Effect of ESG Scores on Portfolio Performance: Evidence from Developing (E-7) Countries

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Abstract

This study aims to integrate ESG (Environmental, Social, and Governance) scores, a measure of sustainability, into asset pricing models in E-7 countries. To determine whether sustainability has an impact on portfolio performance, all firms with available data were included in the analysis. A new factor created from the ESG scores of these firms was integrated into the model based on the five-factor methodology published by Fama & French (2015). Our findings indicate that while ESG scores have both positive and negative effects in explaining returns, this impact is statistically significant only in Türkiye among the E-7 countries.

Keywords: Sustainable Finance, ESG, Asset Pricing Models
JEL Codes: G10, G11, Q56

ESG Skorlarının Portföy Performansı Üzerindeki Etkisi: Gelişmekte Olan (E-7) Ülkelerden Bulgular

Özet

Bu çalışma E-7 ülkelerinde sürdürülebilirlik ölçütü olan ESG (Environmental, Social and Governance) skorlarının varlık fiyatlama modellerine entegrasyonunu hedeflemektedir. Bu amaçla sürdürülebilirliğin portföy performansı üzerinde etkisi olup olmadığını anlamak için verisine ulaşılabilen tüm firmalar çalışmaya dahil edilmiştir. Firmalara ait ESG skorları ile oluşturulan yeni faktör, Fama & French (2015) tarafından yayınlanan 5 faktör metodolojisi baz alınarak entegre edilmeye çalışılmıştır. Sonuçlarımız ESG skorlarının getirileri açıklamada pozitif ve negatif yönlü etkileri olsa da bu etkinin Türkiye haricindeki diğer E-7 ülkelerinde istatistiksel olarak anlamlı olmadığını göstermektedir

Anahtar Sözcükler: Sürdürülebilir Finans, ESG, Varlık Fiyatlama Modelleri
JEL Kodları: G10, G11, Q56

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Genişletilmiş Özet

Bu çalışmanın ana hedefi firmaların sürdürülebilirlik değerlendirmelerinin, yani ESG skorlarının varlık fiyatlama modelleri üzerinde bir etkisi olup olmadığını anlamak ve bu skorların varlık fiyatlama modellerine entegrasyonudur. Çünkü artan sürdürülebilirlik bilincinin yaygınlaştırılması, yatırımcıların çevre ve toplum dostu sürdürülebilir firmalara özendirilmesi sürdürülebilir olmayan ya da olmak konusunda yeterli motivasyona sahip olmayan firmaların harekete geçirilmesinde önemlidir. Özellikle büyük ve eski firmaların üretim ve yönetim faaliyetlerinin sürdürülebilirlik doğrultusunda revize edilmesi yüksek maliyetli ve zaman alıcıdır. Bu sebeple firmaların sürdürülebilirlik konusunda isteksiz oluşu ve hatta bazı firmaların yeşile boyama stratejilerine sahip olması kaçınılmazdır.

Sürdürülebilirlik skorları ile varlık fiyatları arasındaki ilişkinin tespiti ve ispatı ile yatırımcıların sürdürülebilirlik temelli yatırım araçlarına, fonlara ve endekslere yönlendirilmesi önemlidir. Her ne kadar hükümetler, bakanlıklar, denetleyici kurumlar ve toplumun firmalar üzerindeki sürdürülebilirlik baskısı bulunsa da bu baskıya ait etki sınırlıdır. Bu bağlamda firmaların sürdürülebilirlik faaliyetlerinin bireysel-kurumsal yatırımcılar ve fonlar tarafından talep edilmesinin daha etkili olacağı düşünülmektedir.

Bu amaç doğrultusunda varlık fiyatlama modellerine dahil edebilmek için firmaların ESG skorları kullanılarak değişken oluşturulmuştur. ESG skorlarının entegre edilmesinde Nobel Ekonomi Ödüllü ekonomist Eugene Fama ve Kenneth R. French tarafından 2015 yılında yayınlanan "A five-factor asset pricing model" baz alınmıştır.

Bu kapsamda gelişmekte olan ülkelerden Çin, Hindistan, Brezilya, Meksika, Endonezya, Rusya ve Türkiye'de faaliyet gösteren ve verilerine Refinitiv Eikon veritabanı aracılığı ile ulaşılabilen 310 firmaya ait veriler kullanılmıştır. Analizlerin ülke bazında yapıldığı çalışmada 2010-2022 yılları arasındaki veriler kullanılmıştır. Firmaların çalışmaya dahil edilmesi ve hariç bırakılmasında baz alınan çalışmadaki yöntemler kullanılmıştır. Fama ve French 5-faktör modeline entegrasyonu hedeflenen değişken, analizin yapıldığı ülkede faaliyet gösteren yüksek ESG skoruna sahip firmalar ile düşük ESG skoruna sahip firmalardan oluşan portföyler arasındaki yıllık getiri farkını temsil etmektedir. Yapılan analizlerin her biri için çeşitli ön testler, varsayımdan sapma testleri yapılmış ve uygun güçlü dirençli tahminciler kullanılmıştır. Yedi ülkeye ait yapılan analizler sonucunda ülkelere ilişkin her iki modele ait sonuçlar farklılıklar göstermektedir. Firmaların sürdürülebilirlik skorları ile oluşturulmuş değişkenin dahil edildiği model sonuçları E-7 ülkeleri arasında sadece Türkiye'de istatistiksel olarak anlamlı bulunmuştur.

ESG skorları ile oluşturulmuş değişkenlerin istatistiksel olarak anlamsız olduğu anlaşılan ülkeler için birden fazla neden bulunabilir. İlk olarak bu ülkelerde sürdürülebilirlik faaliyetlerinin firmalar için maliyet artırıcı etkisinin hisse senedi performansında etkisi olduğu düşünülebilir. Bununla birlikte ilgili ülkelerde yatırımcıların sürdürülebilirlik bilincinin düşüklüğü ESG temelli portföylerin etkisini sınırlamış olabilir. Ayrıca veri, analiz biçimi ve analiz sonuçları bu etkinin görülmesi üzerinde yeterince ayrıntıya sahip olmamış olabilir.

Türkiye'ye ait istatistiksel olarak anlamlı ve pozitif katsayı ise ESG faaliyetlerine öncelik veren şirketlerin yatırımcılar tarafından önceliklendirildiğini ve Türk piyasasında daha yüksek getiri elde ettiğini göstermektedir. Bu durum, sürdürülebilirlik odaklı yatırım ve stratejilerin artan öneminin altını çizmektedir.

Sonuç olarak, bu çalışma günümüzün artan sürdürülebilirlik bilincinin ve sürdürülebilir finans anlayışının bir parçasıdır. Gelecekte sürdürülebilirlik konusunun önemini daha da artıracağı düşünülmektedir. Bu çalışmaya ait sonuçlar geniş bir veri seti ve zaman aralığını baz almakta ve yıllık ESG skoru kullanmaktadır. Gelecek çalışmalarda farklı veri kaynaklarından farklı veri sıklığı ve zaman aralığı verileri kullanılarak farklı sonuçlar elde edilebilir.

1. Introduction

Sustainability, which has become increasingly important and discussed in recent years, is often defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." Sustainability serves as a guiding optimistic worldview that addresses and offers solutions to many problems in today's world, focusing on life as its central point. Up until today, almost all economic models around the world have been developed during a period when environmental concerns were excluded, natural resources were abundant, and carbon emissions were limited (Schoenmaker, D., & Schramade, W., 2018). For this reason, the dramatic climate changes, infectious diseases, and economic and social disruptions are fundamental, indisputable, comprehensible, and critically important problems that highlight the significance of sustainability and require swift actions. However, the first requirement for this guide to resonate within society is organization and government leadership.

This study investigates whether sustainability can be considered an evaluation criterion in the field of finance. Therefore, the development of sustainability from economic and financial perspectives on a global scale is significant. Governments, international organizations, and institutions have collaborated on sustainability since the 1970s (United Nations, 1972). One of the most recent global developments in sustainability occurred in 2015 at the United Nations Sustainable Development Summit in New York, which aimed to define sustainable development goals with the participation of world leaders.

