How Material is a Material Issue? Stock Returns and the Financial Relevance and Financial Intensity of ESG Materiality.

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Abstract

This paper investigates the role of the intensity and relevance of ESG materiality in equity returns. Adopting the classifications of materiality provided by the Sustainability Accounting Standards Board (SASB), the paper introduces the concept of the financial relevance and financial intensity of ESG materiality in order to estimate how it explains equity returns. The results of the analysis, based on a large sample of U.S. companies included in the Russell 3000 from January 2008 to July 2019 show that not only do ESG rating changes (ESG momentum) have a consistent impact on equity performance, but also that the market seems to reward more those companies operating in industries with a high level of ESG materiality concentration. The implication is that the equity premium of listed companies is better explained by the concentration of material issues (i.e., the Gini index) than by the ESG momentum.

1. Introduction

Since its inception in 2006, the United Nations Principles for Responsible Investment (PRI) has grown to over 2,300 signatories in 2019, representing over $86 trillion in assets under management (AUM). From 2011 to 2019 S&P companies that published sustainability reports increased from 20% to 90% (Governance & Accountability Institute, 2020). Spending on ESG data, including ESG content and indices, has grown from $200 million in 2014 to $505 million in 2018 and it is expected to reach $745 million in 2020 (Pierron, 2019). According to a 2018 global survey by FTSE Russell, more than half of global asset owners are currently implementing or evaluating ESG considerations in their investment strategy. One of the main drivers of this growing importance of ESG integration among investment firms can be found in the increased evidence of the positive impact of ESG materiality on financial performance (Eccles and Klimenko, 2019).

The relationship between sustainability performance and firm value is "complex, ambiguous, and nuanced" (Perrini et al., 2011, p. 60). Nevertheless, it has been recognized that through a performance

improvement on ESG issues, a firm can boost its key value drivers, such as growth, profitability, capital efficiency and risk exposure (Schramade, 2016; Giese et al., 2019). On the academic side, the literature on the relationship between ESG and financial performance is extensive. Since the 1970s more than 2,000 studies have been released; Friede et al. (2015) combining the findings of these studies show that, despite the different methodologies, samples, and datasets adopted, in roughly 90% of them the relationship between ESG and corporate financial performance is non-negative, with the majority of the studies reporting positive findings.

But it is only recently, with the seminal paper of Khan et al. (2016) that concrete evidence on the importance of ESG materiality in investment decision-making has been brought forward. Adopting the concept of materiality of the Sustainability Accounting Standards Board (SASB) and working on a sample of more than 2,000 U.S. companies over 21 years, the authors use Kinder, Lydenberg, and Domini (KLD) data to create materiality and immateriality scores. The results of their analysis demonstrate that companies top performing on ESG material issues outperform those in the bottom quantile. Even more interestingly, the authors also show that a high performance on immaterial ESG issues doesn't lead to superior financial performance. Applying the methodology of Khan et al. (2016), Kotsantonis and Bufalari (2019) reach the same results working on the top 100 largest international banks. Also in the study of van Heijningen (2019), based on a large sample of international companies from 2005 to 2017 and on ESG data by RobecoSAM, materiality is confirmed to improve the predictability of financial performance in comparison to total ESG or immateriality scores.

The dearth of studies in the academic literature investigating the impact of ESG materiality on financial performance, seems to be conflicting with investors' perception. In this regard, Amel-Zadeh and Serafeim (2018), using survey data from a sample of senior investment professionals from mainstream investment organizations, highlight that ESG materiality is likely to become an important part of investment practices as it is believed to be related to investment performance. In a similar vein, in their survey Unruh et al. (2016) found that an increasing number of investment firms are demonstrating that attention to nonfinancial material issues can produce positive impact on financial returns. Because of its link to financial performance and because it is framed in the language of finance, we believe that materiality will increasingly represents the issue for validating the relevance of ESG to financial performance and therefore it needs to be further investigated.

