

Incorporating ESG Factor into Asset Pricing: Effectiveness Assessment in Australian Market

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Abstract. Traditional asset pricing models such as CAPM and Fama-French Multiple Factor Models have been widely used in stock valuation. However, these models have faced challenges in providing sufficient explanatory power to stock returns, especially with the rising awareness on non-financial factors in investment decision-making. This paper examines the effectiveness of the asset pricing model in Australian market, which incorporates the ESG factor into Fama-French Five Factor Model. Through implementing regression analysis on a sample of 25 Australian-listed companies, each representing a distinct Global Industry Classification Standard (GICS) industry group, the findings indicate that the ESG factor significantly contributes to explaining stock returns in most industries, meanwhile still maintaining the explanatory power of traditional factors. However, the study also finds that ESG beta is insignificant in industries where ESG concerns are of lower priority. These results underscore the increasing importance of ESG considerations in investment analysis, particularly in industries where sustainability and ethical considerations play a central role. The findings provide insights for investors, policymakers, and researchers, suggesting that ESG factors should be integrated into asset pricing models to enhance their predictive capabilities.

Keywords: ESG; asset pricing; investment; sustainable finance.

1. Introduction

The rising awareness on non-financial issues such as climate change, inequality, and corporate scandals is shifting investors' focus from purely return maximisation to integrated sustainable development for long-term value creation when making investment decisions. According to Indriani, there has been a significant increase in investments that incorporate environmental, social, and governance (ESG) factors into capital allocation and risk assessment, where survey results indicated that 85% of the responded investors would take environmental and social concerns into account [1]. Despite this growing emphasis, traditional asset pricing models do not explicitly explain how the expected returns are affected by ESG risks. This raises a critical research question: can ESG be integrated into asset pricing models to effectively enhance their explanatory power?

The foundation model for asset pricing is the Capital Asset Pricing Model (CAPM), which is based on the idea that an individual stock would be compensated for being exposed to market risk, and the more sensitive that stock to market changes is, the higher the expected return will be [2]. However, empirical studies have repeatedly shown a failure CAPM in asset pricing due to the limitations of efficient market hypothesis, as capital market needs to not only react fast to the new information but also interpret and process the information accurately [2]. Otherwise, the stock price will not be fully explained by market systematic risk, resulting in "beta" being ineffective that the abnormal returns are not captured by the model.

The Fama-French multifactor models were then introduced to augment the single market factor with more systematic risk factors to improve the explanatory power of the asset pricing model. For instance, studies have approved the robustness of the size factor and value factor in explaining stock returns in addition to market premium [3]. The five-factor model introduced by Fama and French in 2015 further improved the overall performance of the model, which illustrated that firms actively make investments and firms that are profitable could earn more stock returns [4]. However, there are abnormal returns that remain unexplained by using the above asset pricing models, where other factors might also be systematically material.

Recent studies demonstrate that ESG factors have impact on risk exposure and expected returns. Some argue that ESG integration enhances risk-adjusted returns by improving firms' financial performance and attracting long-term investment, while others suggest that ESG-driven investment may lead to green premium, where high-ESG stocks tend to be overvalued in the short term and may potentially reduce future returns in the long run [5]. Findings indicate that European investors overall accept lower returns for ESG compliance, which highlights a strong socially responsible investment trend in Europe [5]. A significant positive relationship between ESG performance and market value is also found in Middle East and North Africa (MENA) firms, where investors particularly prioritise social responsibility and governance over environmental concerns [6]. This paper will examine the effectiveness of incorporating ESG factors into asset pricing model, with a specific focus on the Australian market.

2. Methodology

2.1. Methods

This study investigates the role of ESG factors in asset pricing by extending the Fama-French Five-Factor Model (FF5F) to incorporate Environmental (E), Social (S), and Governance (G) factors as additional risk factors. Specifically, the study examines whether ESG components contribute to explaining stock returns beyond traditional financial factors.

To achieve this, time-series regressions are conducted using a dataset of five-year daily stock returns for selected firms. This study will randomly select 25 Australian listed companies from the 25 Global Industry Classification Standard (GICS) industry groups as samples. The dependent variable is the expected return of the individual stock, and the independent variables include the five Fama-French factors, namely market risk premium, size, value, profitability, and investment, along with the three ESG factors. The significance of the ESG factors is evaluated through statistical measures. For instance, the statistical significance will be assessed by p-value. Through analysing the results, whether ESG factors hold predictive power in asset pricing and whether they provide incremental explanatory value beyond traditional risk factors will be determined.