At this meeting, where the Sustainable Development Goals (SDGs) to be achieved by 2030 were adopted, the global development framework was addressed in a broader, longer-term, and more inclusive manner compared to previous meetings. The 2030 Agenda for Sustainable Development encompasses 17 sustainable development goals and 169 targets (United Nations, 2015). These adopted goals present a significant framework for countries to achieve progress in sustainability with a multidimensional vision that integrates social equity, environmental protection, and economic growth.

In 2015, when the transition from the Millennium Development Goals to the Sustainable Development Goals took place, the goals were made more comprehensive. The goals established in 2015 created a more inclusive framework, targeting both developing and developed countries. Approximately two months after the United Nations Sustainable Development Summit, the Paris Agreement was signed at the 2015 Paris Climate Change Conference (COP21) and was ratified by 191 countries in 2021. Among the main objectives of the agreement are limiting the global temperature increase to below 2°C and, if possible, to 1.5°C (United Nations Paris Agreement, 2015). Scientists and the World Meteorological Organization consider 1.5°C as a critical threshold, warning that exceeding this limit will make the impacts of climate change far more dangerous.

According to the agreement, which includes goals for adapting to climate change and building resilient societies, developed countries are expected to provide financial

support to developing countries in combating climate change. This support is intended to be used for financing projects aimed at reducing greenhouse gas emissions and adapting to climate change. Currently, the world emits a total of 51 billion tons of greenhouse gases into the atmosphere annually. In 2020, due to the significant economic slowdown caused by COVID-19, this amount decreased by approximately 5% (Gates, B., 2021:12; Eryar Ünlü, D., 2022:39). Although there are plans to increase it after 2025, developed countries were expected to provide $100 billion annually in climate financing by 2020.

This study approaches the fundamental concept of sustainability from a financial perspective, focusing on sustainable finance. And following is the structure of the rest of this study. The second section explains sustainability in finance and the ESG scoring methodology. The third section discusses literature related to ESG and stock performance, providing empirical and theoretical support for the study. The fourth section describes the data and methodology in light of current data. Subsequently, in the fifth section, the data analysis and results are reported in detail, while in the final section, the findings are discussed with the relevant literature.

## 2. Sustainable Finance and ESG Practices

In the field of finance, sustainability involves shaping financial decisions and actions in line with the Sustainable Development Goals (SDGs) established during the 2015 United Nations Sustainable Development Summit by various stakeholders such as governments, corporations, and investors, through both direct and indirect methods. In this context, governments and their various agencies primarily create sustainability indices and encourage the establishment of sustainability funds. Additionally, financial supervisory and regulatory authorities and credit rating agencies contribute to the inclusion of sustainability in reporting and credit rating processes.

As of 2022, approximately $30 trillion in investments fall under the framework of Sustainable Responsible Investments (SRI) within the financial ecosystem (Global Sustainable Investment Alliance, 2022). 2025, this investment is expected to reach approximately $40–50 trillion. Raising awareness among investors—whether institutional or individual—on sustainability is crucial. Encouraging investors to incorporate sustainability considerations into their investment decision-making processes is essential for aligning with the SDGs. For this purpose, ESG Scores have been developed to enable investors to measure sustainability in their investment decisions. ESG, an acronym developed in a 2004 report prepared by 20 financial institutions in response to a call from United Nations Secretary-General Kofi Annan, refers to how companies and investors integrate environmental, social, and governance concerns into their business models. The difference between the concept of ESG and Corporate Social Responsibility lies in their focus: while Corporate Social Responsibility refers to firms' efforts to act as more socially responsible and better corporate citizens, the concept of ESG explicitly incorporates governance (Gillan et al., 2021:2).

ESG scores of firms are measured and published by independent data providers, rating agencies, and financial analysis firms. Examples of such organizations include MSCI (Morgan Stanley Capital International) ESG Research, Sustainalytics, FTSE Russell, Refinitiv Eikon, and Bloomberg. ESG scores are determined by assessing performance in three core areas: environmental, social, and governance.

These scores are compiled using data collected from publicly available corporate information, voluntary disclosures made to companies such as Bloomberg and Reuters, non-governmental organizations, stock market activities, news sources, and corporate social responsibility reports. Each component of ESG (Environment, Social, Governance) is assigned a value ranging from 0 to 100.

Table 1
ESG Scores Methodology
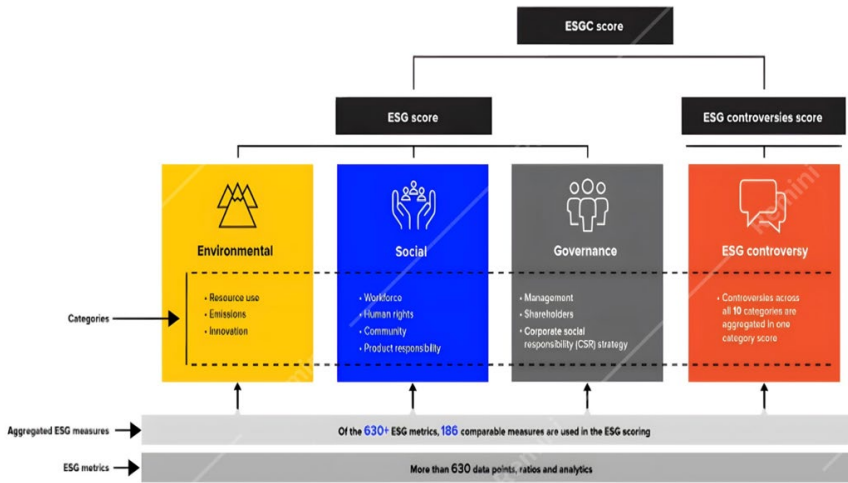
Resource: Refinitiv Eikon, 2023

In this study, we utilized Refinitiv Eikon's ESG methodology, which we accessed through Istanbul Ticaret University. As the table above indicates, ESG scores consist of three main pillars: Environment, Social, and Governance.

The table below outlines the methodology for the subcategories of Environmental, Social, and Governance scores as published by the Refinitiv Eikon Database.

Table 2

Environmental, Social, and Governance Scores Methodology

Pillar	Sub-Pillars	Definitions
Environmental	Resource Use Score	Company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management
	Emissions Score	Measures a company's commitment and effectiveness towards reducing environmental emission in the production and operational processes.
	Environmental Innovation Score	Reflects a company's capacity to reduce the environmental costs and burdens for its customers and thereby creating new market opportunities through new environmental technologies or processes or eco-designed products.
Social	Workforce Score	Measures a company's effectiveness towards job satisfaction, healthy and safe workplace, maintaining diversity and equal opportunities, and development opportunities for its workforce
	Human Rights Score	Company's effectiveness towards respecting the fundamental human rights conventions.
	Community Score	Company's commitment towards being a good citizen, protecting public health and respecting business ethics.
	Product Responsibility Score	Reflects a company's capacity to produce quality goods and services integrating the customer's health and safety, integrity and data privacy.
Governance	Management Score	Measures a company's commitment and effectiveness towards following best practice corporate governance principles
	Shareholders Score	Includes a company's effectiveness towards equal treatment of shareholders and the use of anti-takeover devices
	CSR Strategy Score	The company's practices to communicate that it integrates the economic, social and environmental dimensions into its day-to-day decision-making processes.

Resource: Refinitiv Eikon, 2024

The ESG "Controversies Score" measures a company's exposure to environmental, social, and governance controversies and adverse events reported in global media. The table presents a concise summary of the ESG scores and their pillars. In subsequent sections of the study, research examining the relationship between ESG scores and financial performance will be reviewed chronologically.

3. Literature Review

In recent years, numerous studies have examined the relationship between sustainability and various financial indicators, such as firms' financial performance, firm value, profitability, and stock prices. ESG scores, which represent the quantitative measure of sustainability for firms, are frequently utilized in academic research in this context.