For the scope of our research, it is worth noting that all of the (few) academic papers mentioned above that examine the relationship between ESG performance on material issues and financial performance

treat materiality in a binary way. A topic is either material or it is not and according to this classification it is included or not in the calculation of the material ESG scores used in the analysis.. Indeed, we think that "how material is a material issue" is a topic that deserves to be further investigated. We therefore introduce the concepts of "financial relevance" and "financial intensity" of ESG materiality that allows us to go beyond the binary approach (aimed at responding to the question "Does materiality matter?") and respond to the question "Does financial relevance and intensity of ESG materiality matter?". From a methodological perspective, this approach requires an assessment of not only industry-specific materiality issues (as in the existing papers on the topic) but also of their specific importance to financial performance.

In this paper we create a novel and unique set of indices for the assessement, at the industry level, of the quantity and the quality of ESG materiality consistent with SASB's framework . We use these indices to calculate a Gini index as a measure of the level of concentration of ESG materiality in each industry. We test the impact of the quantity and quality of materiality as a separate factor on an unbalanced panel of U.S. listed companies over a period of 11 years estimating a modified Fama and French three-factor model. We finally test the results obtained simulating an active investment strategy based on the quantity and quality of financial materiality. Our results show that not only does the performance on ESG material issues have a consistent impact on stock performance, but also that what matters more is the level of concentration of materiality (measured by the Gini index). Having less material issues but more financially relevant ones is rewarded by the market. Better fewer but better.

The reminder of the paper is structured as follows. In Section 2, we introduce the concepts of financial relevance and financial intensity of ESG materiality and the methodology for their calculation; in Section 3 we describe the data and sample used in our analysis and explain the methodology; Section 4 discusses the results obtained and their implications. Section 5 shows how our empirical results can be used to build ESG and Gini-weighted portfolios and compare their returns and volatility with the capitalization weighted benchmark. Concluding remarks follow in Section 6.

2. The Dimensions of ESG Materiality

The concept of materiality we adopt in the paper is the one provided by SASB that identifies those sustainability issues that are relevant from an investor's perspective. SASB is a San Francisco-based nonprofit organization established in 2011 to develop measurement standards for reporting on ESG

issues that are of the same relevance and reliability as accounting standards for financial information. In particular, SASB's standards provide investors with decision-useful information on the sustainability issues that are reasonably likely to materially affect near-, medium-, or long-term business value. SASB's definition of materiality is strictly linked to the audience it refers to (i.e., investors) that has its own unique needs, different from those of suppliers, customers, communities, interest groups, and other stakeholders. As investors demand reliable and comparable sustainability information with clear links to financial performance, SASB identifies the subset of sustainability issues that are reasonably likely to be material to them from a universe of 26 generic sustainability issues (General Issue Category [GIC]) organized in the five dimensions of environment, social capital, human capital, leadership and governance, and business model and innovation. As financial materiality of sustainability issues varies across industries (Eccles and Serafeim, 2013), to preserve a focus on financial materiality as well as to attain comparability among peers, SASB's standards are industry specific. They are based on SASB's proprietary industry classification methodology (SASB Industry Classification System-SICS™), comprised of 11 sectors subdivided in 77 industries and where material issues range from 2 to 11, with an average of 5.5. The results of SASB's materiality process are summarized in their Materiality Map©.

In order to assess the quantity of materiality at the industry level, for each industry *j* we calculated an *Industry Materiality Intensity Index* (*IMII)* as the ratio between the number of material issues (mat_i) and the total number (26) of SASB's issues:

$$IMII_j = \frac{\sum_{i=1}^{26} mat_i}{26}$$

Among all 77 SASB industries, Health Care Delivery has the highest number of material issues (11) and hence the highest value of *IMII* of (42.3%). In contrast, Appliance Manufacturing, Toys & Sporting Goods, Tobacco, Mortgage Finance, Real Estate Services, and Car Rental & Leasing have the lowest number (2) and therefore the lowest value of *IMII* (7.7%). Descriptive statistics of the *IMII* for our sample are presented in Table 1. Going further, for each industry SASB also provides information on the link between an industry's material sustainability issues (Disclosure Topics) and each of 13 financial value drivers grouped in the categories of revenue, operating expenses, non-operating

expenses, assets, liabilities, and cost of capital.[1] This allows us to go beyond the classical binary approach and to assess the financial relevance of each industry-specific material issue. To this end, for each industry *j* and for each material issue *i* (mat_i,) we calculated a *Financial Relevance Index* (*FRI*), as the ratio between the number of value drivers impacted by a specific material issue and the total number of value drivers (13) considered by SASB:

$$FRI_{ij} = \frac{\sum_{k=1}^{13} imp_k}{13}$$

Among all industries, the *FRI* ranges from 7.7% to 69.2%, with a mean of 36.7% and a standard deviation of 12.2%.

