodology. The due diligence gives the firm(s) an ESG rating. Anyhow, this is not without any problems. ESG rating agencies disagree substantially on what defines a sustainable firm (Chatterji et al., 2016). This is presented in the article Aggregate Confusion: The Divergence of ESG Ratings (Berg et al., 2020). The research includes six very well-known ESG rating agencies; KLD (MSCI Stats), Sustainalytics, Vigeo Eiris (Moody's), RobecoSAM (S&P Global), Asset4 (Refinitiv), and MSCI. It shows a low correlation between the rating agencies, considering frameworks and methodology. The ratings give confusing signals and information to the market-maker for what can be considered an ESG-compliant firm (Berg et al., 2020). This is causing several issues, including greenwashing, which can severely impact the investor's seriousness against sustainable investing. Mackintosh (2018), for example, points out in a Wall Street Journal story that Tesla was evaluated favourably by MSCI in terms of environmental difficulties in 2018. On the other hand, FTSE came to the opposite conclusion, giving Tesla a low score on environmental issues. Other news outlets, policy-oriented research institutes, and practitioner-oriented periodicals made similar observations (Doyle, 2018; Matos, 2020; Wigglesworth, 2018). Further, Escrig-Olmedo et al. (2019) document that ESG rating agencies do not adequately integrate sustainability principles into their corporate sustainability assessment. Therefore, earlier research that shows a positive relationship between ESG ratings and financial performance when collecting data from rating agencies could raise uncertainty regarding the reliability of the research. This is due to the low correlation between rating agencies and not inadequate integration of sustainable principles.

3. Theory

3.1 Refinitiv ESG Methodology

The Refinitiv ESG Contributor Tool assists investors and other stakeholders in verifying and providing timely information on ESG activities (Refinitiv, 2021). The application allows a company to display various environmental, social, and governance data. Over 500 business-level ESG indicators are captured and calculated by Refinitiv, with a selection of 186 of the most relevant material indicators per industry, powering the entire company evaluation and scoring process. These indicators are divided into 10 subcategories, which reformulate the three pillar scores. The final ESG score is based on publicly available data and reflects the company's ESG performance, commitment, and effectiveness. Environmental, social, and corporate governance pillar scores are obtained from the category scores. The ESG pillar score is a weighted average of the environmental and social category weights, which vary by industry. The weights for governance are the same across all industries.

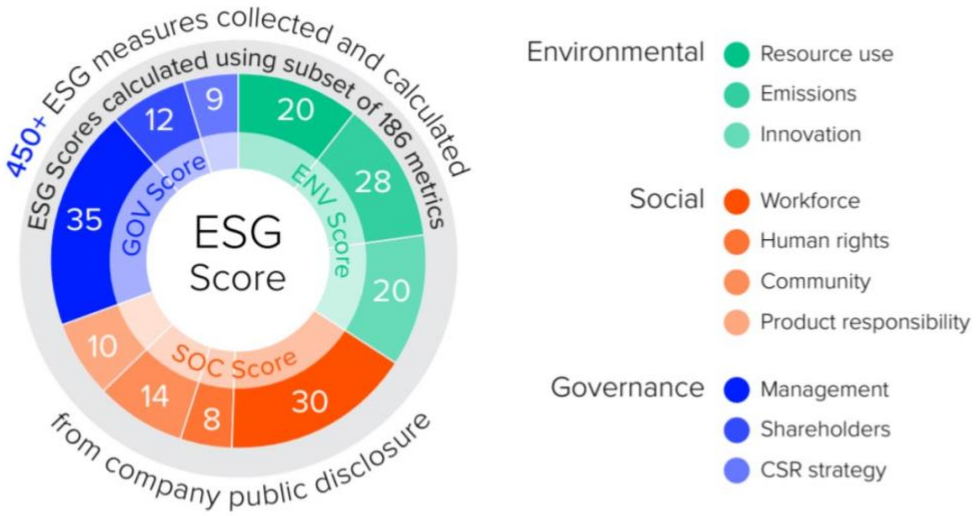

*Figure 1: Refintiv ESG Subcategories (*Refinitiv*, 2022)*

3.2 Sustainability Accounting Standards Board (SASB)

SASB provide companies guidance on which financial material sustainability information to disclose to their investors. The standards are available for 11 industries and 77 sectors and define the subset of ESG concerns that are most important to each industry's financial performance. The SASB Standards are intended to help companies communicate to investors how sustainability issues affect long-term enterprise value (SASB, n.d.). SASB has developed 26 disclosure topics where each industry has different relevant material topics. This means that the topics that are not material are immaterial for that industry. See appendix 1 for a summary of the SASB Materiality Map.

3.3. EU Taxonomy

There is currently no worldwide standard for defining ESG factors or sustainable activities (Berg et al., 2020). The EU Technical Expert Group on Sustainable Finance, on the other hand, has created the TR. The TR is a classification system that establishes a list of economically sustainable environmental activities. Potentially, it can play a significant role in assisting the EU in scaling up sustainable investment. The TR provides criteria for whether economic activities may be considered environmentally sustainable to companies, investors, and policymakers. Under the TR, the Taxonomy Commission developed an actual list of environmentally sustainable activities by setting technical screening criteria for each environmental objective through delegated actions (TEG, 2020b).

The TR sets out four conditions, and every condition must pass for an activity to be sustainable. The conditions are as follows:

1. Make a substantive contribution to at least one of the six environmental objectives

   1. Climate change mitigation
   2. Climate change adaptation
   3. Sustainable and protection of water and marine resources
   4. Transition to a circular economy
   5. Pollution prevention and control
   6. Protection and restoration of biodiversity and ecosystems

2. It must be in line with the technical screening criteria (TEG, 2020a).

   Examine the qualifying activities against the EU's technical screening criteria to see what proportion of them achieve or surpass the minimal criterion for being classified as making a significant contribution. For instance, compare the construction company's green building operations to the TR's technical requirements for "Manufacture of low carbon technologies - Green buildings".

3. Do no significant harm (DNSH) to the other five objectives.

   For the economic activity to be aligned to one of the environmental objectives of the TR, it is not sufficient to meet the technical screening criteria for that objective. Pursuing this activity is also essential to ensure that the company does not significantly harm the other five environmental objectives. Example: For the company to make a positive contribution through the construction of green buildings, it must do so responsibly, so it does not harm the other environmental objectives, such as the EU's objective of Pollution Prevention and Control.

4. Meet minimum safeguards (MMS) (e.g., UN Guiding Principles on Business and Human Rights).

   Ascertain that the firm conducts responsibly and has minimum safeguards to avoid negatively influencing social stakeholders. For example, if the firm is constructing new buildings in a "greenfield" project, is it doing so in a way that respects the local population's rights and obtains the necessary permissions without instances of bribery and corruption.

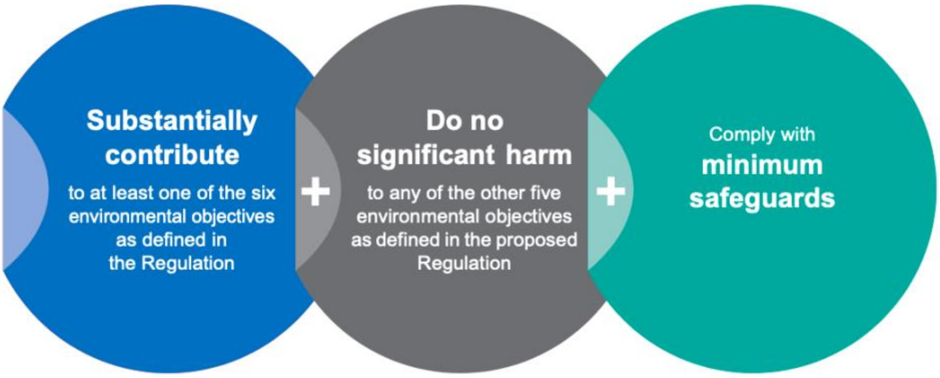

Figure 2: EU Taxonomy requirements for sustainable activities (TEG, 2020b)

4. Methodology and data

As guidance for our investigation, we will use the paper "Corporate Sustainability: *First Evidence on Materiality*"(2016) by Mozaffar Khan, George Serafeim, and Aaron Yoon. They create a new dataset by hand-mapping sustainability investments categorized as material for each industry into firm-specific sustainability ratings, using available materiality classifications of sustainability themes.

4.1 Data collection

All our ESG and financial data are collected from Refinitiv's Eikon database. We find it necessary to use a broad spectrum of data to answer our research question. Our data sample is the STOXX Europe 600 Index, which includes 600 European companies and is preferred because the TR is designed to be utilized mainly within the EU. The data was collected between 2012 and 2021 to get a larger and more representative sample data. This period was also marked by a substantially greater emphasis on sustainability and ESG issues than in previous decades (Kell, 2018). To ensure that we avoid a survivorship bias, where only the winners are considered while the losers who have vanished are not (Chen, 2021), we have included all stocks that were a member of the index during the sample period. This is because only considering those firms that have survived during the period may skew the average results upwards. Therefore, we are starting with the list of constituents in the index at the beginning of 2012, and we only consider firms as they are included in the index for the first time. Even if firms are excluded during the period, we keep them in our sample. This means that we have an increasing number of firms in our sample as they enter the index.

The TR uses NACE (Nomenclature of Economic Activities) codes to define different economic activities, including 21 activities divided into several subcategories. However, the TR only includes 8 of the NACE activities (Appendix 2) with subcategories (Appendix 3). To identify which companies we want to include in our analysis, we have chosen to concentrate on the 8 NACE activities covered by the TR and eliminate those firms not covered by a relevant NACE activity or have unidentified NACE activity. Thus, our final sample composition (Table 1) ended up with 622 firms.

TABLE 1
Sample Composition

Panel A: Sample Construction

	# of Firms
STOXX 600 Constituents 2012-2021	971
Less: not covered by the TR	333
Less: unidentified NACE Code	16
Total	**622**

Panel B: Frequency by Sector

TR NACE Sector	# of Firms
Agriculture, forestry, and fishing	6
Manufacturing	327
Electricity, gas, steam, and air conditioning supply	34
Water Supply; sewerage, waste management and remediation activities	0
Construction	33
Transporting and storage	32
Information and communication	135
Real estate activities	55
Total	**622**

Table 1: Sample Composition and Frequency by Sector

4.2 Portfolio Construction

This section will explain and describe how we built the various portfolios. We created the portfolios yearly using material score characteristics from the two employed frameworks to assign our top, medium, and bottom performance portfolios. The collection of material scores is done from an investor point of view, meaning that we collect material scores at the end of each year, beginning at the end of 2011, and then compute the returns in the following year, with the first year being 2012.