The literature review section presents academic studies exploring the relationship between sustainability, sustainable responsible investment (SRI), and ESG scores with firms' stock prices and performance in chronological order.

Table 3

Literature Review

No	Author(s), (Year)	Sample / Time Range	Objective(s)	Finding(s)
1	Derwall et al., (2005)	US firms / 1995-2003	The purpose of this study was to test whether Socially Responsible Investing (SRI) leads to superior or inferior stock performance.	It was concluded that the top portfolio outperformed the bottom portfolio between 1995 and 2003, and it was stated that adopting an environment-based approach to investments could be beneficial.
2	Kempf and Osthoff, (2007)	S&P500 and DS400 indices firms / 1992-2004	Measure the portfolio performance of stocks with high social responsibility ratings.	Authors suggest that it would be advantageous for investors to adopt the Socially Responsible Investment (SRI) approach.
3	Galema et al., (2008)	KLD Research and Analytics database US firms / 1992-2006	Investigating the effect of Socially Responsible Investment (SRI) on abnormal returns using different variables in the KLD Research and Analytics database.	Different SRI variables could have positive or negative effects on stock returns.
4	Statman and Glushkov,	DS 400 and S&P 500 companies /	Measure the abnormal returns of high and low socially responsible	Authors find that some socially responsible portfolios perform better

	(2009)	1992-2007	portfolios with different models.	than traditional ones but worse than non-socially responsible portfolios.
5	Humphrey and Tan, (2014)	S&P500 index / 1996-2010	Whether the Socially Responsible Investment (SRI) approach provides a superior stock performance by using the data of stocks.	Authors find no difference in the return or risk of screened and unscreened portfolios. They conclude that a typical socially responsible fund will neither gain nor lose from screening its portfolio.
6	De and Clayman, (2015)	Thomson Reuters ESG database and the different Russell indexes. / 2007-2012	Study covers the understanding of whether firms with higher ESG scores mean higher market returns.	Study revealed that there is an ex-post correlation and that companies with higher returns generally have higher ESG scores.
7	Dimson et al., (2015)	613 US firms / 1999-2009	Examining the effects of ESG on stock returns using corporate social responsibility commitments linked to Environmental, Social, and Governance concerns.	Adopting the ESG improvement practices of the companies will benefit the companies in terms of stock performance.
8	Halbritter and Dorfleitner, (2015)	U.S. market /1991-2012.	Examining the effect of ESG scores on stock returns.	The effect of ESG scores on stock returns depends on the database and time frame used, and portfolios that buy company stocks with high ESG scores and sell low ones do not achieve abnormal returns.
9	Sahut and Pasquini-Descomps, (2015)	US, UK and Switzerland / 2007-2011	Study investigates how news-based scores in ESG may have influenced the monthly stocks' market returns.	Using linear regression, it was found that there was no significant relationship between monthly stock returns and ESG scores for the USA and Switzerland. In contrast, a negative relationship was found between ESG performance and stock returns in the UK.

10	Auer and Schuhmacher, (2016)	Asia-Pacific region, the United States and Europe/ 2004-2012	Using monthly stock data authors whether top ESG portfolios outperform bottom ones, and the authors created a portfolio containing 5% stocks with the highest ESG score.	Regardless of geographic region, industry or ESG criterion, active selection of high- or low-rated stocks does not provide superior risk-adjusted performance in comparison to passive stock market investments.
11	Celik et al., (2017)	S&P 500 / 2002-2016	Examine the relationship between company scores (Corporate Governance Score, Economic Score, Environmental Score, and Social Score) and stock returns, both at portfolio-level analysis and firm-level cross-sectional regressions.	Portfolio-level analysis results indicate that there is no significant relation between company scores and stock returns; firm-level analysis indicates that economic, environmental, and social scores have effect on stock returns, however, significance and direction of these effects change, depending on the included control variables in the cross-sectional regression.
12	Breedt et al., (2019)	Most liquid stocks in the USA, Europe, Australia, Canada and Japan	Evaluating whether ESG factors can take precedence over other well-known investment factors in order to measure the abnormal returns of stocks.	The inclusion of ESG factors in a worldwide neutral portfolio does not provide additional returns, as they are covered by other well-known stock factors. The authors nevertheless stated that the inclusion of ESG factors in the portfolio will not adversely affect returns, and ESG should not be viewed as a unique factor.
13	Zehir, E., and Aybars, A. (2020)	Stocks operating in Europe and Türkiye / 2004-2018	Analyzing the performance of portfolios based on environmental, social and governance (ESG) scores	Results show that there is no relationship between socially responsible investing (SRI) and portfolio performance.
14	Boido, C. et al., (2022)	Stocks operating in Europe /	Do portfolios of stocks with higher ESG scores outperform portfolios of stocks with lower	The findings show that portfolios composed of issuers with a better ESG profile deliver higher

		2016-2021	ESG scores.	returns, lower risk and higher efficiency, regardless of the provider chosen.
15	Fu, J. (2024)	China / 2019-2022	The study investigates how stock returns and volatility can be related to ESG.	Study shows that both the composite ESG score, and individual scores have a negative impact on stock returns.

4. Data and Methodology

This study examines all firms operating in E-7 countries (China, India, Brazil, Indonesia, Mexico, Russia, and Türkiye) with available financial and sustainability scores (ESG scores) between 2010 and 2022. Firms with consistent ESG scores for each country throughout the 2010–2022 period were included in the study. All data were obtained via the Refinitiv Eikon database.

A total of 311 firms' financial and sustainability data were included in the analysis: 107 from China, 57 from India, 54 from Brazil, 24 from Indonesia, 21 from Mexico, 23 from Russia, and 25 from Türkiye.

The literature includes studies examining the relationship between ESG scores and stock price performance. This study focuses on the main research question of whether factors derived from ESG scores can be integrated into asset pricing models. Therefore, this study aims to integrate ESG scores into the pricing model presented in the 2015 study "A Five-Factor Asset Pricing Model" by Fama and French. In this context, annual data were used since ESG scores are published annually. Before integrating ESG scores, it is essential to understand the development and methodology of Investment Theory and Factor Models.

For many years, various factors, variables, and models have been utilized in finance to explain changes in stock returns. The Capital Asset Pricing Model (CAPM) is the most widely accepted and frequently referenced in academic studies, applications, and models. Introduced by William F. Sharpe in 1964 and later developed by John Lintner (1965) and Jan Mossin (1966), CAPM explains variations in returns using a single factor. This market beta measures systematic market risk.

As an equilibrium model, CAPM evaluates the relationship between expected return and risk, incorporating the market factor. However, due to its reliance on a single factor, it has been criticized over time. The notion that a single factor cannot explain stock returns and that additional factors and variables must be considered led to the development of multifactor asset pricing models.

In this context, Fama and French introduced a new model to the finance literature in

1993 through their study "Common Risk Factors in the Return on Stocks and Bonds," which added firm size and book-to-market (B/M) ratio factors to the market factor. In subsequent years, Carhart (1997) expanded the model by incorporating the momentum factor (Winner Minus Loser – WML), which posits that stocks that have performed well in the past will continue to do so in the future, while stocks that have performed poorly will continue to underperform. The evolution of asset pricing models has been driven by researchers incorporating observed periodic effects over time.