2.2. Data Sources

The dataset consists of the publicly listed firms on the Australian Securities Exchange (ASX) covering the period from 16th March 2020 to 14th March 2025. These firms are listed in Table 1. Specifically:

- $r_{i,t}$ = Adjusted closing stock price_t/Adjusted closing stock price_{t-1} - 1
- r_f (risk-free rate) = Averaged daily Australian 10-year government bond yield during the five years' period, which represents a stable, low-risk return that investors can earn over a long period of time.
- r_m (market return) = S&P/ASX 200 Index return, which tracks the performance of the 200 largest publicly traded companies on the ASX and serves as a benchmark for the Australian equity market.
- SMB (Small Minus Big) = S&P/ASX Small Ordinaries Index return - S&P/ASX 200 Index return, where the S&P/ASX Small Ordinaries Index is used as an institutional benchmark for small-cap Australian equity portfolios.
- HML (High Minus Low) = S&P/ASX 200 Value Index return - S&P/ASX 200 Growth Index return, where the value stocks tend to have high book-to-market ratio and growth stocks tend to have low book-to-market ratio.
- RMW (Robust Minus Weak) = S&P/ASX 200 Quality Index return - S&P/ASX 200 Value Index return, where high quality stocks have strong profitability while the value stocks are often mature firms with weaker profitability and earnings multiples.
- CMA (Conservative Minus Aggressive) = S&P/ASX 200 High Dividend Index return - S&P/ASX All Technology Index return, where firms with stable earnings and low reinvestment tend

to focus on returning cash to shareholders rather than aggressive expansion, and technology firms typically reinvest heavily in innovation and growth rather than distributing dividends.

• ESG = S&P/ASX 200 ESG Index return - S&P/ASX 300 Metals & Mining return, where S&P/ASX 200 ESG Index includes companies that meeting sustainability criteria and S&P/ASX 300 Metals & Mining is likely to have a relatively low ESG score due to environmental concerns and social and governance risks associated with mining activities.

Table 1. Sample companies

No.	Industry Group	Company
1	Energy	Santos Limited (STO)
2	Materials	Adriatic Metals Plc (ADT)
3	Capital Goods	Emeco Holdings Limited (EHL)
4	Commercial & Professional Services	Smartgroup Corporation Ltd (SIQ)
5	Transportation	Qantas Airways Limited (QAN)
6	Automobile & Components	PWR Holdings Limited (PWH)
7	Consumer Durables & Apparel	Breville Group Limited (BRG)
8	Consumer Services	Tabcorp Holdings Limited (TAH)
9	Consumer Discretionary Distribution & Retail	JB Hi-Fi Limited (JBH)
10	Consumer Staples Distribution & Retail	Woolworths Group Limited (WOW)
11	Food, Beverage & Tobacco	Bega Cheese Limited (BGA)
12	Household & Personal Products	McPherson's Limited (MCP)
13	Health Care Equipment & Services	Sonic Healthcare Limited (SHL)
14	Pharmaceuticals, Biotechnology & Life Sciences	Neuren Pharmaceuticals Limited (NEU)
15	Banks	Commonwealth Bank of Australia (CBA)
16	Financial Services	AMP Limited (AMP)
17	Insurance	Medibank Private Limited (MPL)
18	Software & Services	Megaport Limited (MP1)
19	Technology Hardware & Equipment	Dicker Data Limited (DDR)
20	Semiconductors & Semiconductor Equipment	Archer Materials Limited (AXE)
21	Media & Entertainment	Domain Holdings Australia Limited (DHG)
22	Telecommunication Services	Telstra Group Limited (TLS)
23	Utilities	AGL Energy Limited (AGL)
24	Equity Real Estate Investment Trusts (REITs)	Mirvac Group (MGR)
25	Real Estate Management & Development	LendLease Group (LLC)

2.3. Model Specification

$$r_{i,t} - r_f = \alpha_{i,t} + \beta_{1,i}(r_{m,t} - r_f) + \beta_{2,i}SMB_t + \beta_{3,i}HML_t + \beta_{4,i}RMW_t + \beta_{5,i}CMA_t + \beta_{6,i}ESG_t + \varepsilon_{i,t} \quad (1)$$

• where:

- $r_{i,t} - r_f$ is the excess return of stock i at time t
- $\alpha_{i,t}$ refers the premium of stock i beyond the market return at time t
- β_i s represent the sensitivity of the stock i 's return to the factors respectively
- $\varepsilon_{i,t}$ measures the idiosyncratic risk of stock i at time t