4.2.1 SASB Material Portfolios

To construct the materiality ESG score, we started by mapping the 26 subcategories included in the SASB materiality map to the 10 ESG pillars from Refinitiv. Appendix 4 shows our final mapping. Each pillar from Refinitiv has its own pillar score obtained from their EIKON databases, with corresponding weights (Appendix 5). Furthermore, we followed SASB guidelines for 59 sectors aligned with the companies in our sample. Specifically, we downloaded each sector standard that identifies what is classified as material issues for a given sector. The remaining items were classified as immaterial for companies operating in the same sector. Thereby, we multiplied the obtained proportion of material and immaterial items with the pillar scores and weights from Refinitiv:

$$\sum_{n_{item}=1}^{10} Material\ proportion_{n,i} \cdot Pillar_{n,i,t} \cdot W_n$$

Equation 1: Material Proportion

Where, $Material\, proportion_{n,i}$ is the proportion of materiality for each item in each company. $Pillar_{n,i,t}$ is the pillar score for each item, company, and sample period. W_n is the weighted average score for each item.

To further construct the SASB material portfolios, we rank the portfolios yearly by assigning firms into three material groups: Low-, Medium-, and High-performance. These portfolios are rebalanced each year, as the ESG performance may vary for the companies in our sample during the period covered.

4.2.2 EU Taxonomy Portfolios

The TR is not complete per day date, discussed in greater detail in Section 4.4. Therefore, we utilized the same method as in Section 4.2.1 to identify the most important materiality criterion relevant to the TR. However, we are still considering conditions 1, 3, and 4, as described in Section 3.3, but not applying condition 2. This is because the TR is incomplete, and we would need the remaining screening criteria to thoroughly assess the firms against the TR. From the Refinitiv ESG Contributor Tool, we have identified the pillars *human rights, energy management, and emission* as the most significant material factors in the TR. Human rights represent the criteria "MMS". According to the criterion, an economic activity can only be considered aligned with the TR if it meets minimum safeguards in the areas of international human and labour rights. Emission and energy management represent the "DNSH" criteria, and the criteria "make a substantive contribution to at least one of the six environmental objectives". The emission criteria are important and central to the EU's broader aim to achieve net-zero emissions by 2050. Emission would capture the environmental footprint of a business, and energy management would capture the company's effort towards a sustainable business. Both emission and energy management scores could describe if a company contributes positively or negatively to one of the environmental objectives and DNSH.

According to the TR, a firm must pass through various stages to be considered sustainable. We have considered this by creating three separate portfolios (Fail-, Low-, High-TR). The first portfolio is the one that fails to perform under the DNSH and/or MMS. For example, it does not matter if a company has a good emission score if it fails on human rights. The second portfolio, Low-performance, is the one that has gotten through the first elimination round (Fail-TR) but performs low at energy management and emission. The third portfolio represents the companies with the highest energy management and emission score. Each portfolio is held for one year before they get rebalanced. This procedure is carried out each year throughout the sample period.

4.2.3 Combined Portfolios

To help verify whether the relatively new framework from the EU gives any meaningful predictive power over financial performance, we merge both the TR portfolios and the SASB material portfolios. The reason for making portfolios constructed based on two different frameworks is to determine if there is a significant coherence between the frameworks and the results. For example, a company that performs High according to the TR but Low according to the SASB materiality framework. The whole construction of combinations gave us five new portfolios; High-TR performance combined with Low and High SASB materiality, Low-TR performance combined with Medium SASB materiality, and Fail-TR combined with Low and High SASB materiality. These portfolios are also held for one year before they are rebalanced each year throughout the sample period.

4.3 Evaluating performance

We use Fama and French (1993) monthly calendar-time regression to estimate abnormal performance in the previously identified portfolios. We run their five-factor model that includes market, size, book-to-market, profitability, and investment. In addition, to further investigate the performance, we run a separated regression where the Carhart (1997) momentum factor has been included in the five-factor model. The article by Khan et al. (2016) points out that if ESG data are informative about a firm's future performance that is not attributed to its correlation with the factors from Fama-French, then this informativeness will be captured in a significant alpha estimate. The alpha is the intercept of the investment strategy and our main coefficient of interest. Thus, we run the following regression:

$$R_{it} = \alpha_{it} + \beta_1 MRRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \epsilon_{it}$$

Equation 2: Fama-French five-factor model

With momentum,

$$R_{it} = \alpha_{it} + \beta_1 MRRF_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 RMW_t + \beta_5 CMA_t + \beta_6 MOM_t + \epsilon_{it}$$

Equation 3: Fama-French five-factor model with momentum

Where, R_{it} denotes the excess return of portfolio i at time t. $MRRF_t$ gives the excess return of the market return over the risk-free rate at time t. SMB_t relates to the size factor, which is based on the difference between the return of a portfolio of small stocks minus the return of a portfolio consisting of large stocks. The value factor is captured by HML_t, where the return difference between a portfolio with a high book-to-market (B/M) ratio and a portfolio with a low B/M ratio is taken. RMW_t captures the potential profitability premium and is calculated as the return difference of two portfolios, which refer to high profitability and low profitability companies. CMA_t measures the difference between the return of a portfolio of stocks with a low investment and the return of a portfolio consisting of stocks with a high investment, and lastly, MOM_t refers to winners and losers with respect to past performance.

4.4 Limitations

As we seek to explain if the notion of materiality has great importance in defining how ESG issues impact a company's economic performance, we have chosen to exclude the impact of immateriality scores in our study. Moreover, this is based on the study of van Heijningen (2019). This report finds that performance trends can be seen in portfolios graded according to their scores on material indicators. For instance, the top portfolio continuously beats the bottom portfolio in terms of materiality score, meaning that the top portfolio generates a sizable amount of risk-adjusted alpha while the bottom portfolio does not. This result is in line with the idea that there is a chance to generate alpha because important ESG data is not currently reflected adequately in share prices. In contrast, no such association was discovered for portfolios evaluated on immaterial ESG characteristics, proving that this information is less pertinent for incorporating ESG data into fundamental research. Thus, materiality defines what is most important for business and stakeholders and has importance to whether shareholders should choose to buy, hold, or sell a security. Additionally, we are just focusing on the material factors within the TR, making both SASB and the TR comparable.

Companies subject to the Non-Financial Reporting Directive in the EU are required to report under the TR for the climate change mitigation and adaptation objectives starting January 1, 2022, for the reporting year 2021. The other four objectives starting January 1, 2023, for the reporting year 2022 (TEG, 2020b). This means that the final technical screening criteria for the last four objectives have not yet been published when we write this thesis. Furthermore, we are just using three factors from Refinitiv to determine if the company is materially aligned with the TR, not the screening criteria published. This method used could have a significant impact on how we construct our portfolios and, therefore, also affect our regression results. However, even though the TR is not fully completed, and we are just using three factors to determine the company's materiality score, we have used the TR framework as it is currently published. As the TR is a living document, there will never be a "final" version. Since industries, companies, technology, and reporting frameworks evolve, the TR will align with the development over time. However, the established environmental objectives and standards can be used to provide a clear path forward for businesses whose operations are not currently covered by the TR.

5. Results

This chapter will present the results of our regression models from the Fama-French and Carhart models. We run time-series regressions on all our constructed portfolios to see if sustainable SASB materiality and TR issues influenced financial performance and how they performed when controlling for the Fama-French factors described in Section 4.3. Table 2 shows the summary statistics on the different portfolios.

TABLE 2

Summary Statistics on Portfolio Composition

	Variable	n	Median	Min	Max	1Q	3Q
1	SASB ML	120	-0,00312	-0,04907	0,04953	-0,01252	0,01458
2	SASB MM	120	-0,00067	-0,04489	0,05208	-0,01547	0,01733
3	SASB MH	120	-0,00010	-0,04405	0,07027	-0,01541	0,01560
4	TR Fail	120	-0,00211	-0,04603	0,04501	-0,01420	0,01622
5	TR Low	120	-0,00137	-0,04385	0,06678	-0,01485	0,01682
6	TR High	120	0,00085	-0,04302	0,05346	-0,01374	0,01331
7	High TR - Low Mat	120	-0,00126	-0,05525	0,07089	-0,01558	0,01541
8	High TR - High Mat	120	-0,00005	-0,04650	0,04949	-0,01264	0,01494
9	Low TR - Medium Mat	120	0,00004	-0,04450	0,07042	-0,01521	0,01567
10	Fail TR - Low Mat	120	-0,00264	-0,05100	0,05557	-0,01529	0,01497
11	Fail TR - High Mat	120	0,00171	-0,06212	0,07309	-0,01817	0,01696
12	SASB ML	120	0,00214	-0,04553	0,05026	-0,01196	0,01021
13	SASB MM	120	-0,00097	-0,04440	0,07849	-0,01451	0,01514
14	SASB MH	120	-0,00184	-0,04440	0,05256	-0,01265	0,01336
15	TR Fail	120	-0,00178	-0,03285	0,03930	-0,01176	0,01182
16	TR Low	120	-0,00291	-0,04155	0,05570	-0,01301	0,01374
17	TR High	120	0,00029	-0,04174	0,04480	-0,01133	0,01148
18	High TR - Low Mat	120	0,00097	-0,06367	0,06776	-0,01951	0,01781
19	High TR - High Mat	120	-0,00016	-0,04734	0,04685	-0,01328	0,01084
20	Low TR - Medium Mat	120	-0,00066	-0,06520	0,08758	-0,01345	0,01331
21	Fail TR - Low Mat	120	-0,00248	-0,03642	0,05041	-0,01140	0,00822
22	Fail TR - High Mat	120	-0,00217	-0,07258	0,08706	-0,01967	0,01826

Table 6 represent the descriptive statistics of the portfolio variables that will be used in the Fama-French regression analysis. 1-11 is the EW portfolios. 12-22 is the VW portfolios. 1-3 and 12-14 is the SASB materiality portfolios, representing the score Material Low (ML), Material Medium (MM) and Material High (MH). 4-6 and 15-17 is the EU Taxonomy portfolios, representing the performance Fail, Low and High. 7-11 and 18-22 is the combined portfolios, reperesenting a combination of Fail, Low and High performance on the TR, and Low, Medium and High performance on the SASB material framework.

Table 2: Summary Statistics on Portfolio Composition

5.1 Results from SASB Portfolios regressions

Table 3 shows the results of the Fama-French five-factor regressions on the Low-, Medium-, and High-performance SASB portfolios. We have investigated whether the underlying risk factors are driving the abnormal returns in the material portfolios. We also evaluate whether the alpha differences between the Low, Medium and High portfolios are significantly different from zero. For a detailed summary of each portfolio regression, see appendix 6.