In 2015, Fama and French expanded their three-factor model by adding two new factors: profitability (RMW) and investment (CMA), thus developing a five-factor model. Using the same dataset as in their earlier three-factor models, Fama and French found statistically more significant results with their five-factor model, expressed below.

$$R_{it}-Rf_{it}=\alpha_i+\beta_i(Rm-Rf)_{it}+s_i\,SMB_{it}+h_iHML_{it}+r_iRMW_{it}+c_iCMA_{it}+\varepsilon_i \qquad (1)$$

$R_{it}-RF_{it}$= The expected excess return of security/portfolio i over the risk-free rate,

$Rm_{it}-Rf_{it}$ = The expected excess return of the market portfolio over the risk-free rate,

SMB_{it} = The return difference between portfolios of small-cap stocks and large-cap stocks *(Small Minus Big),*

HML_{it} = The return difference between portfolios of stocks with high and low book-to-market ratios *(High Minus Low),*

RMW_{it} = The return difference between portfolios of stocks with high and low profitability *(Robust Minus Weak),*

CMA_{it} = The return difference between portfolios of stocks with high and low investment levels *(Conservative Minus Aggressive),*

β_i= sensitivity of the excess returns of portfolio i to the excess returns of the market,

s_i= sensitivity of the excess returns of portfolio i to the SMB factor,

h_i= sensitivity of the excess returns of portfolio i to the HML factor,

r_i= sensitivity of the excess returns of portfolio i to the RMW factor,

c_i= sensitivity of the excess returns of portfolio i to the CMA factor,

α_i= the difference between the actual return and the return predicted by the model,

ε_i= the residuals

In their 2015 study, Fama and French tested the FF5F model, which includes the market factor, firm size (SMB), book-to-market ratio (HML), profitability (RMW), and investment (CMA) factors of firms traded on the NYSE, AMEX, and NASDAQ stock markets. During the portfolio formation phase, they followed the same methodology as in their 1993 study, where they introduced the FF3F model.

The firm size factor, SMB, essentially considers the market capitalization of firms. Market capitalization for a firm is calculated as the product of the number of outstanding shares and the stock price, commonly denoted as MCAP, Market Capitalization, or MV (Market Value). In Fama and French's studies (1993 and 1995), firms were ranked annually based on their market capitalization at the end of year "t" and divided into small and big groups. The classifications were determined using market capitalization figures as of the end of June of the corresponding year, and these figures were utilized to construct portfolios for the period from July of the year "t" to June of the year "t+1."

The value factor, HML, is calculated based on firms' book-to-market ratios. Firms classified by market capitalization were further ranked by their book-to-market ratios and divided into three groups: 30% Low (L), 40% Medium (M), and 30% High (H). The book-to-market ratio for each firm in a given year was calculated by simultaneously dividing the equity value at the end of year "t-1" by the market value.

One of the two new factors included in Fama and French's five-factor model, the Profitability Factor (RMW), essentially represents the operating profitability ratio. Firms previously grouped by market capitalization were further categorized into three groups based on the ratio of operating profit to equity value: 30% Weak (W), 40% Medium (M), and 30% Robust (R). The annual profitability ratio for each firm was calculated by dividing the operating profit of year "t-1" by the equity value of year "t-1."

The second new factor included in Fama and French's 2015 model is the Investment Factor, referred to as CMA. Also known as the investment ratio, this factor is calculated based on the asset growth rate of firms. It is determined by dividing the difference in total assets between years "t-1" and "t-2" by the total value of assets in year "t-2." As previously explained, this factor is divided into three groups. Firms with a low investment ratio are classified as 30% Conservative (C), medium-sized firms as 40% Medium (M), and firms with a high investment ratio as 30% Aggressive (A). For each firm, the investment ratio for year "t" is calculated by dividing the total asset difference between years "t-1" and "t-2" by the total asset value in year "t-2." This study aims to integrate a sixth factor, based on ESG scores, into the five-factor asset pricing model developed by Fama and French in 2015. For this purpose, the model is mathematically represented, as shown below.

$$R_{it}-Rf_{it}=\alpha_i+\beta_i(Rm-Rf)_{it}+s_iSMB_{it}+h_iHML_{it}+r_iRMW_{it}+c_iCMA_{it}+e_i\mathbf{ESG_{it}}+\varepsilon_i \qquad (2)$$

Since ESG scores are published annually, the other variables in the model were also adjusted using annual data. In this study, which analyzes each E-7 country separately, the firms' annual returns and risk-free interest rates were used as the independent variable. Beta values for the firms were calculated using the Refinitiv Eikon platform. For each country, the annual return of the most representative stock exchange was used to represent market returns. Consistent with Fama and French's 2015 study, companies with negative equity during the 2010–2022 period were excluded from the analysis. Market capitalization data were considered as of the end of December each year during the construction of the variables.

The Sustainability Factor (ESG) was calculated using the sustainability scores of each firm from the t−1 year. As part of this process, firms were first divided into large and small groups based on their market capitalization. Then, they were classified into three categories according to their ESG scores: 30% of firms with low ESG scores were categorized as Small (S), 40% with medium ESG scores as Medium (M), and 30% with high ESG scores as Big (B).

S/S: A portfolio of stocks from firms with small market capitalization and low ESG scores.

S/M: A portfolio of stocks from firms with small market capitalization and medium ESG scores.

S/B: A portfolio of stocks from firms with small market capitalization and high ESG scores.

B/S: A portfolio of stocks from firms with large market capitalization and low ESG scores.

B/M: A portfolio of stocks from firms with large market capitalization and medium ESG scores.

B/B: A portfolio of stocks from firms with large market capitalization and high ESG scores.

During the portfolio formation phase, the risk factors were calculated as in Fama and French's (2015) study. The calculation methods are detailed in the table below. Additionally, the ESG factor to be integrated was also calculated in a manner similar to the methodology of Fama and French (2015).

Table 4

Factor Components and Cutoff Points

Cutoff Points	Factor Components
	$SMBB/M = (SH + SN + SL)/3 – (BH + BN + BL)/3$
Size: Median	$SMBOP = (SR + SN + SW)/3 – (BR + BN + BW)/3$
Book to Market Ratio (B/M): 30th and 70th percentiles	$SMBInv = (SC + SN + SA)/3 – (BC + BN + BA)/3$
	$SMBESG = (SS + SN + SB)/3 – (BS + BN + BN)/3$
Profitability: 30th and 70th percentiles	$SMB = (SMBB/M + SMBOp + SMBInv + SMBESG)/4$
Investment: 30th and 70th percentiles	$HML = (SH + BH)/2 – (SL + BL)/2$
	$RMW = (SR + BR)/2 – (SW + BW)/2$
ESG: 30th and 70th percentiles	$CMA = (SC + BC)/2 – (SA + BA)/2$
	$ESG = (SB + BB)/2 – (SS + BS)/2$

5. Data Analysis and Findings

In order to integrate the new factor based on ESG scores into the Fama and French five-factor model, all necessary financial data for firms included in the analysis from E-7 countries were collected. Market returns and risk-free interest rates were calculated separately for each country to conduct country-specific analyses. Since each country was evaluated individually, data was retrieved in the respective local currency of each country. After constructing the factors, the data was analyzed using the panel data analysis method. During the analysis stage, preliminary tests were conducted for each country to identify the most suitable estimator for the dataset.

Additionally, various assumption deviation tests were performed, including cross-sectional dependence, autocorrelation, and heteroskedasticity. Based on the findings from these tests, the analyses were conducted using the most appropriate estimators. The analyses were performed using the STATA econometric software package. The correlation coefficients between independent variables and the Variance Inflation Factor (VIF) analyses for each country within the scope of the study are provided in the appendix.

5.1. Summary Statistics for Countries

The tables present summary statistics (mean, median, standard deviation, minimum, maximum, and number of observations) for the firms operating in countries from 2010 to 2022, based on the established model.

Table 5

Summary Statistics of China

Variable	Mean	Median	Std. Dev.	Min	Max	N
Ri-Rf	0.0477	-0.05	0.4320	-0.70	3.27	1391
Bx(Rm-Rf)	0.0786	0.06	0.2385	-0.80	1.2	1391
CMA	-0.0138	-0.03	0.1104	-0.21	0.16	1391
HML	0.0069	0.08	0.2601	-0.54	0.52	1391
RMW	0.0253	0.01	0.1667	-0.34	0.25	1391
ESG	0.0223	0.02	0.0852	-0.13	0.23	1391
SMB	0.0246	0.04	0.1117	-0.02	0.25	1391

From 2010 to 2022, the average excess returns over the risk-free rate in China were approximately 5%, with a high standard deviation. The negative value of the CMA factor indicates that capital-intensive firms have lower average returns than others. The ESG factor, included for integration into the model, has an average value of approximately 2%.