3. Results

Table 2. Regression results of coefficients and p-value

		β_1	β_2	β_3	β_4	β_5	β_6
STO	Coefficients	1.152089	0.413421	0.088074	-0.595593	0.265002	-0.230491
	P-value	0.000000	0.000307	0.582633	0.000037	0.000001	0.000148
ADT	Coefficients	0.687344	1.498467	0.099719	-0.463834	0.000348	-0.634737
	P-value	0.000000	0.000000	0.730159	0.074120	0.997181	0.000000
EHL	Coefficients	1.127652	1.045269	0.528279	-0.736676	-0.059074	-0.342470
	P-value	0.000000	0.000000	0.032405	0.000905	0.482278	0.000249
SIQ	Coefficients	0.969770	0.894813	0.438166	0.278447	0.080882	0.245696
	P-value	0.000000	0.000000	0.018478	0.095224	0.201522	0.000482
QAN	Coefficients	1.149649	0.424850	-0.348426	-1.109155	-0.130539	-0.009087
	P-value	0.000000	0.000446	0.039767	0.000000	0.023800	0.887080
PWH	Coefficients	0.668967	1.151666	-0.128172	0.021244	0.055461	0.278760
	P-value	0.000000	0.000000	0.547627	0.911600	0.445127	0.000556
BRG	Coefficients	1.200518	0.877564	-0.409813	-0.006411	-0.181124	0.357402
	P-value	0.000000	0.000000	0.008983	0.963638	0.000710	0.000000
TAH	Coefficients	0.987195	0.669015	0.000451	-0.134398	0.084566	0.216093
	P-value	0.000000	0.000002	0.998161	0.444860	0.205381	0.003576
JBH	Coefficients	0.994089	0.414200	0.515441	0.697936	-0.042218	0.337420
	P-value	0.000000	0.000051	0.000320	0.000000	0.385912	0.000000
WOW	Coefficients	0.679156	-0.471187	-0.012896	0.309278	0.008420	0.214505
	P-value	0.000000	0.000000	0.893236	0.000349	0.797068	0.000000
BGA	Coefficients	0.751628	0.381230	-0.234626	0.206755	0.105353	0.238278
	P-value	0.000000	0.001019	0.148751	0.156397	0.057144	0.000109
MCP	Coefficients	0.451564	0.428656	-0.131060	-0.320580	-0.111403	-0.051612
	P-value	0.000003	0.046515	0.664115	0.236892	0.278803	0.650960
SHL	Coefficients	0.761389	-0.193817	-0.091183	0.349767	-0.110562	0.286274
	P-value	0.000000	0.033438	0.475300	0.002329	0.011171	0.000000
NEU	Coefficients	0.927007	1.597974	-1.219092	-0.727407	0.210086	0.409040
	P-value	0.000000	0.000000	0.002171	0.041383	0.120504	0.006476
CBA	Coefficients	1.186228	-0.252350	0.112036	-0.257411	0.093673	0.222297
	P-value	0.000000	0.000001	0.122174	0.000080	0.000155	0.000000
AMP	Coefficients	1.133755	0.692138	0.430664	0.278133	0.139025	0.231700
	P-value	0.000000	0.000002	0.033209	0.125392	0.043628	0.002458
MPL	Coefficients	0.622410	-0.129334	0.566628	0.855499	0.058956	0.187451
	P-value	0.000000	0.129987	0.000002	0.000000	0.148707	0.000037
MP1	Coefficients	1.199413	0.783683	0.296834	0.266278	-1.125539	-0.299884
	P-value	0.000000	0.000363	0.334544	0.334944	0.000000	0.009982
DDR	Coefficients	0.783881	0.725804	-0.174118	-0.158848	-0.368455	0.144662
	P-value	0.000000	0.000000	0.378261	0.370610	0.000000	0.052910
AXE	Coefficients	0.933159	1.311443	0.399497	-0.211844	-0.467960	-0.573117
	P-value	0.000002	0.002759	0.514922	0.700505	0.025318	0.013555
DHG	Coefficients	1.049357	0.469309	0.434521	0.409012	-0.553056	0.062709
	P-value	0.000000	0.001365	0.034350	0.026539	0.000000	0.418788
TLS	Coefficients	0.599962	-0.173250	-0.073095	0.206473	0.067593	0.231171
	P-value	0.000000	0.006381	0.411360	0.009835	0.025915	0.000000
AGL	Coefficients	0.724714	0.056515	0.837852	0.797522	0.175552	0.073993
	P-value	0.000000	0.608202	0.000000	0.000000	0.000886	0.205646
MGR	Coefficients	1.226071	0.635130	0.436451	-0.462176	-0.079322	0.197455
	P-value	0.000000	0.000000	0.001637	0.000206	0.092563	0.000166
LLC	Coefficients	1.122668	0.733727	0.168874	-0.457230	0.066262	0.208021
	P-value	0.000000	0.000000	0.251224	0.000555	0.186470	0.000191

The estimated coefficients corresponding to the traditional Fama-French five factors exhibit expected statistical significance across most of the firms, as shown in Table 2. Specifically, market risk factor (β_1) is highly significant (p-value <0.01) for all the sample companies, which reaffirms its explanatory power in asset pricing. The size factor (β_2) also demonstrates significance for the majority of the sample. However, the value (β_3), profitability (β_4), and investment (β_5) factors exhibit mixed results where some companies fail to achieve statistical significance, which suggests that their explanatory power may vary by industry.