TABLE 3

Investments in *Material* Sustainability Issues

Value-Weighted						
	Low Performance		Medium Performance		High Performance	
Parameter	**Estimate**	**t**	**Estimate**	**t**	**Estimate**	**t**
Intercept	0,0017	0,94	-0,0014	-0,65	0,0002	0,14
Market	0,6503 ***	13,89	0,7171 ***	12,90	0,7393 ***	15,45
SMB	-0,1506	-1,42	-0,2762 *	-2,20	-0,4048 ***	-3,74
HML	-0,0637	-0,46	0,1326	0,80	-0,0519	-0,37
RMW	0,3918 *	2,21	0,7351 ***	3,49	0,3596 *	1,98
CMA	-0,0940	-0,49	-0,0727	-0,32	0,1553	0,79
n	120		120		120	
Annualized Alpha	2,01 %		-1,65 %		0,30 %	
Differences in Aplhas	1,71 %		-1,95 %			

Equal-Weighted						
	Low Performance		Medium Performance		High Performance	
Parameter	**Estimate**	**t**	**Estimate**	**t**	**Estimate**	**t**
Intercept	-0,0005	-0,24	-0,0046 *	-2,18	-0,0026	-1,28
Market	0,7964 ***	15,48	0,8074 ***	14,66	0,8213 ***	15,18
SMB	0,3018 *	2,59	0,2434	1,95	-0,0205	-0,17
HML	0,0303	0,20	0,2900	1,78	0,3075	1,92
RMW	0,4858 *	2,49	0,7840 ***	3,75	0,4803 *	2,34
CMA	-0,1440	-0,68	-0,0697	-0,31	-0,1400	-0,63
n	120		120		120	
Annualized Alpha	-0,57 %		-5,47 % *		-3,16 %	
Differences in Aplhas	2,59 %		-2,31 %			

***, **, * Indicate p-value less than 0,1 percent, 1 percent, and 5 percent, respectively.
Table 3 represents alphas, factor loadings, and t-statistics from monthly calendar-time Fama French regressions. This table reports results for value-weighted and equal-weighted portfolios of firms scoring Low, Medium and High according to our SASB materiality mapping. The regressions are estimated from January 2012 to December 2021. Market is the market excess return; SMB, HML, RMW and CMA are the Fama and French (1993) size, book-to-market, profitability and investment factors.

Table 3: Investments in Material Sustainability Issues

From the VW portfolios, the alpha of the High-performance outperforms the Medium-performance by 1.95% but underperforms compared to the Low portfolio by 1.71%. Respectively, the same goes for the EW portfolios. The High-performance portfolio outperforms the Medium-performance by 2.31% and underperforms the Low portfolio by 2.59%. Thus, the Low-performance portfolios always have better performance than Medium and High when looking at both VW and EW portfolios. However, the result reveals that only the EW Medium portfolio (-5.47%) has a significant abnormal return on a five percent level.

Looking at the differences in alpha between the portfolios shows a similar trend. The result shows that Medium-performance underperforms, and Low-performance outperforms the High-performance EW and VW portfolios. There are no statistically significant alpha differences between the different portfolios. The results using the SASB as a framework show that the Low-performance portfolio yields the highest abnormal return but is not statistically significant.

5.1.1 Material Portfolios with Momentum

We are also running a separate regression that includes the Carhart (1997) momentum factor into the five-factor model from Fama French. See appendix 9 for a detailed summary of each portfolio regression. Table 4 represents the annualized alpha from both the Five-factor and the Five-factor plus momentum model, where we also have reported the differences in alpha between the High and Low, and the High and Medium portfolios.

TABLE 4
Materiality Performance with Momentum

	Materiality					
	Value-Weighted			Equal-Weighted		
	Annualized alpha			Annualized alpha		
	Low	Medium	High	Low	Medium	High
Five-factor model	2,01 %	-1,65 %	0,30 %	-0,57 %	-5,47 %	-3,16 %
Five-factor model + MOM	2,15 %	-1,06 %	0,79 %	0,23 %	-3,69 %	-1,85 %
Difference in Alpha: High is the benchmark	1,35 %	-1,86 %		2,08 %	-1,84 %	

Table 4: Materiality Performance with Momentum

In the VW portfolios, the alpha of the High-performance outperforms the Medium-performance by 1.86% but underperforms compared to the Low portfolio by 1.35%. Respectively, the same goes for the EW portfolios. The High-performance portfolio outperforms the Medium-performance by 1.84% and underperforms the Low portfolio by 2.08%. This result shows a similar trend as the regular Five-factor model, but the momentum factor positively affects all the EW and VW portfolios. In the VW portfolios, the momentum factor increases the alpha of the Low-performance portfolio from 2.01% to 2.15%. The same happens to the High-performance portfolio, where the annualized alpha goes from 0.30% to 0.79%. However, in the EW portfolios, the momentum factors seem to have the most positive effect, where the different portfolios increase in the range of 0.8% to 1.78%. Even though the momentum factor has a generally positive effect on the result, it yields no statistically significant abnormal return. The same goes for the difference between the portfolios, where we fail to discover any statistically significant alphas.

5.2 Results from EU Taxonomy Portfolios

Table 5 shows the results of the Fama-French five-factor regressions on the Fail-, Low-, and High-performance TR portfolios. We examine whether the underlying risk factors are driving the abnormal returns in the material portfolios. We also evaluate whether the alpha differences between the Fail, Low, and High portfolios are significantly different from zero. For a detailed summary of each portfolio regression, see appendix 7.

TABLE 5
Investments in *Taxonomy Relevant Issues*

Value-Weighted

	FAIL Performance			Low Performance			High Performance		
Parameter	Estimate		t	Estimate		t	Estimate		t
Intercept	0,0010		0,623	-0,0018		-0,893	0,0012		0,674
Market	0,5317	***	14,448	0,7477	***	14,436	0,7246	***	15,225
SMB	0,0152		0,154	-0,3602	**	-3,074	-0,4009	***	-3,723
HML	-0,1644		-1,268	0,0523		0,341	0,0279		0,198
RMW	0,1515		0,914	0,6226	**	3,169	0,4811	**	2,665
CMA	-0,1389		-0,776	0,1673		0,789	0,0013		0,007
n	120			120			120		
Annualized Alpha	1,24 %			-2,11 %			1,46 %		
Differences in Aplhas	-0,22 %			-3,57 %	**				

Equal-Weighted

	FAIL Performance			Low Performance			High Performance		
Parameter	Estimate		t	Estimate		t	Estimate		t
Intercept	-0,0016		-0,82	-0,0043	*	-2,02	-0,0024		-1,24
Market	0,8163	***	15,53	0,8440	***	14,97	0,7826	***	15,54
SMB	0,3430	**	2,88	0,0765		0,60	0,0461		0,41
HML	0,0612		0,39	0,4168	*	2,49	0,1782		1,19
RMW	0,4367	*	2,19	0,7280	***	3,45	0,6019	**	3,15
CMA	-0,1705		-0,79	-0,0612		-0,27	-0,1235		-0,60
n	120			120			120		
Annualized Alpha	-1,97 %			-5,20 %	*		-2,85 %		
Differences in Aplhas	0,88 %			-2,35 %	*				

***, **, * Indicate p-value less than 0,1 percent, 1 percent, and 5 percent, respectively.
Table 5 represents alphas, factor loadings, and t-statistics from monthly calendar-time Fama French regressions. This table reports results for value-weighted and equal-weighted portfolios of firms scoring Fail, Low and High according to our Taxonomy mapping. The regressions are estimated from January 2012 to December 2021. Market is the market excess return; SMB, HML, RMW and CMA are the Fama and French (1993) size, book-to-market, profitability and investment factors.

Table 5: Investments in Taxonomy Relevant Issues

From the VW portfolios, the High-performance portfolio yields the highest abnormal return (1.46%). This portfolio outperforms the Low-performance by 3.57% and the Fail portfolio by 0.22%. On the other hand, the results when EW shows a different tendency, as the VW and EW results differ substantially. The Fail portfolio has the highest annualized alpha when EW and is outperforming the High-performance by 0.88%. However, the High-performance still outperforms the Low-performance (2.35%). Respectively, the Medium-performance yields the weakest abnormal return, both in the EW and VW portfolios, whereas in the EW portfolio, it is statistically significant at a 5 percent level. As for the High- and Low-performance portfolios, we fail to discover any significant alphas. This infers that no abnormal returns are found, indicating that the alphas may indeed be explained by the model.

Although we discover mostly insignificant alpha estimates, we find significant alpha estimates by looking at the differences between some of the portfolios. In the VW portfolio, we discover a significant alpha difference between High and Low (3.57%) at a 1 percent level but fail to discover any significant difference between High and Fail (0.22%). In the EW portfolios, we also find a significant difference between High and Low (2.35%) at a 5 percent level, but same as in the VW, we fail to find any significant difference between High and Fail (-0.88%) when EW.

5.2.1 EU Taxonomy Portfolios with Momentum

We have conducted the same approach in the TR portfolios as in the materiality portfolios, where we run separate regressions with the Carhart (1997) momentum factor. See appendix 10 for a detailed summary of each portfolio regression. Table 6 represents the annualized alpha from both models, where we have highlighted the differences in alpha between the High-performance to the Fail- and Low-performance portfolios.

TABLE 6
EU Taxonomy Performance with Momentum

	EU Taxonomy					
	Value-Weighted			Equal-Weighted		
	Annualized alpha			Annualized alpha		
	Fail	Low	High	Fail	Low	High
Five-factor model	1,24 %	-2,11 %	1,46 %	-1,97 %	-5,20 %	-2,85 %
Five-factor model + MOM	1,44 %	-0,15 %	2,16 %	-0,52 %	-3,71 %	-1,82 %
Difference in Alpha: High is the benchmark	-0,71 %	-2,30 % **		1,30 %	-1,89 %	

Table 6: EU Taxonomy Performance with Momentum

The results from the VW portfolios show that the alphas increase by adding the momentum factor. In the Fail portfolio, the alpha increases marginally from 1.24% to 1.44% by adding the momentum factor. In the Low-performance portfolio, the momentum factor increases the alpha from -2.11% to -0.15%. In the High-performance, the alpha goes from 1.46% to an alpha estimate of 2.16% with momentum. As a result, when the portfolios are VW, and by adding the momentum factor, the High-performance still yields the strongest abnormal return. In the EW portfolios, adding the momentum factor also increases the abnormal returns in all portfolios. However, in the EW portfolios, the Fail portfolio yields the highest abnormal return, similar to the TR portfolios without momentum. Furthermore, there is still only a significant difference between the High-performance and Low-performance in the VW portfolios, the same as the model without momentum. Therefore, we fail to reveal any changes to our results by adding the momentum element, except that it shows a positive effect on the abnormal returns, both in the EW and VW portfolios.