Table 6

Summary Statistics for India

Variable	Mean	Median	Std. Dev.	Min	Max	N
Ri-Rf	0.0822	0.04	0.4315	-0.96	2.84	741
Bx(Rm-Rf)	0.0511	0.04	0.1822	-0.58	0.58	741
CMA	0.0000	0.02	0.1885	-0.3	0.33	741
HML	-0.0930	-0.25	0.2517	-0.38	0.42	741
RMW	0.0630	0.07	0.1476	-0.28	0.27	741
ESG	0.0484	0.04	0.1475	-0.17	0.27	741
SMB	0.0430	0	0.1750	-0.22	0.35	741

The 13-year average excess returns over the risk-free rate for these firms are approximately 8%. The averages for the Market Risk Premium, RMW, ESG, and SMB factors range between 4% and 6%. The 13-year average of the zero CMA factor indicates that companies investing in capital in India do not differentiate themselves. Similarly, the Book-to-Market Ratio factor has an average very close to zero, but it is observed to have a negative average. This suggests that investors in India do not distinguish value stocks.

In Brazil, it is observed that the average returns are positive; however, the median value is negative, which is notable. This indicates that while some firms in the market exhibit above-average positive performance, the overall market experiences imbalances and volatility. The market risk coefficient has a negative average, which could indicate that many firms in the Brazilian market move inversely to the market or that there are macroeconomic uncertainties such as recession and high inflation. Results suggest that ESG factors have a negative impact on returns in Brazil or that sustainability-focused investments are not attractive in the Brazilian market.

Table 7

Summary Statistics of Brazil

Variable	Mean	Median	Std. Dev.	Min.	Max.	N
Ri-Rf	0.0347	-0.02	0.4434	-1	2.68	702
$B_x(R_m-R_f)$	-0.0368	-0.04	0.1874	-0.58	0.68	702
CMA	0.0400	0.06	0.2072	-0.31	0.37	702
HML	0.0669	0.01	0.2593	-0.24	0.68	702
RMW	0.0007	0.02	0.1158	-0.23	0.15	702
ESG	-0.0246	-0.05	0.1165	-0.17	0.21	702
SMB	0.0684	0.07	0.1425	-0.19	0.28	702

Table 8

Summary Statistics of Indonesia

Variable	Mean	Median	Std. Dev.	Min.	Max.	N
Ri-Rf	0.0835	0.015	0.4478	-0.73	3.26	312
$B_x(R_m-R_f)$	0.0251	-0.02	0.1787	-0.39	0.75	312
CMA	-0.0469	-0.06	0.1949	-0.43	0.37	312
HML	0.0215	0.02	0.2001	-0.46	0.34	312
RMW	0.0284	0.01	0.1713	-0.27	0.35	312
ESG	-0.0146	-0.02	0.2846	-0.55	0.68	312
SMB	0.1015	0.07	0.2762	-0.24	0.69	312

Between 2010 and 2022, the average excess return relative to the risk-free rate for firms in Indonesia was about 8 percent, suggesting that firms generally outperform the risk-free rate on average. However, the high standard deviation (0.4478) and the wide range of values (-0.73 to 3.26) indicate high market volatility. When the summary statistics for the CMA factor are analyzed, it is observed that firms with higher capital investment have lower returns. Similarly, ESG-oriented firms generally have lower returns.

Table 9

Summary Statistics of Mexico

Variable	Mean	Median	Std. Dev.	Min.	Max.	N
Ri-Rf	0.0492	0	0.3373	-0.65	1.62	273
$B_x(R_m-R_f)$	-0.0201	-0.03	0.1191	-0.38	0.33	273
CMA	0.0076	0.06	0.1903	-0.34	0.38	273
HML	0.0615	0.16	0.3334	-0.64	0.51	273
RMW	-0.0415	-0.07	0.1669	-0.29	0.30	273
ESG	0.0215	-0.06	0.2395	-0.42	0.42	273
SMB	0.0676	0.05	0.1392	-0.13	0.30	273

The summary statistics for Mexico indicate that the average returns above the risk-free interest rate are approximately 5%, while the median value is zero. The zero median value suggests that the returns are not symmetrically distributed and that a significant portion takes neutral to negative values. The high standard deviation of the average returns and the wide range of values further indicate high volatility. The low average of the CMA factor indicates a small positive effect of capital-intensive firms on returns. The RMW factor, with a negative average and median, suggests that profitable firms generate lower returns.

Table 10

Summary Statistics of Russia

Variable	Mean	Median	Std. Dev.	Min.	Max.	N
Ri-Rf	0.0702	0.03	0.4384	-0.89	2.63	299
$B_x(R_m-R_f)$	-0.0255	0.03	0.2009	-0.79	0.35	299
CMA	-0.0969	-0.02	0.2513	-0.53	0.33	299
HML	-0.0615	-0.03	0.2301	-0.53	0.30	299
RMW	0.0676	0.06	0.2691	-0.37	0.48	299
ESG	0.0300	0.01	0.2123	-0.22	0.56	299
SMB	0.0238	0.04	0.2328	-0.30	0.55	299

When examining the summary statistics for 23 firms operating in Russia, the average excess returns over the risk-free rate are approximately 7%. However, the high standard deviation indicates significant market risk. The average value for the Market Risk Coefficient is negative, suggesting that many firms react negatively to the market risk premium. This could be explained by the dominance of defensive sectors or the impact of economic uncertainties. Findings related to the CMA and HML factors indicate that capital-intensive and value stocks are not considered attractive by investors in the Russian market. The ESG factor is considered to have a limited but positive effect on returns in Russia, and its importance may increase in the long term.

Table 11

Summary Statistics of Türkiye

Variable	Mean	Median	Std. Dev.	Min.	Max.	N
Ri-Rf	0.2378	0.1	0.7143	-0.65	5.94	325
$B_x(R_m-R_f)$	-0.0614	-0.06	0.2018	-0.75	0.28	325
CMA	0.0800	0.06	0.2500	-0.48	0.70	325
HML	-0.4153	-0.08	0.2135	-0.57	0.29	325
RMW	0.0215	0.04	0.2326	-0.62	0.29	325
ESG	0.0238	0.05	0.1008	-0.13	0.27	325
SMB	0.1423	0.12	0.1962	-0.05	0.76	325

Average excess returns relative to the risk-free interest rate are higher than in other countries. However, a high standard deviation indicates high-risk levels and high volatility. Minimum and positive values show this situation more clearly. The results for the CMA factor show that capital-intensive firms in Türkiye had better returns than firms with high investment levels over the 13 years. The RMW factor has a positive mean and median, indicating that profitable firms generally generate higher returns. The ESG factor also has a positive mean and a low standard deviation, indicating that ESG factors have a positive but limited impact on investors in Türkiye.

5.2. Analysis Results and Findings

The panel data analysis results for the E-7 countries are presented in the table below. The R^2 values for the models of China, India, Brazil, Indonesia, Mexico, Russia, and Türkiye are 8%, 32%, 26%, 20%, 18%, 33%, and 41%, respectively. Robust and bootstrap standard errors have been used to mitigate multicollinearity, heteroskedasticity, and cross-sectional dependence problems.