Averaging the *FRI*s of the material issues within each industry, we calculated an *Industry Financial Relevance Index* (*IFRI*):

$$IFRI_j = \frac{\sum_{i=1}^{MI_j} FRI_{ij}}{MI_j}$$

where MI_j is the number of material issues of industry *j*. Among all 77 SASB industries, the *IFRI* ranges from 17.5% (Health Care Delivery) to 53.9% (Tobacco), with a mean of 31.1%. (Descriptive statistics for our sample are presented in Table 1.) Figure 1 shows, for example, how SASB's Materiality Map would change for the Health Care Delivery and Tobacco industries when we move from the traditional binary approach to materiality and include the financial relevance of the material issues: financial materiality can be more or less "diluted" among industry-specific material issues, with possible implications for companies and investors.

It is worth noting that the two indices, *IMII* and *IFRI* are negatively correlated (overall $\rho = -0.14$). An industry can have a large number of material issues with a low average financial relevance.

Moreover, when a value driver is impacted by a material issue, the impact is labeled by SASB as "High or 'Medium." In order to measure the level of the financial impact, for each material issue we

[1] The 13 value drivers considered by SASB are: Market share, New markets, Pricing power, Cost of revenues, Capex, R&D, Extraordinary expenses, Tangible assets, Intangible assets, Contingent Liabilities, Pension and other liabilities, Cost of capital, Industry divestment risk.

calculated a *Financial Intensity Index* (*FII*) as the ratio between the number of value drivers impacted "High" and the total number of value drivers impacted by the material issues:

$$FII_{ij} = \frac{\sum_{k=1}^{TI_{ij}} imp_k}{TI_{ij}}$$

where TI_{ij} is the total number of value drivers impacted by the material issue *i* of industry *j*.

Figure 1 - SASB Materiality Map with Financial Relevance of Material Issues for the Tobacco and Health Care Delivery Industries

SASB Materiality Map

Dimension	General Issue Category	Tobacco	Health Care Delivery
Environment	Ghg Emissions		
	Air Quality		
	Energy Management		
	Water & Wastewater Management		
	Waste & Hazardous Materials Management		
	Ecological Impacts		
Social Capital	Human Rights & Community Relations		
	Customer Privacy		
	Data Security		
	Access & affordability		
	Product Quality & Safety		
	Customer Welfare		
	Selling Practices & Product Labeling		
Human Capita	Labor Practices		
	Employee Health & Safety		
	Employee Engagement,Diversity & Inclusion		
Business Model & Innovation	Product Design & Lifecycle Management		
	Business Model Resilience		
	Supply Chain Management		
	Materials Sourcing & Efficiency		
	Phsical impacts Of Climate Change		
Leadership & Governance	Business Ethics		
	Competitive Behavior		
	Management Of the Legal & Regulatory Environment		
	Critical Incident Risk Management		
	Systemic Risk Management		

SASB Materiality Map with Financial Relevance of Material Issues

Dimension	General Issue Category	Tobacco	Health Care Delivery
Environment	Ghg Emissions		
	Air Quality		
	Energy Management		7.69%
	Water & Wastewater Management		
	Waste & Hazardous Materials Management		7.69%
	Ecological Impacts		
Social Capital	Human Rights & Community Relations		
	Customer Privacy		
	Data Security		30.77%
	Access & affordability		15.38%
	Product Quality & Safety		23.08%
	Customer Welfare	61.54%	7.69%
	Selling Practices & Product Labeling	30.77%	7.69%
Human Capita	Labor Practices		
	Employee Health & Safety		7.69%
	Employee Engagement,Diversity & Inclusion		30.77%
Business Model & Innovation	Product Design & Lifecycle Management		
	Business Model Resilience		
	Supply Chain Management		
	Materials Sourcing & Efficiency		
	Phsical impacts Of Climate Change		0.230769
Leadership & Governance	Business Ethics		30.77%
	Competitive Behavior		
	Management Of the Legal & Regulatory Environment		
	Critical Incident Risk Management		
	Systemic Risk Management		