5.3 Results from Combined Portfolios

We merge both frameworks from the TR and SASB portfolios and create a new set of combined portfolios, to shed more light on the differential return between the frameworks. These results can be seen in detail in appendix 11. Table 7 shows our results where we compare firms that score High and High, High and Low, Low and Medium, Fail and Low, and Fail and High on the TR and the SASB, respectively. This allows us to provide sharper evidence of the shareholder value implications of sustainability investments.

TABLE 7
Performance on EU Taxonomy and Material issues - Combined portfolios

Value-Weighted

	High performance TR and High performance on materiality		High performance TR and Low performance on materiality		Low performance TR and Medium performance on materiality		Fail TR and Low performance on materiality		Fail TR and High performance on materialty	
Parameter	**Estimate**	**t**	**Estimate**	**t**	**Estimate**	**t**	**Estimate**	**t**	**Estimate**	**t**
Intercept	0,0018	0,96	0,0012	0,48	-0,0020	-0,88	0,0020	1,15	0,0017	0,62
Market	0,6956 ***	14,11	0,7524 ***	11,07	0,6499 ***	10,66	0,5714 ***	12,55	0,7978 ***	10,95
SMB	-0,4709 ***	-4,22	-0,4640 **	-3,02	-0,4514 **	-3,27	0,1135	1,10	-0,3765 *	-2,28
HML	-0,1222	-0,84	0,0256	0,13	0,2370	1,31	-0,3126 *	-2,32	0,0889	0,41
RMW	0,2450	1,31	0,8569 **	2,94	0,9719 ***	4,20	-0,0396	-0,23	0,3906	1,45
CMA	0,1322	0,66	0,0005	0,00	0,0621	0,25	0,0115	0,06	-0,1815	-0,61
Annualized Alph:	2,16 %		1,48 %		-2,45 %		2,38 %		2,06 %	
Differences in Aplhas			-0,68 %		-4,61 %		0,22 %		-0,10 %	

Equal-weighted

	High performance TR and High performance on materiality		High performance TR and Low performance on materiality		Low performance TR and Medium performance on materiality		Fail TR and Low performance on materiality		Fail TR and High performance on materialty	
Parameter	**Estimate**	**t**	**Estimate**	**t**	**Estimate**	**t**	**Estimate**	**t**	**Estimate**	**t**
Intercept	-0,0011	-0,60	-0,0019	-0,79	-0,0056 *	-2,50	0,0003	0,16	-0,0006	-0,24
Market	0,7483 ***	15,15	0,7866 ***	12,66	0,8148 ***	13,70	0,8335 ***	15,23	0,7962 ***	11,43
SMB	-0,1113	-1,00	0,1930	1,37	0,1897	1,41	0,3427 **	2,77	0,0030	0,019
HML	0,0617	0,42	0,0325	0,18	0,4227 *	2,40	-0,1682	-1,04	0,3826	1,853
RMW	0,3186	1,70	0,7875 **	3,34	0,8876 ***	3,93	0,3157	1,52	0,2824	1,069
CMA	-0,1458	-0,72	0,0702	0,28	-0,0297	-0,12	-0,0746	-0,33	-0,4115	-1,444
Annualized Alph:	-1,35 %		-2,24 %		-6,77 % *		0,41 %		-0,76 %	
Differences in Aplhas			-0,89 %		-5,42 % **		1,76 %		0,59 %	

***, **, * Indicate p-value less than 0,1 percent, 1 percent, ad 5 percent, respectively.
Table 7 represents alphas, factor loadings, and t-statistics from monthy calendar-time regressions. This table results for value-weighted and equal-weighted portfolios of firms scoring High on TR and High on materiality, High on TR and Low on materiality, Low on TR and Medium on materiality, Fail TR and Low on materiality, Fail TR and High on materiality. The regressions are estimated from January 2012 to December 2021. Market is the market excess return; SMB, HML, RMW and CMA are the Fama and French (1993) size, book-to-market, profitability and investment factors

Table 7: Performance on Taxonomy and Material Issues – combined portfolios

The result from the VW portfolios shows that the High-TR-High-Materiality portfolio outperforms High-TR-Low-Materiality, Low-TR-Medium-Materiality, and Fail-TR-High-Materiality by 0.68%, 4.61%, and 0.10% respectively. However, the High-TR-High-Materiality underperforms compared to the Fail-TR-Low-Materiality by 0.22%. As for the VW portfolios, we fail to discover any significant alpha estimate. Likewise, looking at the differences between the VW portfolios, we fail to see any statistically significant alphas.

In the EW portfolios, the results show an opposite trend. The High-TR-High-Materiality portfolio still outperforms the High-TR-Low-Materiality (0.89%) and the Low-TR-Medium-Materiality (5.42%). However, it underperforms compared to Fail-TR-Low-Materiality (1.76%) and Fail-TR-High-Materiality (0.59%). Although the EW shows signs of better abnormal performance for the Fail-TR-Low-Materiality combination, we fail to find any statistically significant alpha. Furthermore, looking at the differences between the portfolios, using High-TR-High-Materiality as a benchmark, we find a statistically significant alpha estimate to the Low-TR-Medium-Materiality. This portfolio, consisting of companies situated in the middle of the ESG ranking, also shows a statistically significant alpha of -6.67%. Similar to when we ran the regression separately between the two frameworks, the portfolios ranked in the middle often show the lowest abnormal performance.

5.3.1 Combined Portfolios with Momentum

We have conducted the same approach in the combined portfolios as in the TR and SASB materiality portfolios, where we run separate regressions with the Carhart (1997) momentum factor. See appendix 11 for a detailed summary of each portfolio. Table 8 represents the annualized alpha from both models, where we have highlighted the differences in alpha between combined portfolios with the High-TR-High-Materiality portfolio as the benchmark.

TABLE 8

Combined Portfolios Performance with Momentum

	High performance TR and High performance Materiality		High performance TR and Low performance Materiality		Low performance TR and Medium performance Materiality		Fail TR and Low performance Materiality		Fail TR and High performance Materialty	
	EW	VW	EW	VW	EW	VW	EW	VW	EW	VW
Five-factor model	-1,35 %	2,16 %	-2,24 %	1,48 %	-6,77 %	-2,45 %	0,41 %	2,38 %	-0,76 %	2,06 %
Five-factor model + MOM	-0,73 %	2,84 %	-1,80 %	2,18 %	-5,20 %	-2,35 %	1,36 %	2,49 %	0,34 %	2,80 %
Difference Alphas: Column (1) is the benchmark			-1,07 %	-0,66 %	-4,47 % *	-5,19 % *	2,09 %	-0,35 %	1,07 %	-0,04 %

Table 8: Combined Portfolios Performance with Momentum

In the EW portfolios, the High-TR-High-Materiality portfolio outperforms the High-TR-Low-Materiality and the Low-TR-Medium-Materiality portfolio by 1.07% and 4.47%, respectively. However, the High-TR-High-Materiality underperforms compared to the Fail-TR-Low-Materiality and Fail-TR-High-Materiality by 2.09% and 1.07%. On the other hand, in the VW portfolios, the High-TR-High-Materiality portfolio outperforms all the other portfolios in the range of 0.04% to 5.19%. Overall, the momentum factor positively affects all the EW and VW portfolios. Furthermore, comparing the Five-factor plus momentum model with the results in 5.1.1 and 5.2.1, we see that the momentum factor has less impact on the EW combined portfolios. The results show an evenly positive effect from the momentum factors on the EW and VW combined portfolios. In contrast, in 5.1.1 and 5.2.1, the results showed a much more positive impact of the momentum factor on the EW portfolios.

Even though the momentum factor has a generally positive effect on the result, it yields no statistically significant abnormal return. However, there is a statistically significant difference between the High-TR-High-Materiality and the Low-TR-Medium-Materiality portfolios. The difference is statistically significant when EW (-4.47%) and VW (-5.19%) at a five percent level.

6. Discussion

This chapter will discuss our findings from Chapter 5 and the limitations of our results in more detail.

6.1 Comments on Results

The results from the Fama-French five-factor and five-factor plus momentum regressions provide no support for our hypothesis that high-scoring firms perform better than low-scoring firms on ESG-related issues. Using a similar approach as Khan et al. (2016), with a different market, our result is not coherent as their research proposes that materiality positively impacts financial performance. We find rather opposite signals that firms performing low based on ESG rating often yields stronger abnormal returns. However, we discover only insignificant alpha estimates between the High and Low rated portfolios, indicating a neutral relationship between ESG performance and stock performance.

There could be several reasons for the conflicting results, and that we cannot conclude whether ESG has a positive or negative impact on the stock performance. According to Borgers et al. (2012), the market had previously failed to price the intangible assets associated with ESG performance because the outperformance of well-performing ESG companies disappears after the sampling period. However, the advantage of ESG performance has vanished because of stock market learning mechanisms. A similar neutral link between ESG performance and stock performance in a subsequent period is discovered by Halbritter and Dorfleitner (2015), substantiating the idea that a learning mechanism has occurred. As a result, one explanation would be that these learning effects have taken place, and the European market now appropriately rates the performance of ESG factors.

Another study by Waddock and Graves (1997) also argues in favour of a neutral relationship. They suggest that there is no reason to predict a relationship, as there are so many intervening variables between ESG and financial performance. The only reason why a relationship might exist could be by chance. The neutral relationship is also coherent with the findings of Revelli and Viviani (2014). They find that there is neither a weakness nor a strength in comparing sustainable investments to other conventional investments.

The difficulty of evaluating ESG performance and the fact that ESG ratings do not fully account for all effects of ESG activities are two additional potential explanations for a neutral relationship. As Halbritter and Dorfleitner (2015) argue, the magnitude and direction of the impact are substantially dependent on the rating provider, the company sample, and the particular subperiod. Most measures used to calculate ESG scores are based on qualitative data, which can be challenging to quantify and combine into a score. Berg et al. (2020) conclude that the various ESG rating providers give varied findings since there is no standard for reporting ESG information. Furthermore, rating providers' data collection and underlying grading methodologies range significantly. The actual ESG performance is less likely to be reflected in the various ESG scores due to the stark variances. As a result, investors that use ESG scores for screening allocate money to businesses that were not initially intended.

Our results reveal that scoring high on material ESG issues yields stronger abnormal returns than the medium ESG portfolio. However, as previously mentioned, we fail to see any statistical outperformance comparing the top and bottom performers. The portfolios situated in the middle of ESG performance tend to perform the worse. A possible explanation could be that these portfolios do not involve companies seen as sin businesses or companies with excellent ESG scores. Therefore, they do not share the same upsides as the bad and great performers. Although we fail to find any statistically significant difference between the High- and Low-performance portfolios, the Low-performance portfolio has greater abnormal returns in the SASB materiality portfolios. This supports the risk-return trade-off, where a higher risk gives a higher reward. For example, fossil fuel producers may face risks associated with climate or regulatory shocks to which renewable energy producers are immune (Cornell, 2020). Therefore, companies should be rewarded for bearing this risk. Another explanation for why firms scoring Low or Fail often yield the highest abnormal return is that sin businesses are included in the portfolios. Most of these companies are represented in the TR-Fail and SASB-Low portfolios. Hong and Kacperczyk (2009) show that firms operating in these industries achieve greater returns than equivalent equities in other areas. Sin stock performs relatively well in both economic downturns as well as in economic booms(Fontinelle, 2020). By holding sin stocks, the investors must also be compensated in terms of greater return for the reputational cost associated with these stocks (Fama & French, 2007).