Table 12

Analysis Results of E-7 Countries

	China	India	Brazil	Indonesia	Mexico	Russia	Türkiye
MRP	0.4299***	0.9289***	1.1126***	0.8574***	1.0943***	1.0707***	-0.5633**
	(0.038)	(0.1231)	(0.1297)	(0.1542)	(0.0990)	(0.1006)	(0.1590)
CMA	0.2064	0.0603	0.0087	-0.1587**	-0.3127**	-0.0155	-0.2895*
	(0.1540)	(0.1733)	(0.1211)	(0.0663)	(0.0592)	(0.1204)	(0.1092)
HML	0.2917***	0.1335**	-0.0322	0.1267	0.0377	-0.1237	0.5178***
	(0.0631)	(0.0539)	(0.1143)	(0.0951)	(0.0363)	(0.1476)	(0.1328)
RMW	0.2315*	0.0770	0.2033	0.1182	-0.3814***	-0.1523	-0.5945**
	(0.1269)	(0.1453)	(0.1732)	(0.1251)	(0.0683)	(0.1190)	(0.2069)
ESG	0.2505	-0.0578	-0.1580	0.0789	0.0015	-0.0713	1.5210***
	(0.1767)	(0.0784)	(0.1248)	(0.0535)	(0.0804)	(0.0830)	(0.1987)
SMB	-0.1740	0.4400**	0.3288	0.3264***	0.4181***	0.3015***	1.6756***
	(0.1570)	(0.1560)	(0.1550)	(0.0472)	(0.0482)	(0.0719)	(0.2521)
cons	0.0076	0.0261*	0.0509**	0.0165	0.0272***	0.0936***	-0.0208
	(0.006)	(0.0127)	(0.0159)	(0.0217)	(0.0056)	(0.0175)	(0.0321)

Standard errors are reported in parentheses, and significance at ten percent, five percent, and one percent levels is indicated by *, **, and ***, respectively. The word MRP (Market Risk Premium) stands for Bx (Rm-Rf).

Regarding the independent variables for China, the Market Risk Coefficient is observed to have a positive and significant effect on returns. This suggests that investors in the Chinese market are sensitive to market risk premiums, a result consistent with the CAPM. Based on the results from the CMA factor, there is no statistically significant relationship between capital investments and returns. Firms with high book-to-market ratios in the Chinese market have higher returns, a result aligned with traditional factor models. From the perspective of the profitability factor, the results indicate a limited effect, suggesting that more profitable firms have higher returns compared to less profitable firms.

Regarding the ESG factor, which is intended to be integrated into the model, the results indicate that it does not have a significant effect on returns. This could be interpreted as ESG investments not yet being a decisive criterion for investors in the Chinese market.

Analysis results of India indicate that the model has a reasonable explanatory power for returns in the Indian market. The Capital Investment Factor, however, does not significantly affect returns, indicating no statistically significant relationship between capital investments and returns. Investing in capital-intensive firms does not lead to significant differences in returns in the Indian market. The HML factor, representing value stocks, is attractive to investors and provides higher returns. The RMW factor positively impacts returns but is not statistically significant, which means investors in the Indian market may not consider profitability as a primary factor. Similarly, the ESG factor is also insignificant in explaining returns, indicating that sustainability-based investments are not yet widespread in India. Finally, the SMB (firm size factor) variable positively and significantly impacts returns.

When examining the analysis results for 54 firms operating in Brazil, it is observed that only the Market Risk Premium and Firm Size (SMB) factors are statistically significant. The results for the SMB factor indicate that smaller firms in the Brazilian market offer higher risk premiums. However, unlike the Market Risk Premium and SMB factors, the CMA, HML, RMW, and ESG factors are not statistically significant. The insignificance of factors such as ESG, CMA, HML, and RMW suggests that these factors do not sufficiently influence investment decisions or are not considered by investors in the Brazilian market. The ESG factor has a negative effect on returns, but this relationship is also not statistically significant. This suggests that investors in Brazil do not follow a strategy based on sustainability.

When evaluating the model results for Indonesia, it is observed that the R-squared is approximately 20%, while the HML, RMW, and ESG variables are statistically insignificant. On the other hand, the Market Risk Premium, CMA, and SMB variables are found to be significant. The CMA factor, which has a negative coefficient, indicates a negative relationship between capital intensity and returns for firms, suggesting that investors perceive these firms as having low profitability or high-risk levels. The panel data analysis results for the SMB factor also show a positive and significant impact on explaining returns.

When analyzing the model results for 21 firms operating in Mexico, it was found that only the HML and ESG factors were statistically insignificant. The CMA factor has a strong and negative effect on returns among the statistically significant variables. This indicates that investors perceive capital-intensive firms as inefficient or riskier. The Profitability Factor (RMW) is similar to the CMA factor, with a strong and negative impact on returns. This can be interpreted as profitable firms being considered less risky and, therefore, offering lower risk premiums. Investors view profitable firms as safer but with lower returns. Another significant variable in the model, the SMB factor, has both a strong

and positive effect on returns.

In Russia, only two variables are statistically significant. As observed in previous country analyses, the Market Risk Premium factor positively and significantly affects returns. Furthermore, it is evident that firms with smaller market capitalizations provide higher returns by offering higher risk premiums. When examining factors that are not statistically significant, the CMA factor has a negative effect on returns; however, this relationship is not statistically significant. The HML factor, representing value stocks, does not significantly impact returns in the Russian market. The RMW factor has a negative effect on returns, but this relationship is not statistically significant. More profitable firms may be associated with lower returns in the Russian market. Similarly, the ESG factor has a negative effect on returns, but this relationship is also not statistically significant.

In the Türkiye market, the market risk premium has a negative impact on returns. This may be influenced by macroeconomic factors such as economic uncertainties. The CMA factor indicates that capital-intensive firms have lower returns, which could be related to the inefficient utilization of investments. The RMW factor suggests that profitable firms are perceived as less risky and offer lower returns. When considering factors with positive coefficients, the HML factor indicates that value stocks have a positive effect and are attractive to investors in Türkiye. The results for the ESG factor reveal a significant and powerful positive effect on returns. This indicates that firms prioritizing ESG practices are rewarded by investors and achieve higher returns in the Türkiye market. This underscores the growing importance of sustainability-focused investments and strategies. Similarly, the results for the SMB factor also demonstrate a significant and strong positive impact on returns. This can be explained by smaller firms offering higher risk premiums. Additionally, this effect may be observed due to recent initial public offerings, which have introduced smaller-cap but strong firms into the market.

6. Conclusion and Discussion

The analysis results vary across countries. The total number of firms included in the analysis for each country significantly influences the outcomes. The first limitation of this study is the use of firms with consistent and accessible ESG scores for the period between 2010 and 2022. The results could have differed if the time period had been shortened to include more firms in the analysis.

When the results are evaluated compared to the existing literature, the findings regarding market risk premiums are statistically significant for all E-7 countries. These results align with Halbritter and Dorfleitner's (2015) and Sahut and Pasquini-Descomps (2015) studies. Regarding the CMA factor, the results are statistically significant and have a negative coefficient in Indonesia, Mexico, and Türkiye. However, in China, India, and Brazil, the results are statistically insignificant and have a positive coefficient. In Russia, the results are both statistically insignificant and have a negative coefficient.

The general findings for the HML factor indicate that it is statistically significant, with a positive coefficient only in China, India, and Türkiye. These results contrast with the study by Statman and Glushkov (2009) but align with Sahut and Pasquini-Descomps (2015). For Indonesia and Mexico, the HML factor results are positive but statistically insignificant, aligning with Halbritter and Dorfleitner's (2015) study.

The RMW factor, which indicates that more profitable companies achieve higher returns, is statistically significant in China, Mexico, and Türkiye but is insignificant in other countries. This outcome reflects whether investors prioritize profitable companies in their investment decisions. Since the RMW factor relates to the profitability levels of companies in previous years, the results indicate whether investors in each country prefer reliable companies or those offering higher risk premiums.

When examining the ESG factor, which was integrated into the Fama & French five-factor asset pricing model, the results reveal that it negatively affects returns in India, Brazil, and Russia. Conversely, it positively affects returns in China, Indonesia, Mexico, and Türkiye. However, the ESG factor is statistically significant only in Türkiye among the E-7 countries. These findings align with the studies by Celik et al. (2017), Auer and Schuhmacher (2016), and Zehir and Aybars (2020), while they contrast with Galema et al. (2008).