The *FII* ranges from 0% (not one driver is impacted "High" by the material issue) to 100% (all of the value drivers are impacted "High" by the material issue). Averaging the *FII*s of the material issues within each industry, we calculated an *Industry Financial Intensity Index* (*IFII*):

$$IFII_j = \frac{\sum_{i=1}^{MI_j} FII_{ij}}{MI_j}$$

where MI_j is the number of material issues of industry *j*. The *IFII* ranges from 13.3% (Managed Care) to 79.4% (Airlines), with a mean of 43.9% and a standard deviation of 13.5%. Descriptive statistics

of all the calculated indices in our sample are presented in Section 3. Detailed data at the industry level for all SASB's 77 industries are shown in Appendix I.

A combined analysis of the *IFRI* and the *IFII* shows that also in this case the correlation, even if positive, is very low (ρ=0.04) (Figure 2). The Tobacco industry has the highest scores as its two material issues (Customer Welfare and Selling Practices & Product Labeling) impact on average six value drivers with an *IFRI* of 46.2% and their impact is labelled as "High" on average in four cases with an *IFRI* of 68.8%. In contrast, the 11 material issues in the Managed Care industry impact on average 3.2 value drivers (*IFRI* of 24.6%) and the industry average number of value drivers impacted as "High" is only 0.4 (*IFRI* of 13.3%).

Figure 2 - Financial Relevance and Financial Intensity of Materiality in SASB's Industries