As for the TR portfolios, our results imply that high ESG-rated companies yield the highest abnormal returns compared to the SASB framework. As the TR is constructed per day's date, the framework primarily considers large public-interest companies with more than 500 employees, including listed companies, banks, and insurance companies, to report on the regulation (TEG, 2020b). From section 5.2, the result from the Fama-French regression shows that the VW TR-High performance portfolio performs the best abnormal return. The result also reveals that the SMB factor has a negative exposure and is significant at a 0.1% level. This means that the VW TR-High portfolio is more exposed to firms with a high market capitalization. Although the result does not reveal any statistically significant abnormal return, this shows an interesting argument at first glance. One explanation for why firms with high market capitalization are situated in the High portfolio is that ESG activities often is seen as highly costly. Smaller companies do not generate enough free cash flow to invest sustainably at the same scale. Therefore, they also have better resources and more ESG data available for the rating agencies, which often leads to a higher score in their scoring process (Akgun et al., 2021). So, if an investor focuses mainly on ESG rating while choosing their investment strategy, they could end up with a portfolio of primarily large-cap firms. While this could have been beneficial in the past, it may not be the best strategy going forward if we return to a period of small-cap outperformance.

6.2 Limitations and Implications for Further Research

The small amount of statistically significant alphas could be due to the sample period of 10 years. We think our results could have been more precise by increasing the period using additional data and information. We also have a varied sample size in the portfolios, which could influence the results. In the combined portfolios, this limitation is most relevant, as the portfolios consist of fewer companies, which reduces the power of the study. Second, the Europe STOXX 600 index mainly represents large corporations. This implies that we are only looking into generally stable and established organizations, ignoring smaller up-and-coming corporations that may perform better in terms of sustainability. Therefore, our results could give a large-cap biased solution.

Furthermore, we utilized the TR classification to identify which organizations should be included (and which should be excluded), where we used NACE codes as a foundation. This reduced our sample size to 622 out of 971 companies. The results could have been considerably different if we had applied the same framework to all organizations, regardless of the company's NACE category. Throughout the research, we have used the TR categories because we want to use as much of the TR framework as feasible. As for the TR portfolios, there is reasonable to assume that more than three factors are considered material. Since the TR framework will gradually develop over time, our focus was to use the factors we have determined most important as of now. In the future, other economic activities and different sectors will likely be relevant and feasible to be integrated into the TR. Therefore, our portfolios could have been ranked differently if we had a more developed version of the TR. Consequently, our results from those portfolios might not give a fully clear picture of the relationship between the TR and stock performance.

7. Conclusion

This thesis has investigated the relationship between material ESG performance and financial performance using our own TR framework and the SASB framework. The most important material factors within each framework distinguish which portfolio each firm is located in. We were able to beneficially employ the frameworks by investigating European equities, specifically the Europe Stoxx 600, from 2012 to 2021.

We find evidence from the TR and the combined portfolios that there is a significant difference between high- and medium-ranked portfolios, where the medium performs worse. However, the lowest-ranked portfolios also outperform the portfolios situated in the middle. Further, based on the frameworks used in our study, we find no significant results on abnormal returns between the highest-rated ESG portfolios and the lowest, indicating a neutral relationship between ESG performance and stock performance. Accordingly, we can conclude that the TR currently does not have any impact on the portfolio returns. Therefore, the relationship between the variables does not support our hypothesis that a positive relationship exists, implying that ESG performance neither creates nor destroys value.

As the TR is not yet finished, in future research, there would be possible to use a European standard to determine a sustainable activity from the developed screening criteria once it is completed. Using a complete framework will probably lead to more precise and accurate results. Additionally, we would encourage using several ESG rating providers to gather ESG data, as the differences in ratings between providers are often substantial. Lastly, we would urge to increase the sample size to get a more comprehensive representation of firms.

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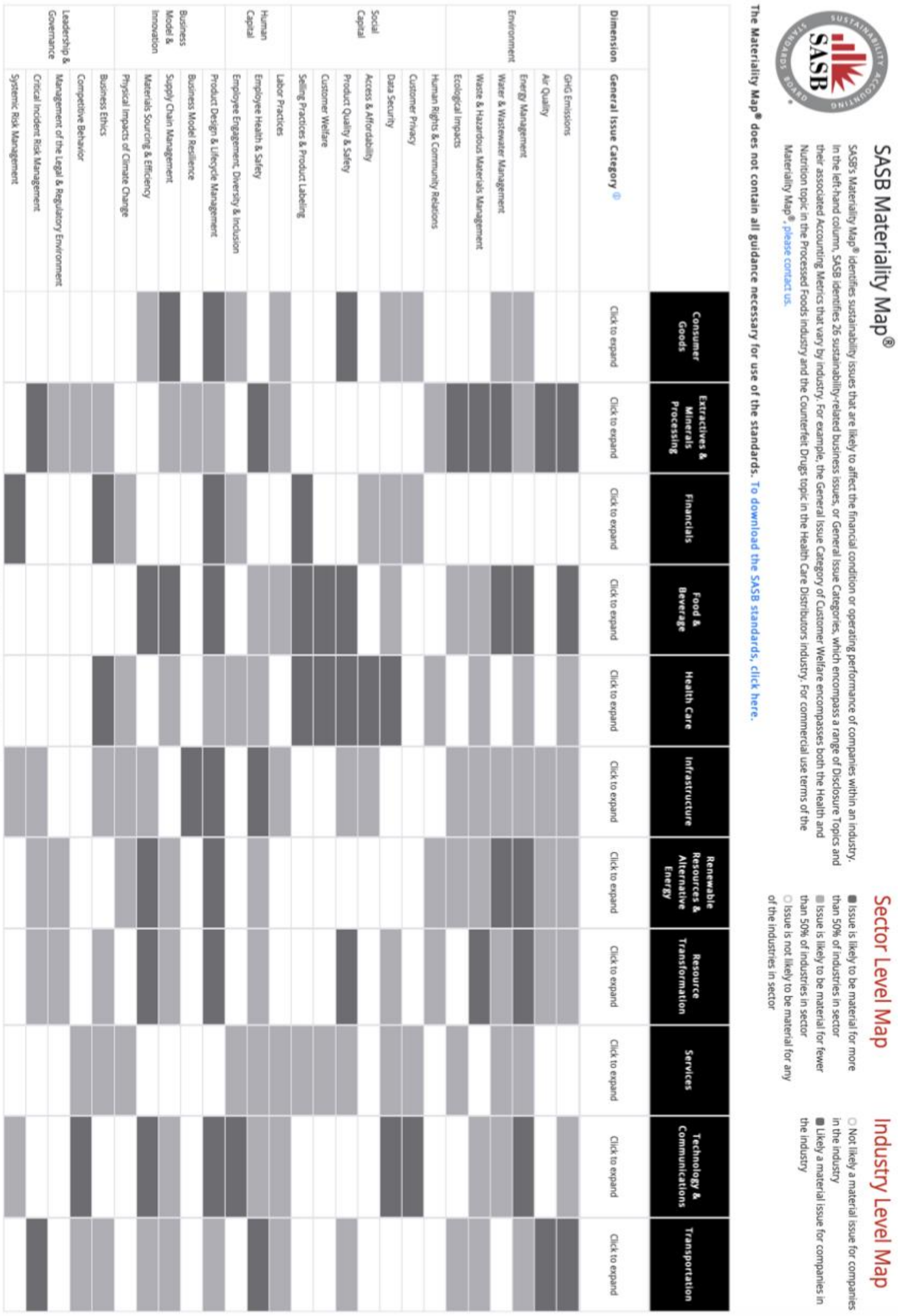
Appendix

A1. SASB Materiality Map



Appendix 1: SASB Materiality Map (SASB, 2022)

A2. NACE Macro Categories

TR/NACE Macro Categories
A - Agriculture, forestry, and fishing
C - Manufacturing
D - Electricity, gas, steam, and air conditioning supply
E - Water Supply; sewerage, waste management, and remediation activities
F - Construction
L - Real estate activities
H - Transporting and storage
J - Information and communication

Appendix 2: TR/NACE Macro Categories (TEG, 2020b)

A3. EU Taxonomy Classification

NACE Macro-Sector	Activity
A - Agriculture, forestry, and fishing	Afforestation
	Rehabilitation, Reforestation
	Reforestation
	Existing Forest Management
	Conservation forest
	Growing of perennial crops
	Growing of non-perennial crops
	Livestock production
C - Manufacturing	Manufacture of low carbon technologies
	Manufacture of cement
	Manufacture of aluminum
	Manufacture of iron and steel
	Manufacture of hydrogen
	Manufacture of other inorganic basic chemicals - Manufacture of carbon black
	Manufacture of other inorganic basic chemicals - Manufacture of disodium carbonate (soda ash)
	Manufacture of other inorganic basic chemicals - Manufacture of chlorine
	Manufacture of other organic basic chemicals
	Manufacture of fertilizers and nitrogen compounds
	Manufacture of plastics in primary form
D - Electricity, gas, steam, and air conditioning supply	Production of Electricity from Solar PV
	Production of Electricity from Concentrated Solar Power

	Production of Electricity from Wind Power
	Production of Electricity from Ocean Energy
	Production of Electricity from Hydropower
	Production of Electricity from Geothermal
	Production of Electricity from Gas (not exclusive to natural gas)
	Production of Electricity from Bioenergy (Biomass, Biogas, and Biofuels)
	Transmission and Distribution of Electricity
	Storage of Electricity
	Storage of Thermal Energy
	Storage of Hydrogen
	Manufacture of Biogas or Biofuels
	Retrofit of Gas Transmission and Distribution Networks
	District Heating/Cooling Distribution
	Installation and operation of Electric Heat Pumps
	Cogeneration of Heat/cool and Power from Concentrated Solar Power
	Cogeneration of Heat/cool and Power from Geothermal Energy
	Cogeneration of Heat/cool and Power from Gas (not exclusive to natural gas)
	Cogeneration of Heat/cool and Power from Bioenergy (Biomass, Biogas, Biofuels)
	Production of Heat/cool from Concentrated Solar Power
	Production of Heat/cool from Geothermal
	Production of Heat/cool from gas (not exclusive to natural gas)
	Production of Heat/cool from Bioenergy (Biomass, Biogas, Biofuels)
	Production of Heat/cool using Waste Heat
E - Water Supply; sewerage, waste management, and remediation activities	Water collection, treatment, and supply
	Centralized wastewater treatment
	Anaerobic Digestion of Sewage sludge
	Separate collection and transport of non-hazardous waste in source segregated fractions
	Anaerobic digestion of bio-waste
	Composting of bio-waste
	Material recovery from non-hazardous waste
	Landfill gas capture and utilization
	Direct Air Capture of CO_2
	Capture of anthropogenic emissions
	Transport of CO_2
	Permanent Sequestration of captured CO_2
F - Construction	Construction of new buildings
	Building renovation