The ESG factor is statistically significant and has a positive impact only in Türkiye. This indicates that ESG scores have a distinguishing positive feature for companies in Türkiye and that these scores are considered by investors. The statistically significant and positive impact of the ESG factor in Türkiye aligns with the studies by Galema et al. (2008), Derwall et al. (2005), Kempf and Osthoff (2007), Dimson et al. (2015), De and Clayman (2015), and Boido et al. (2022). However, these findings contradict the studies by Sahut and Pasquini-Descomps (2015), Breedt et al. (2019), Zehir and Aybars (2020), and Fu (2024). Türkiye stands out among the analyzed countries with its higher ESG and sub pillars scores, which appears to have influenced the results.

When evaluating the results for the SMB factor, it is statistically significant and positively explains returns in all countries except China and Brazil. In these countries, portfolios consisting of small market capitalization firms better explain returns, indicating that small firms offering higher risk premiums provide higher returns. The results for India, Indonesia, Mexico, Russia, and Türkiye align statistically with the studies by Sahut and Pasquini-Descomps (2015) and Halbritter and Dorfleitner (2015). However, the findings from China and Brazil contradict these studies. The study by Statman and Glushkov (2009) is statistically consistent with the SMB factor results obtained for China and Brazil.

The general findings of this study suggest that ESG factors are not yet fully effective in asset pricing models across E-7 countries. The limited scope of data and the focus solely on developing countries may have influenced the results. Future studies could expand the analysis to include more countries, broadening the scope. Additionally, the ESG factor

could be structured differently by relating it to the growth rates of ESG scores. Further studies could test the integration of ESG scores into asset pricing models in countries with a higher number of firms rated for ESG.

This study emphasizes the growing importance of ESG in investment strategies. Findings indicate that portfolios integrating firms with higher ESG scores are more effective in explaining returns. Additionally, the results demonstrate the alignment of sustainability practices with financial performance. However, the results also highlight regional disparities and the need for improved ESG reporting standards in emerging economies. Institutions, investors, and especially governments must collaborate to develop a strong ESG ecosystem to ensure sustainable economic growth.

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References

Afrooz, Z., & Kruusman, A. (2019). *The Effect of the ESG Score on Stock Price Jumps: A Quantitative Study on Nordic Countries* [Master's thesis]. Lund University. https://www.diva-portal.org/smash/record.jsf?dswid=4981&pid=diva2%3A1325390

Auer, B. R., & Schuhmacher, F. (2016). Do socially (ir) responsible investments pay? New evidence from international ESG data. *The Quarterly Review of Economics and Finance*, 59, 51-62. https://doi.org/10.1016/j.qref.2015.07.002

Balatbat, M., Siew, R., & Carmichael, D. (2012). ESG scores and its influence on firm performance: Australian evidence. In Australian School of Business School of Accounting, School of Accounting Seminar Series Semester. Vol 2, 1-30. Australia: University of New South Wales, India.

Baptista, O. C. A. (2019). *The Impact of Esg Criteria on Portfolio Financial Performance* (Order No. 28787929). Available from ProQuest Dissertations & Theses Global. (2592265182). https://www.proquest.com/dissertations-theses/impact-esg-criteria-on-portfolio-financial/docview/2592265182/se-2.

Boido, C., Ceccherini, P., & D'Imperio, A. (2022). ESG Scores-Is it the new way to build a European portfolio? *Journal of Finance and Investment Analysis*, 11(3), 1-21 https://doi.org/10.47260/jfia/1131.

Breedt, A., Ciliberti, S., Gualdi, S., & Seager, P. (2019). Is ESG an Equity Factor or Just an Investment Guide? *The Journal of Investing*, 28(2), 32-42.

Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of finance*, 52(1), 57-82. https://doi.org/10.1111/j.1540-6261.1997.tb03808.x

Celik, S., Aktan, B., Tvaronaviciene, M. & Bengitoz, P. (2017). Linkage between company scores and stock returns. *Journal of International Studies*, 10(1), 219-232. doi:10.14254/2071-8330.2017/10-4/17

De, I., & Clayman, M. R. (2015). The benefits of socially responsible investing: An active manager's perspective. *The Journal of Investing*, 24(4), 49-72.

Derwall, J., Guenster, N., Bauer, R., & Koedijk, K. (2005). The eco-efficiency premium puzzle. *Financial Analysts Journal,* 61(2), 51-63. https://doi.org/10.2469/faj.v61.n2.2716

Dimson, E., Karakaş, O., & Li, X. (2015). Active ownership. *The Review of Financial Studies*, 28(12), 3225-3268. https://doi.org/10.1093/rfs/hhv044

Eryar Ünlü, D. (2022). *İyi Olan Kazansın! Sürdürülebilirliğin 5N 1K'sı*. Sia Kitap, 2022.

European Commission. (2011). *A renewed EU strategy 2011-14 for corporate social responsibility* (COM(2011) 681 final). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52011DC0681

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of financial economics,* 33(1), 3-56. https://doi.org/10.1016/0304-405X(93)90023-5

Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of financial economics*, 116(1), 1-22. https://doi.org/10.1016/j.jfineco.2014.10.010

Fu, J. (2024). ESG, Stock Returns and Stock Volatility: Evidence from Chinese Listed Companies. In *SHS Web of Conferences* (Vol. 181, p. 02002). *EDP Sciences*. https://doi.org/10.1051/shsconf/202418102002

Galema, R., Plantinga, A., & Scholtens, B. (2008). The stocks at stake: Return and risk in socially responsible investment. *Journal of Banking & Finance*, 32(12), 2646-2654. https://doi.org/10.1016/j.jbankfin.2008.06.002

Gates, B. (2021). *How to avoid a climate disaster: the solutions we have and the breakthroughs we need*. Vintage.

Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, 66, 101889. https://doi.org/10.1016/j.jcorpfin.2021.101889

Global Sustainable Investment Alliance. (2022). Global sustainable investment review 2022. Global Sustainable Investment Alliance. https://www.gsi-alliance.org/wp-content/uploads/2022/04/GSIR-2022.pdf

Global Carbon Project. (2023). *Global Carbon Budget 2023*. Retrieved November 16, 2024, from https://www.globalcarbonproject.org/

Gompers, P., Ishii, J., & Metrick, A. (2003). Corporate governance and equity prices. *The quarterly journal of economics*, 118(1), 107-156. https://doi.org/10.1162/00335530360535162

Halbritter, G., & Dorfleitner, G. (2015). The wages of social responsibility—where are they? A critical review of ESG investing. *Review of Financial Economics*, 26, 25-35. https://doi.org/10.1016/j.rfe.2015.03.004

Humphrey, J. E., & Tan, D. T. (2014). Does it really hurt to be responsible? *Journal of business ethics*, 122(3), 375-386. https://doi.org/10.1007/s10551-013-1741-z

International Energy Agency. (2023). CO2 emissions in 2023. Retrieved from https://www.iea.org/reports/co2-emissions-in-2023.

International Energy Agency. (2023). Latin America Energy Outlook. Retrieved November 16, 2024, from https://www.iea.org/

Jensen, M. C., Black, F., & Scholes, M. S. (1972). The capital asset pricing model: Some empirical tests.

Kempf, A., & Osthoff, P. (2007). The effect of socially responsible investing on portfolio performance.