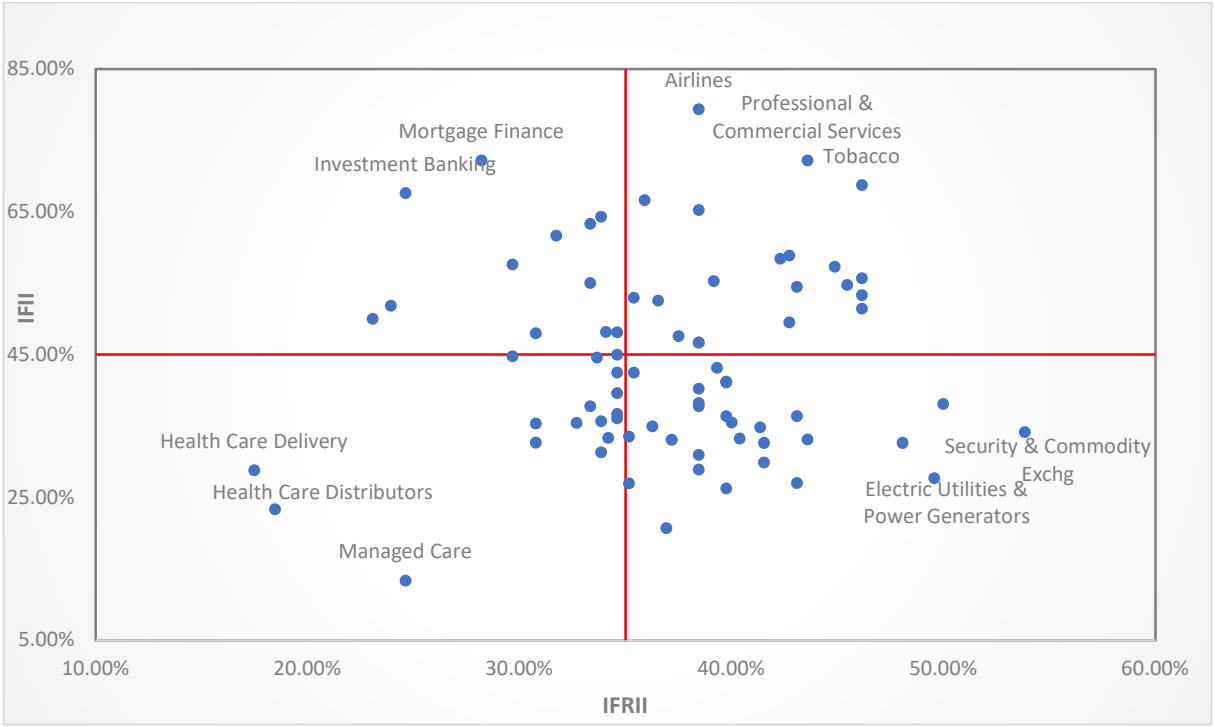


Table 1 shows the values of the indices at the sector level. The highest average *IMII* is reported by the Extractives & Minerals Processing sector (31.7%), whereas the Service sector (13.2%) is the one with the lowest intensity of materiality. The industries in the Resource Transformation sector have, on average, the highest number of drivers impacted by their material issues (IFRI equals to 40.3%), and the lowest is among industries in the Heath Care sector (22.9%). Finally, the material issues of

the industries in the financial sector have, on average the highest relative "High" impact on value drivers (IFII equalis to 54.4%), whereas the Infrastructure sector presents the lowest value (33.5%).

Table 1 - Materiality Intensity Index (*IMII*), Industry Financial Relevance Index (*IFRI*) and Industry Financial Intensity Index (*IFII*) by Sector

SASB Sector	Avg.IMII	Avg.IFRI	Avg.IFII
Consumer Goods	13.7%	37.9%	41.5%
Extractives & Minerals Processing	**31.7%**	39.8%	54.3%
Financials	14.3%	35.9%	**54.4%**
Food & Beverage	27.4%	35.2%	43.0%
Health Care	25.0%	22.9%	36.7%
Infrastructure	19.2%	40.2%	33.5%
Renewable Resources & Alternative Energy	17.3%	36.4%	37.5%
Resource Transformation	26.9%	**40.3%**	36.2%
Services	13.2%	38.1%	49.9%
Technology & Communications	23.7%	39.9%	44.7%
Transportation	18.8%	37.3%	46.9%

As a final step, in order to assess the combined impact of materiality intensity, financial relevance, and financial intensity and to assess the dispersion effect of ESG financial materiality, for each industry we calculated a Gini index of ESG materiality, taking into account, for each industry, the Industry Materiality Intensity Index *(IMII)*, the Industry Financial Relevance Index *(IFRI,)* and the Industry Financial Intensity Index *(IFII).* Theoretically, the Gini coefficient varies from 0 to 1, with 0 representing the perfect dispersion of materiality and 1 representing the perfect concentration. The first would represent the case in which all SASB issues are material for the industry and equally impacting the value drivers; the latter would be the case in which only one issue is material for the industry and hits "High" all 13 value drivers. The Gini coefficient ranges from 0.66 (Metals & Mining) to 0.94 (Tobacco), with an average value of 0.83.

3. Research Design and Methodology

3.1 Data and Sample

Our analysis is based on a sample of U.S.-headquartered companies included in the Russell 3000 from January 2008 to June 2019. Sustainability data are from Truvalue Labs (TVL), a San Francisco-based AI/big data company that calculates ESG metrics based on SASB's material issues utilizing

unstructured data from more than 75,000 non-company-self-reported sources and applying natural language processing. The performance of each of the 26 SASB's sustainability issues is scored using a 0 to 100 scale: a score of 50 represents a neutral impact; scores above 50 indicate positive performance, and scores below reflect negative performance.

In our analysis, to assess a firm's sustainability performance, we used the TVL Insight Score, a measure of a firm's long term ESG score, derived using an exponentially weighted moving average of the underlying, short term, Pulse Score[2] (Malinak et al., 2017). From the original sample, and to ensure the robustness of our analysis, we selected those companies for which TVL scores for each industry-specific material issues were available on any given last day of each month. We then computed the material ESG score equally weighting the single TVL Insight Scores of each material issue. Finally, for the purpose of our analysis, we selected only those companies for which scores were available for at least 12 consecutive months. Financial data were retrieved from Thomson Eikon Datastream. For each observation we computed stock price performance at the end of each month. The final sample consists of 731 firms and a total of 56,569 observations, with a minimum of 12 and a maximum of 137 monthly observations. Sector composition of our sample is reported in Table 2 (industry composition in Appendix II).