	Individual renovation measures, installation of renewables on-site, and professional, scientific, and technical activities
	Infrastructure for low carbon transport (water transport)
	Infrastructure for low carbon transport (land transport)
L - Real estate activities	Acquisition and ownership of buildings
H - Transporting and storage	Passenger Rail Transport (Interurban)
	Freight Rail Transport
	Public transport
	Freight transport services by road
	Interurban scheduled road transport
	Inland passenger water transport
	Inland freight water transport
	Passenger cars and commercial vehicles
J - Information and communication	Data-driven climate change monitoring solutions
	Data processing, hosting, and related activities

Appendix 3: SASB Materiality Map (SASB, 2022)

A4. SASB Disclosure Topics

Refinitiv Pillars	SASB Disclosure Topics				
Enviromental					
Emission	Air Quality	GHG Emissions	Waste and hazardous material mgm		
Resource Use	Energy Management	Water and wastewater	Ecological Impacts		
Innovation	Product Design & Lifecycle Management	Supply Chain Management	Business Model Resilience	Physical Impacts of Climate change	Material Sourcing and Efficiency
Social					
Work Force	Employee health and safety	Employee Engagement, Diversity & Inclusion	Labor Practices		
Human Rights	Human Rights & Community Relations				
Community	Access and Affordability	Business Etichs			
Product responsibility	Costumer Privacy	Product Quality and Safety	Data Security	Customer Welfare	Selling Practice & Product Labeling
Governance					
Management	Critical Incident Risk Management	Systematic Risk Management	Management Legal & Regulatory Environment	Supply Chain Management	Business Model Resiliance
Shareholders	Competitive Behavior				
CSR strategy	Business Ethics	Physical Impacts of Climate Change	Materials Sourcing and Efficiency		

Appendix 4: SASB Disclosure Topics

A5. Refinitiv Categories, Indicators, and Weights

	Indicators	Weight
Enviromental		
Emission	28	15%
Resource Use	20	11%
Innovation	20	11%
Social		0%
Work Force	30	16%
Human Rights	8	4%
Community	14	8%
Product responsibility	10	5%
Governance		0%
Management	35	19%
Shareholders	12	6%
CSR strategy	9	5%
TOTAL	186	100%

Appendix 5: Refinitiv ESG Categories

A6. SASB Fama-French Five-Factor Regressions

SASB Material Low

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.049070 -0.012516 -0.003121  0.014582  0.049527

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0004746  0.0019525  -0.243   0.8084
MRRF         0.7964493  0.0514416  15.483   <2e-16 ***
SMB          0.3017812  0.1163887   2.593   0.0108 *
HML          0.0302742  0.1525279   0.198   0.8430
RMW          0.4858386  0.1951315   2.490   0.0142 *
CMA         -0.1440150  0.2104940  -0.684   0.4953
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02008 on 114 degrees of freedom
Multiple R-squared:  0.7662, Adjusted R-squared:  0.7559
F-statistic: 74.71 on 5 and 114 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.045532 -0.011962  0.002139  0.010207  0.050255

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.001676   0.001777   0.944   0.3474
MRRF         0.650253   0.046814  13.890   <2e-16 ***
SMB         -0.150554   0.105919  -1.421   0.1579
HML         -0.063659   0.138807  -0.459   0.6474
RMW          0.391760   0.177578   2.206   0.0294 *
CMA         -0.093983   0.191559  -0.491   0.6246
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01827 on 114 degrees of freedom
Multiple R-squared:  0.703,  Adjusted R-squared:   0.69
F-statistic: 53.97 on 5 and 114 DF,  p-value: < 2.2e-16
```

SASB Material Medium

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.044892 -0.015471 -0.000665  0.017330  0.052081

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.004559   0.002090  -2.181 0.031247 *
MRRF         0.807446   0.055073  14.661  < 2e-16 ***
SMB          0.243445   0.124604   1.954 0.053180 .
HML          0.289966   0.163294   1.776 0.078445 .
RMW          0.783974   0.208905   3.753 0.000277 ***
CMA         -0.069716   0.225351  -0.309 0.757609
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02149 on 114 degrees of freedom
Multiple R-squared:  0.7605, Adjusted R-squared:   0.75
F-statistic:  72.4 on 5 and 114 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.04440 -0.01451 -0.00097  0.01514  0.07849

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.001377   0.002110  -0.652 0.515516
MRRF         0.717135   0.055602  12.898  < 2e-16 ***
SMB         -0.276151   0.125803  -2.195 0.030182 *
HML          0.132527   0.164865   0.804 0.423157
RMW          0.735058   0.210915   3.485 0.000699 ***
CMA         -0.072708   0.227520  -0.320 0.749879
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0217 on 114 degrees of freedom
Multiple R-squared:  0.6884, Adjusted R-squared:  0.6748
F-statistic: 50.38 on 5 and 114 DF,  p-value: < 2.2e-16
```

SASB Material High

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.044054 -0.015405 -0.000099  0.015602  0.070273

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.002632   0.002054  -1.281   0.2027
MRRF         0.821291   0.054116  15.176   <2e-16 ***
SMB         -0.020453   0.122440  -0.167   0.8676
HML          0.307535   0.160458   1.917   0.0578 .
RMW          0.480330   0.205277   2.340   0.0210 *
CMA         -0.140040   0.221438  -0.632   0.5284
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02112 on 114 degrees of freedom
Multiple R-squared:  0.7751, Adjusted R-squared:  0.7652
F-statistic: 78.57 on 5 and 114 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.044401 -0.012654 -0.001835  0.013362  0.052559

Coefficients:

               Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.0002482  0.0018160   0.137  0.89152
MRRF         0.7392577  0.0478453  15.451  < 2e-16 ***
SMB         -0.4048289  0.1082520  -3.740  0.00029 ***
HML         -0.0519179  0.1418646  -0.366  0.71507
RMW          0.3596371  0.1814898   1.982  0.04993 *
CMA          0.1552587  0.1957783   0.793  0.42941
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01867 on 114 degrees of freedom
Multiple R-squared:  0.7466, Adjusted R-squared:  0.7355
F-statistic: 67.17 on 5 and 114 DF,  p-value: < 2.2e-16
```

A7. EU Taxonomy Fama-French Five-Factor Regressions

TR Fail

EW

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.04603 -0.01420 -0.00211  0.01622  0.04501

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.001645   0.001996  -0.824  0.41142
MRRF         0.816280   0.052578  15.525  < 2e-16 ***
SMB          0.342977   0.118960   2.883  0.00471 **
HML          0.061193   0.155898   0.393  0.69540
RMW          0.436678   0.199442   2.189  0.03060 *
CMA         -0.170458   0.215144  -0.792  0.42983
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02052 on 114 degrees of freedom
Multiple R-squared:  0.772,  Adjusted R-squared:  0.762
F-statistic: 77.21 on 5 and 114 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.032849 -0.011758 -0.001775  0.011816  0.039296

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.001035   0.001660   0.623    0.534
MRRF         0.631737   0.043724  14.448   <2e-16 ***
SMB          0.015222   0.098927   0.154    0.878
HML         -0.164362   0.129644  -1.268    0.207
RMW          0.151531   0.165856   0.914    0.363
CMA         -0.138859   0.178914  -0.776    0.439
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01706 on 114 degrees of freedom
Multiple R-squared:  0.7174, Adjusted R-squared:  0.705
F-statistic: 57.89 on 5 and 114 DF,  p-value: < 2.2e-16
```

TR Low

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.043845 -0.014853 -0.001368  0.016821  0.066776

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.004331   0.002140  -2.024 0.045275 *
MRRF         0.843994   0.056372  14.972  < 2e-16 ***
SMB          0.076542   0.127543   0.600 0.549614
HML          0.416798   0.167145   2.494 0.014080 *
RMW          0.727995   0.213832   3.405 0.000916 ***
CMA         -0.061196   0.230667  -0.265 0.791259
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.022 on 114 degrees of freedom
Multiple R-squared:  0.7765, Adjusted R-squared:  0.7667
F-statistic: 79.23 on 5 and 114 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.041554 -0.013007 -0.002911  0.013737  0.055703

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.001755   0.001966  -0.893  0.37391
MRRF         0.747679   0.051792  14.436  < 2e-16 ***
SMB         -0.360231   0.117182  -3.074  0.00264 **
HML          0.052336   0.153567   0.341  0.73388
RMW          0.622563   0.196461   3.169  0.00196 **
CMA          0.167309   0.211928   0.789  0.43148
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02021 on 114 degrees of freedom
Multiple R-squared:  0.7263, Adjusted R-squared:  0.7143
F-statistic:  60.5 on 5 and 114 DF,  p-value: < 2.2e-16
```

TR High

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.043024 -0.013743  0.000849  0.013312  0.053459

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.002375   0.001912  -1.243  0.21656
MRRF         0.782581   0.050365  15.538  < 2e-16 ***
SMB          0.046113   0.113952   0.405  0.68648
HML          0.178208   0.149335   1.193  0.23521
RMW          0.601901   0.191046   3.151  0.00208 **
CMA         -0.123480   0.206087  -0.599  0.55025
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01965 on 114 degrees of freedom
Multiple R-squared:  0.7693, Adjusted R-squared:  0.7592
F-statistic: 76.04 on 5 and 114 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.041735 -0.011334  0.000289  0.011482  0.044796

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.001218   0.001806   0.674 0.501411
MRRF         0.724589   0.047591  15.225  < 2e-16 ***
SMB         -0.400892   0.107676  -3.723 0.000307 ***
HML          0.027890   0.141109   0.198 0.843670
RMW          0.481146   0.180523   2.665 0.008809 **
CMA          0.001271   0.194736   0.007 0.994804
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01857 on 114 degrees of freedom
Multiple R-squared:  0.7476, Adjusted R-squared:  0.7366
F-statistic: 67.55 on 5 and 114 DF,  p-value: < 2.2e-16
```

A8. Combined Fama-French Five-Factor Regressions

High TR – Low Material

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.055247 -0.015581 -0.001264  0.015413  0.070886