European financial management, 13(5), 908-922. https://doi.org/10.1111/j.1468-036X.2007.00402.x

Limkriangkrai, M., Koh, S., & Durand, R. B. (2017). Environmental, social, and governance (ESG) profiles, stock returns, and financial policy: Australian evidence. *International Review of Finance*, 17(3), 461-471. https://doi.org/10.1111/irfi.12101

Lintner, J. (1965). Security prices, risk, and maximal gains from diversification. *The journal of finance,* 20(4), 587-615. https://doi.org/10.2307/2977249

Lundin, F., & Olandersson, M. (2019). *Sustainability and Profitability in Sweden : A Quantitative Study of Swedish Firms [*Dissertation]. Retrieved from https://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-160392

Malik, M. (2015). Value-enhancing capabilities of CSR: A brief review of contemporary literature. *Journal of Business Ethics*, 127(2), 419-438. https://doi.org/10.1007/s10551-014-2051-9

Managi, S., Okimoto, T., & Matsuda, A. (2012). Do socially responsible investment indexes outperform conventional indexes? *Applied Financial Economics*, 22(18), 1511-1527. https://doi.org/10.1080/09603107.2012.665593

Mǎnescu, C. (2011). Stock returns in relation to environmental, social and governance performance: Mispricing or compensation for risk? *Sustainable development*, 19(2), 95-118. https://doi.org/10.1002/sd.510

Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, 7(1), 77–91. https://doi.org/10.2307/2975974

Mossin, J. (1966). Equilibrium in a capital asset market. Econometrica: *Journal of the econometric society*, 768-783. https://doi.org/10.2307/1910098

Sahut, J. M., & Pasquini-Descomps, H. (2015). ESG impact on market performance of firms: International Evidence. *Management International/International Management/Gestiòn Internacional*, 19(2), 40-63. https://doi.org/10.7202/1030386ar

Schoenmaker, D., & Schramade, W. (2018). Principles of sustainable finance. Oxford University Press.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The journal of finance*, 19(3), 425-442. https://doi.org/10.1111/j.1540-6261.1964.tb02865.x

Statman, M., & Glushkov, D. (2009). The wages of social responsibility. *Financial Analysts Journal*, 65(4), 33-46. https://doi.org/10.2469/faj.v65.n4.5

United Nations (1972). Stockholm Declaration and Action Plan for the Human Environment. Stockholm, Sweden: United Nations. https://www.un.org/en/conferences/environment/stockholm1972.

United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. Retrieved from https://sustainabledevelopment.un.org/post2015/transformingourworld.

WCED, S. W. S. (1987). World commission on environment and development. Our common future, 17(1), 1-91.

Zehir, E., & Aybars, A. (2020). Is there any effect of ESG scores on portfolio performance? Evidence from Europe and Turkey. *Journal of Capital Markets Studies*, 4(2), 129-143. https://doi.org/10.1108/JCMS-09-2020-0034

Appendix

A. Correlation Coefficients and Variance Inflation Factors for Countries

The correlation coefficients and Variance Inflation Factors (VIF) values for all countries are presented below. Correlation coefficients for independent variables that exceed ±70% are highlighted in bold. To address cases of high correlation, robust and bootstrap standard errors have been used to mitigate issues of multicollinearity, heteroskedasticity, and cross-sectional dependence. Additionally, the results of the VIF analysis conducted for each country serve as a validation, with the critical value for the average VIF set at 5. The average VIF values obtained in the results do not indicate any issues.

Table A.1. China Correlation Coefficients and Variance Inflation Factors

China	Bx(Rm-Rf)	CMA	HML	RMW	ESG	SMB
Bx(Rm-Rf)	1					
CMA	-0.0731	1				
HML	-0.2375	0.1115	1			
RMW	-0.3049	-0.6597	-0.1284	1		
ESG	-0.2826	-0.3750	0.3022	0.2298	1	
SMB	-0.0680	-0.0603	-0.2835	-0.4679	-0.5326	1

Variable	VIF	1/VIF
RMW	4.05	0.2470
SMB	3.04	0.3293
ESG	2.70	0.3706
CMA	2.68	0.3735
Bx(Rm-Rf)	1.58	0.6317
HML	1.23	0.8163
Mean VIF	**2.54**	

Table A.2. India Correlation Coefficients and Variance Inflation Factors

India	Bx(Rm-Rf)	CMA	HML	RMW	ESG	SMB
Bx(Rm-Rf)	1					
CMA	0.2899	1				
HML	0.4035	0.6790	1			
RMW	-0.4624	-0.6649	**-0.7846**	1		
ESG	-0.2930	-0.1282	-0.4114	0.3325	1	
SMB	0.5032	**0.8568**	0.6205	-0.5370	-0.2389	1

Variable	VIF	1/VIF
CMA	7.28	0.1372
SMB	6.33	0.1580
RMW	3.64	0.2746
HML	3.33	0.3004
Bx(Rm-Rf)	1.97	0.5077
ESG	1.37	0.7315
Mean VIF	**3.99**	

Table A.3. Brazil Correlation Coefficients and Variance Inflation Factors

Brazil	Bx(Rm-Rf)	CMA	HML	RMW	ESG	SMB
Bx(Rm-Rf)	1					
CMA	0.2970	1				
HML	0.3653	**0.7564**	1			
RMW	-0.4607	-0.3226	-0.5458	1		
ESG	0.0415	0.0195	0.0808	0.1064	1	
SMB	0.6083	-0.0047	0.0348	-0.2343	-0.1751	1

Variable	VIF	1/VIF
HML	3.19	0.3132
CMA	2.48	0.4029
Bx(Rm-Rf)	2.21	0.4530
SMB	1.83	0.5478
RMW	1.74	0.5744
ESG	1.13	0.8886
Mean VIF	**2.10**	

Table A.4. Indonesia Correlation Coefficients and Variance Inflation Factors

Indonesia	$B_x(R_m-R_f)$	CMA	HML	RMW	ESG	SMB
$B_x(R_m-R_f)$	1					
CMA	0.3287	1				
HML	0.2150	0.5913	1			
RMW	0.3686	0.1321	-0.2022	1		
ESG	-0.3184	-0.6207	-0.6665	-0.0641	1	
SMB	0.3096	0.2463	0.0463	0.0516	0.0473	1

Variable	VIF	1/VIF
ESG	2.36	0.4230
HML	2.35	0.4248
CMA	2.13	0.4692
Bx(Rm-Rf)	1.48	0.6754
RMW	1.40	0.7167
SMB	1.28	0.7883
Mean VIF	**1.83**	

Table A.5. Mexico Correlation Coefficients and Variance Inflation Factors

Mexico	Bx(Rm-Rf)	CMA	HML	RMW	ESG	SMB
Bx(Rm-Rf)	1					
CMA	0.0992	1				
HML	-0.2335	0.0537	1			
RMW	0.1759	**-0.8501**	-0.0934	1		
ESG	0.6149	0.1200	**-0.7135**	0.0967	1	
SMB	0.3111	0.2079	-0.2008	-0.0174	0.5268	1

Variable	VIF	1/VIF
CMA	5.22	0.1916
RMW	5.08	0.1969
ESG	5.07	0.1970
HML	2.76	0.3619
Bx(Rm-Rf)	2.09	0.4778
SMB	1.59	0.6292
Mean VIF	**3.64**	

Table A.6. Russia Correlation Coefficients and Variance Inflation Factors

Russia	Bx(Rm-Rf)	CMA	HML	RMW	ESG	SMB
Bx(Rm-Rf)	1					
CMA	-0.5041	1				
HML	-0.1484	-0.1605	1			
RMW	-0.0399	-0.0268	**-0.8045**	1		
ESG	0.1177	-0.0472	-0.3103	0.0796	1	
SMB	0.2830	-0.5986	-0.0195	-0.0675	0.6077	1

Variable	VIF	1/VIF
HML	6.33	0.1579
RMW	5.54	0.1805
CMA	4.34	0.2306
SMB	3.87	0.2582
ESG	2.37	0.4212
Bx(Rm-Rf)	2.23	0.4478
Mean VIF	**4.11**	

Table A.7. Türkiye Correlation Coefficients and Variance Inflation Factors

Türkiye	Bx(Rm-Rf)	CMA	HML	RMW	ESG	SMB
Bx(Rm-Rf)	1					
CMA	-0.4769	1				
HML	0.2019	-0.0868	1			
RMW	0.5022	-0.5295	-0.3973	1		
ESG	0.0264	-0.0031	-0.5784	0.1490	1	
SMB	**-0.7335**	0.6607	0.1562	**-0.8143**	-0.0542	1

Variable	VIF	1/VIF
SMB	6.45	0.1549
RMW	3.97	0.2521
Bx(Rm-Rf)	3.35	0.2986
HML	3.14	0.3187
CMA	2.08	0.4812
ESG	1.84	0.5446
Mean VIF	**3.47**	