The ESG factor (β_6) is statistically significant at the 5% level (p-value < 0.05) for 20 out of the 25 companies, which implies a notable role of ESG in asset pricing for the majority of industries. However, certain companies display weaker or insignificant ESG factor coefficients such as QAN in the transportation industry and MCP in the household & personal products industry. Additionally, the results also reveal the difference among sectors regarding the influence of ESG factor on stock returns. For instance, the ESG beta of ADT is estimated to be -0.63, which means an overall negative relationship between ESG performance and the materials industry return. By contrast, the 0.41 ESG beta of NEU indicates that the pharmaceuticals, biotechnology & life sciences industry is performing well in terms of ESG.

To examine whether the multicollinearity exists among the factors that may result in the coefficient estimates being inflated, the Variance Inflation Factor (VIF) test is implement for the regression results of the 25 companies, which is calculated as:

$$VIF = \frac{1}{1-R^2} \tag{2}$$

Table 3. VIF test results

	STO	ADT	EHL	SIQ	QAN
VIF	1.585583	1.188503	1.302666	1.288796	1.534873
	PWH	BRG	TAH	JBH	WOW
VIF	1.159492	1.768025	1.238428	1.507639	1.500130
	BGA	MCP	SHL	NEU	CBA
VIF	1.190262	1.032868	1.393611	1.078558	3.625484
	AMP	MPL	MP1	DDR	AXE
VIF	1.283948	1.251299	1.515135	1.327053	1.062879
	DHG	TLS	AGL	MGR	LLC
VIF	1.484819	1.405617	1.199834	1.916166	1.618965

In Table 3, it suggests that the results are all between 1 and 2 except for CBA at 3.6. The results indicate that multicollinearity is not a problem in the model and the coefficient estimations are reliable.

4. Discussion

The results above illustrate the effectiveness of incorporating ESG factor into the traditional asset pricing model to estimate stock returns in Australian market, where the sensitivity of the stock return is statistically significant to changes in ESG risks in the majority of the sample while still maintaining the explanatory power of the traditional five factors approved by Fama and French. This is because ESG factors are transforming financial reporting and investment in Australia. According to ASIC, investors increasingly demand transparent ESG disclosure, where the Taskforce on Climate-related Financial Disclosures (TCFD) framework is widely adopted by ASX100 companies [7]. Additionally, ASIC is actively enforcing ESG integrity, tackling greenwashing, and supporting sustainable finance market development [7]. Thus, integrating ESG factor into corporate strategies is essential to maintaining market credibility, attracting investment, and ensuring long-term resilience in an increasingly sustainability-focused world.

Furthermore, ESG factor is more impactful in sectors where sustainability is central to business operations such as energy, technology and consumer goods. However, its effect on stock returns may be less essential for industries where ESG issues are less directly linked to financial performance compared to other concerns. For example, transportation industry is subject to operational challenges and macroeconomic changes over ESG concerns especially airlines, where fuel costs, demand fluctuations and regulations related to safety and environmental issues may influence stock prices more straightforward than ESG factors [8]. Although previous studies confirmed a significant but negative correlation between firm value and governance score, no significant relationship was found between firm value and environmental and social scores, which suggested that ESG dimensions may not have direct impact on firm valuation [9].

5. Conclusion

This paper examines the limitations of traditional asset pricing models and extends the Fama-French Five-Factor Model by incorporating ESG as a sixth factor in explaining stock returns in the Australian market. A regression analysis was conducted on 25 sample companies from 25 industry groups to assess the statistical significance of factor coefficients. The results suggest that the ESG factor is generally significant in explaining stock returns while preserving the explanatory power of traditional factors, with no evidence of multicollinearity. However, ESG beta was insignificant in industries where ESG concerns are less prioritised.

This study has limitations. The analysis focuses solely on the Australian market, where ESG is increasingly emphasised by investors and regulators. Additionally, the sample size may be insufficient to confidently generalise the findings across the entire market. Future research will address these gaps by using a larger sample size and exploring other economic entities globally.

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