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.001863   0.002359  -0.790  0.43134
MRRF         0.786558   0.062156  12.655  < 2e-16 ***
SMB          0.192998   0.140631   1.372  0.17264
HML          0.032542   0.184297   0.177  0.86016
RMW          0.787479   0.235774   3.340  0.00113 **
CMA          0.070199   0.254336   0.276  0.78304
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02426 on 114 degrees of freedom
Multiple R-squared:  0.6749, Adjusted R-squared:  0.6607
F-statistic: 47.34 on 5 and 114 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.063670 -0.019512  0.000973  0.017811  0.067577

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.0012365  0.0025807   0.479  0.63277
MRRF         0.7524385  0.0679951  11.066  < 2e-16 ***
SMB         -0.4639639  0.1538415  -3.016  0.00316 **
HML          0.0255599  0.2016098   0.127  0.89934
RMW          0.7568780  0.2579229   2.935  0.00404 **
CMA          0.0004701  0.2782289   0.002  0.99865
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02654 on 114 degrees of freedom
Multiple R-squared:  0.6122, Adjusted R-squared:  0.5952
F-statistic: 35.99 on 5 and 114 DF,  p-value: < 2.2e-16
```

High TR – High Material

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.046502 -0.012644 -0.000045  0.014939  0.049485

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.001125   0.001875  -0.600   0.5496
MRRF         0.748286   0.049398  15.148   <2e-16 ***
SMB         -0.111296   0.111764  -0.996   0.3215
HML          0.061730   0.146468   0.421   0.6742
RMW          0.318648   0.187379   1.701   0.0918 .
CMA         -0.145757   0.202131  -0.721   0.4723
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01928 on 114 degrees of freedom
Multiple R-squared:  0.752,  Adjusted R-squared:  0.7411
F-statistic: 69.12 on 5 and 114 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.047343 -0.013277 -0.000161  0.010841  0.046851

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.001800   0.001872   0.962    0.338
MRRF         0.695648   0.049320  14.105  < 2e-16 ***
SMB         -0.470916   0.111589  -4.220 4.93e-05 ***
HML         -0.122164   0.146238  -0.835    0.405
RMW          0.245006   0.187085   1.310    0.193
CMA          0.132180   0.201814   0.655    0.514
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01925 on 114 degrees of freedom
Multiple R-squared:  0.7073, Adjusted R-squared:  0.6944
F-statistic: 55.09 on 5 and 114 DF,  p-value: < 2.2e-16
```

Low TR – Medium Material

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.044498 -0.015212  0.000038  0.015670  0.070420

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.005640   0.002258  -2.498 0.013918 *
MRRF         0.814797   0.059491  13.696  < 2e-16 ***
SMB          0.189673   0.134600   1.409 0.161511
HML          0.422734   0.176394   2.397 0.018178 *
RMW          0.887592   0.225664   3.933 0.000144 ***
CMA         -0.029746   0.243430  -0.122 0.902959
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02322 on 114 degrees of freedom
Multiple R-squared:  0.7448, Adjusted R-squared:  0.7336
F-statistic: 66.54 on 5 and 114 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.065197 -0.013445 -0.000659  0.013313  0.087582

Coefficients:

             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.002039   0.002313  -0.882  0.37986
MRRF         0.649912   0.060951  10.663  < 2e-16 ***
SMB         -0.451388   0.137903  -3.273  0.00141 **
HML          0.236970   0.180723   1.311  0.19241
RMW          0.971859   0.231202   4.204 5.25e-05 ***
CMA          0.062127   0.249404   0.249  0.80373
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02379 on 114 degrees of freedom
Multiple R-squared:  0.6226, Adjusted R-squared:  0.6061
F-statistic: 37.62 on 5 and 114 DF,  p-value: < 2.2e-16
```

Fail TR – Low Material

EW

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.05100 -0.01529 -0.00264  0.01497  0.05557

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.0003387  0.0020768   0.163  0.87075
MRRF         0.8335333  0.0547173  15.233  < 2e-16 ***
SMB          0.3427260  0.1238000   2.768  0.00658 **
HML         -0.1681590  0.1622403  -1.036  0.30217
RMW          0.3156524  0.2075569   1.521  0.13108
CMA         -0.0745747  0.2238976  -0.333  0.73969
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02135 on 114 degrees of freedom
Multiple R-squared:  0.7487, Adjusted R-squared:  0.7376
F-statistic: 67.91 on 5 and 114 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.036417 -0.011398 -0.002484  0.008215  0.050406

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.001982   0.001728   1.147   0.2539
MRRF         0.571425   0.045541  12.548   <2e-16 ***

SMB          0.113465   0.103037   1.101   0.2731
HML         -0.312631   0.135031  -2.315   0.0224 *
RMW         -0.039642   0.172747  -0.229   0.8189
CMA          0.011541   0.186347   0.062   0.9507
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01777 on 114 degrees of freedom
Multiple R-squared:  0.6429, Adjusted R-squared:  0.6273
F-statistic: 41.05 on 5 and 114 DF,  p-value: < 2.2e-16
```

Fail TR – High Material

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.062117 -0.018166  0.001706  0.016957  0.073088

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.000635   0.002644  -0.240   0.8106
MRRF         0.796211   0.069660  11.430   <2e-16 ***
SMB          0.002972   0.157608   0.019   0.9850
HML          0.382643   0.206545   1.853   0.0665 .
RMW          0.282448   0.264237   1.069   0.2874
CMA         -0.411500   0.285040  -1.444   0.1516
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02718 on 114 degrees of freedom
Multiple R-squared:  0.6824, Adjusted R-squared:  0.6685
F-statistic: 48.99 on 5 and 114 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.072576 -0.019674 -0.002173  0.018264  0.087056

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.001718   0.002765   0.621   0.5357
MRRF         0.797815   0.072840  10.953   <2e-16 ***
SMB         -0.376491   0.164802  -2.284   0.0242 *
HML          0.088911   0.215974   0.412   0.6814

RMW          0.399565   0.276299   1.446   0.1509
CMA         -0.181478   0.298052  -0.609   0.5438
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02843 on 114 degrees of freedom
Multiple R-squared:  0.6146, Adjusted R-squared:  0.5977
F-statistic: 36.35 on 5 and 114 DF,  p-value: < 2.2e-16
```

A9. SASB Fama-French Regression with Momentum

SASB Material Low

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.048460 -0.010946 -0.003742  0.014041  0.049973

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.0001903  0.0020450   0.093  0.92604
MRRF         0.7860000  0.0522968  15.030  < 2e-16 ***
SMB          0.3173142  0.1171771   2.708  0.00782 **
HML         -0.0515288  0.1700486  -0.303  0.76243
RMW          0.4847344  0.1949833   2.486  0.01438 *
CMA         -0.0737681  0.2200761  -0.335  0.73810
MOM         -0.0854868  0.0788133  -1.085  0.28037
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02006 on 113 degrees of freedom
Multiple R-squared:  0.7686, Adjusted R-squared:  0.7563
F-statistic: 62.55 on 6 and 113 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.045130 -0.011855  0.002139  0.010439  0.049848

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.001789   0.001870   0.956   0.3409
MRRF         0.648488   0.047831  13.558   <2e-16 ***
SMB         -0.147930   0.107171  -1.380   0.1702
HML         -0.077475   0.155527  -0.498   0.6194
RMW          0.391573   0.178333   2.196   0.0302 *
CMA         -0.082119   0.201283  -0.408   0.6841
MOM         -0.014438   0.072083  -0.200   0.8416
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01835 on 113 degrees of freedom
Multiple R-squared:  0.7031, Adjusted R-squared:  0.6873
F-statistic:  44.6 on 6 and 113 DF,  p-value: < 2.2e-16
```

SASB Material Medium

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.042568 -0.013413 -0.000809  0.015508  0.053077

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.003074   0.002151  -1.429 0.155708
MRRF         0.784112   0.055003  14.256  < 2e-16 ***
SMB          0.278131   0.123240   2.257 0.025942 *
HML          0.107293   0.178847   0.600 0.549764
RMW          0.781508   0.205072   3.811 0.000226 ***
CMA          0.087151   0.231463   0.377 0.707234
MOM         -0.190899   0.082891  -2.303 0.023108 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0211 on 113 degrees of freedom
Multiple R-squared:  0.7712, Adjusted R-squared:  0.7591
F-statistic: 63.49 on 6 and 113 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.045269 -0.013678 -0.001139  0.015019  0.078818

Coefficients:
             Estimate Std. Error t value Pr(>|t|)

(Intercept) -0.000885   0.002217  -0.399 0.690439
MRRF         0.709409   0.056683  12.515  < 2e-16 ***
SMB         -0.264666   0.127005  -2.084 0.039424 *
HML          0.072041   0.184311   0.391 0.696630
RMW          0.734241   0.211337   3.474 0.000727 ***
CMA         -0.020768   0.238535  -0.087 0.930774
MOM         -0.063209   0.085424  -0.740 0.460868
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02174 on 113 degrees of freedom
Multiple R-squared:  0.6899, Adjusted R-squared:  0.6735
F-statistic: 41.91 on 6 and 113 DF,  p-value: < 2.2e-16
```

SASB Material High

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.040127 -0.015032 -0.001137  0.015523  0.070232

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.001541   0.002135  -0.722   0.4719
MRRF         0.804147   0.054604  14.727   <2e-16 ***
SMB          0.005031   0.122347   0.041   0.9673
HML          0.173323   0.177551   0.976   0.3311
RMW          0.478518   0.203585   2.350   0.0205 *
CMA         -0.024787   0.229785  -0.108   0.9143
MOM         -0.140256   0.082290  -1.704   0.0911 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02094 on 113 degrees of freedom
Multiple R-squared:  0.7807, Adjusted R-squared:  0.7691
F-statistic: 67.05 on 6 and 113 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.04285 -0.01290 -0.00224  0.01282  0.05254

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.0006619  0.0019075   0.347 0.729226
MRRF         0.7327560  0.0487804  15.022  < 2e-16 ***
SMB         -0.3951640  0.1092982  -3.615 0.000449 ***
HML         -0.1028169  0.1586147  -0.648 0.518159
RMW          0.3589500  0.1818728   1.974 0.050864 .
CMA          0.1989672  0.2052784   0.969 0.334488
MOM         -0.0531911  0.0735140  -0.724 0.470837
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01871 on 113 degrees of freedom
Multiple R-squared:  0.7478, Adjusted R-squared:  0.7344
F-statistic: 55.83 on 6 and 113 DF,  p-value: < 2.2e-16
```

A10. EU Taxonomy Fama-French Regression with Momentum

TR Fail
EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.047441 -0.014095 -0.002113  0.015061  0.047364

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0004343  0.0020664  -0.210  0.83390
MRRF         0.7972496  0.0528435  15.087  < 2e-16 ***
SMB          0.3712656  0.1184020   3.136  0.00219 **
HML         -0.0877874  0.1718262  -0.511  0.61041
RMW          0.4346667  0.1970216   2.206  0.02939 *
CMA         -0.0425234  0.2223767  -0.191  0.84869
MOM         -0.1556898  0.0796372  -1.955  0.05305 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02027 on 113 degrees of freedom
Multiple R-squared:  0.7795, Adjusted R-squared:  0.7678
F-statistic: 66.57 on 6 and 113 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.033146 -0.011712 -0.001947  0.011951  0.039409

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.001203   0.001746   0.689    0.492
MRRF         0.629084   0.044661  14.086   <2e-16 ***
SMB          0.019165   0.100068   0.192    0.848
HML         -0.185127   0.145220  -1.275    0.205
RMW          0.151251   0.166514   0.908    0.366
CMA         -0.121027   0.187943  -0.644    0.521
MOM         -0.021700   0.067306  -0.322    0.748
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01713 on 113 degrees of freedom
Multiple R-squared:  0.7177, Adjusted R-squared:  0.7027
F-statistic: 47.88 on 6 and 113 DF,  p-value: < 2.2e-16
```

TR Low

EW

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.04424 -0.01531 -0.00143  0.01587  0.06673

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.003093   0.002219  -1.394  0.16606
MRRF         0.824534   0.056743  14.531  < 2e-16 ***
SMB          0.105470   0.127138   0.830  0.40853
HML          0.264453   0.184504   1.433  0.15453
RMW          0.725939   0.211559   3.431  0.00084 ***
CMA          0.069628   0.238785   0.292  0.77113
MOM         -0.159206   0.085513  -1.862  0.06523 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02176 on 113 degrees of freedom
Multiple R-squared:  0.7832, Adjusted R-squared:  0.7717
F-statistic: 68.03 on 6 and 113 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.041874 -0.013229 -0.003972  0.013102  0.055693

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.001481   0.002068  -0.716  0.47545
MRRF         0.743370   0.052881  14.057  < 2e-16 ***
SMB         -0.353825   0.118485  -2.986  0.00346 **
HML          0.018602   0.171947   0.108  0.91404
RMW          0.622108   0.197160   3.155  0.00205 **
CMA          0.196277   0.222533   0.882  0.37964
MOM         -0.035253   0.079693  -0.442  0.65908
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02028 on 113 degrees of freedom
Multiple R-squared:  0.7268, Adjusted R-squared:  0.7123
F-statistic:  50.1 on 6 and 113 DF,  p-value: < 2.2e-16
```

TR High

EW

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.03982 -0.01374  0.00050  0.01213  0.05403

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.001520   0.001995  -0.762  0.44751
MRRF         0.769143   0.051008  15.079  < 2e-16 ***
SMB          0.066089   0.114290   0.578  0.56424
HML          0.073010   0.165859   0.440  0.66064
RMW          0.600481   0.190179   3.157  0.00204 **
CMA         -0.033143   0.214654  -0.154  0.87757
MOM         -0.109936   0.076871  -1.430  0.15544
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01957 on 113 degrees of freedom
Multiple R-squared:  0.7734, Adjusted R-squared:  0.7614
F-statistic: 64.29 on 6 and 113 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.041296 -0.010713  0.000311  0.011674  0.045183

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.001796   0.001893   0.949 0.344798
MRRF         0.715509   0.048411  14.780  < 2e-16 ***
SMB         -0.387395   0.108471  -3.571 0.000523 ***
HML         -0.043191   0.157415  -0.274 0.784294
RMW          0.480186   0.180497   2.660 0.008941 **
CMA          0.062311   0.203725   0.306 0.760275
MOM         -0.074283   0.072958  -1.018 0.310777
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01857 on 113 degrees of freedom
Multiple R-squared:  0.7499, Adjusted R-squared:  0.7367
F-statistic: 56.48 on 6 and 113 DF,  p-value: < 2.2e-16
```

A11. Combined Fama-French Regression with Momentum

High TR – Low Mat
EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.055888 -0.015177 -0.000857  0.015122  0.069566

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.001499   0.002481  -0.604  0.54686
MRRF         0.780843   0.063450  12.306  < 2e-16 ***
SMB          0.201494   0.142168   1.417  0.15915
HML         -0.012200   0.206316  -0.059  0.95295
RMW          0.786875   0.236568   3.326  0.00119 **
CMA          0.108621   0.267013   0.407  0.68492
MOM         -0.046758   0.095622  -0.489  0.62580
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02434 on 113 degrees of freedom
Multiple R-squared:  0.6756, Adjusted R-squared:  0.6584
F-statistic: 39.22 on 6 and 113 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.063810 -0.020711  0.001321  0.017609  0.065479

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.001814   0.002711   0.669  0.50470
MRRF         0.743357   0.069329  10.722  < 2e-16 ***
SMB         -0.450464   0.155341  -2.900  0.00449 **
HML         -0.045533   0.225432  -0.202  0.84029
RMW          0.755918   0.258488   2.924  0.00417 **
CMA          0.061520   0.291753   0.211  0.83337
MOM         -0.074295   0.104482  -0.711  0.47850
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02659 on 113 degrees of freedom
Multiple R-squared:  0.6139, Adjusted R-squared:  0.5934
F-statistic: 29.95 on 6 and 113 DF,  p-value: < 2.2e-16
```

High TR – High Mat

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.050158 -0.012489 -0.001338  0.015189  0.049466

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0006075  0.0019672  -0.309    0.758
MRRF         0.7401504  0.0503085  14.712   <2e-16 ***
SMB         -0.0992014  0.1127220  -0.880    0.381
HML         -0.0019619  0.1635833  -0.012    0.990
RMW          0.3177882  0.1875699   1.694    0.093 .
CMA         -0.0910626  0.2117087  -0.430    0.668
MOM         -0.0665605  0.0758168  -0.878    0.382
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0193 on 113 degrees of freedom
Multiple R-squared:  0.7536, Adjusted R-squared:  0.7406
F-statistic: 57.62 on 6 and 113 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.045225 -0.013014  0.000532  0.011576  0.047357

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.002366   0.001963   1.205    0.231
MRRF         0.686764   0.050196  13.682  < 2e-16 ***
SMB         -0.457711   0.112470  -4.070 8.76e-05 ***
HML         -0.191707   0.163218  -1.175    0.243
RMW          0.244067   0.187151   1.304    0.195
CMA          0.191900   0.211235   0.908    0.366
MOM         -0.072675   0.075647  -0.961    0.339
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01925 on 113 degrees of freedom
Multiple R-squared:  0.7096, Adjusted R-squared:  0.6942
F-statistic: 46.03 on 6 and 113 DF,  p-value: < 2.2e-16
```

Low TR – Medium Mat

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.044078 -0.015734 -0.001803  0.016097  0.071299

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.004331   0.002341  -1.850 0.066994 .
MRRF         0.794213   0.059878  13.264  < 2e-16 ***
SMB          0.220271   0.134164   1.642 0.103410
HML          0.261589   0.194700   1.344 0.181786
RMW          0.885417   0.223249   3.966 0.000129 ***
CMA          0.108634   0.251980   0.431 0.667201
MOM         -0.168401   0.090239  -1.866 0.064609 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02297 on 113 degrees of freedom
Multiple R-squared:  0.7524, Adjusted R-squared:  0.7393
F-statistic: 57.24 on 6 and 113 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.065289 -0.013592 -0.000794  0.013712  0.087635

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.001961   0.002435  -0.805  0.42249
MRRF         0.648673   0.062283  10.415  < 2e-16 ***
SMB         -0.449547   0.139551  -3.221  0.00167 **
HML          0.227275   0.202518   1.122  0.26414
RMW          0.971729   0.232214   4.185 5.67e-05 ***
CMA          0.070453   0.262098   0.269  0.78857
MOM         -0.010132   0.093862  -0.108  0.91423
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02389 on 113 degrees of freedom
Multiple R-squared:  0.6227, Adjusted R-squared:  0.6026
F-statistic: 31.08 on 6 and 113 DF,  p-value: < 2.2e-16
```

Fail TR – Low Mat
EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.051927 -0.014940 -0.002809  0.014480  0.057115

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.001131   0.002172   0.521  0.60353
MRRF         0.821076   0.055553  14.780  < 2e-16 ***
SMB          0.361244   0.124472   2.902  0.00446 **
HML         -0.265680   0.180635  -1.471  0.14412
RMW          0.314336   0.207122   1.518  0.13190
CMA          0.009170   0.233777   0.039  0.96878
MOM         -0.101913   0.083720  -1.217  0.22603
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02131 on 113 degrees of freedom
Multiple R-squared:  0.7519, Adjusted R-squared:  0.7387
F-statistic: 57.08 on 6 and 113 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.036526 -0.011323 -0.002292  0.008156  0.050143

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.002075   0.001820   1.141   0.2564
MRRF         0.569961   0.046532  12.249   <2e-16 ***
SMB          0.115641   0.104260   1.109   0.2697
HML         -0.324094   0.151304  -2.142   0.0343 *
RMW         -0.039797   0.173490  -0.229   0.8190
CMA          0.021384   0.195817   0.109   0.9132
MOM         -0.011979   0.070126  -0.171   0.8647
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01785 on 113 degrees of freedom
Multiple R-squared:  0.643,  Adjusted R-squared:  0.6241
F-statistic: 33.92 on 6 and 113 DF,  p-value: < 2.2e-16
```

Fail TR – High Mat

EW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.059973 -0.018436  0.000889  0.017675  0.073053

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.0002843  0.0027686   0.103    0.918
MRRF         0.7817634  0.0708020  11.042   <2e-16 ***
SMB          0.0244488  0.1586401   0.154    0.878
HML          0.2695384  0.2302201   1.171    0.244
RMW          0.2809209  0.2639778   1.064    0.290
CMA         -0.3143728  0.2979497  -1.055    0.294
MOM         -0.1181982  0.1067013  -1.108    0.270
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02716 on 113 degrees of freedom
Multiple R-squared:  0.6858, Adjusted R-squared:  0.6691
F-statistic: 41.11 on 6 and 113 DF,  p-value: < 2.2e-16
```

VW

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.073371 -0.020275 -0.000713  0.017827  0.081621

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.002335   0.002904   0.804   0.4231
MRRF         0.788109   0.074270  10.611   <2e-16 ***
SMB         -0.362064   0.166410  -2.176   0.0317 *
HML          0.012933   0.241496   0.054   0.9574
RMW          0.398540   0.276907   1.439   0.1528
CMA         -0.116234   0.312543  -0.372   0.7107
MOM         -0.079399   0.111927  -0.709   0.4796
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.02849 on 113 degrees of freedom
Multiple R-squared:  0.6163, Adjusted R-squared:  0.5959
F-statistic: 30.25 on 6 and 113 DF,  p-value: < 2.2e-16
```