Table 2 – Sector composition

SICS Sector	Firms		Observations	
	abs	%	abs	%
Consumer Goods	55	7.5%	4,164	7.3%
Extractives & Minerals Processing	44	6.0%	2,810	4.9%
Financials	69	9.4%	5,423	9.5%
Food & Beverage	110	15.0%	8,665	15.2%
Health Care	53	7.3%	4,415	7.7%
Infrastructure	89	12.2%	7,064	12.4%
Renewable Resources & Alternative Energy	38	5.2%	3,038	5.3%
Resource Transformation	80	10.9%	6,188	10.9%
Services	88	12.0%	7,462	13.1%
Technology & Communications	44	6.0%	3,394	6.0%
Transportation	61	8.3%	4,346	7.6%
Total	*731*	*100%*	*56,969*	*100%*

[2] The Pulse score is a measure of near-term (daily) ESG performance changes that highlights opportunities and controversies, enabling real-time monitoring of companies.

3.2 Methodology

The empirical analysis aims to examine how U.S. equity yields are affected by the financial relevance and intensity of ESG materiality. Our dependent variable is represented by the stock premium ($Returns_{i,t} - RF_t$) of U.S.-listed companies observed from January 2008 to June 2019. Using a panel regression methodology, we started with the estimation of the basic form of the Capital Asset Pricing Model (CAPM), developed by Sharpe (1964), Lintner (1965), and Mossin (1966), using equation (1):

$$Returns_{i,t} - RF_t = \alpha + \beta_1\left(Returns_{mkt,t} - RF_t\right) + \in_{ijst} \qquad (1)$$

Where:

$Returns_{i,t}$ = total return of a stock i at time t;

RF_t= risk free rate of return at time t;

$Returns_{mkt,t}$ = total market portfolio returns at time t,

$Returns_{i,t} - RF_t$=expected excess return;

$Returns_{mkt,t} - RF_t$ = excess return on the market portfolio (index)

While CAPM is still the most widely accepted description for share prices, empirical studies have found contradictory evidence (Basu, 1977; DeBont and Thaler, 1985; Campbell and Cochrane, 2000). In our contribution we estimate the three-factor model proposed by Fama and French (1993), based on market risk, the outperformance of small firms compared to large firms, and the outperformance of companies with a high book/market ratio compared to small firms with a high book/market ratio. We tested our dependent variable with the equation (2):

$$Returns_{i,t} - RF_t = \alpha + \beta_1\left(Returns_{mkt,t} - RF_t\right) + \beta_2\, SMB_t + \beta_3\, HML_t + \in_{ijst} \quad (2)$$

where SMB_t and HML_t represent, respectively, the size premium (small minus big) and the value premium (high minus low)[3].

[3] Factors included in equations (1) and (2) were retrieved from Kenneth French's data library: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Developed

The first relevant ESG component we introduce in our analysis is the dynamics of the score, calculated as the monthly change of the ESG score (ESG momentum). In the model the variable is considered in relative terms and with a one period lag. We capture the impact of the ESG dynamics on the premium observed in the stock market with equation (3):

$$Returns_{i,t} - RF_t = \alpha + \beta_1\left(Returns_{mkt,t} - RF_t\right) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 \Delta ESGscore_{i,t-1} + \in_{ijst} \quad (3)$$

where $\Delta ESGscore_{i,t-1}$ is the relative change of ESG material score of a stock *i* in month *t-1*.

On the basis of the existing literature on the impact of ESG materiality performance on stock returns, we expect a positive relationship between ESG momentum and the equity premium.. But if the change of the material ESG score can be an explanatory element of equity returns in addition to the Fama–French three-factor model, the purpose of our paper is to assess whether the financial relevance and intensity of ESG materiality can also be factored in the selection and optimization of a financial portfolio. To this end, we estimate a series of equations that seek to capture the additional dimensions of ESG materiality, including the indices introduced in Section 2: i.e., the *Industry Materiality Intensity Index* (*IMII*) - equation (4) -, the *Industry Financial Relevance Index* (*IFRI*) - equation (5) -, and the *Industry Financial Intensity Index* (*IFII*) - equation (6).

$$Returns_{i,t} - RF_t = \alpha + \beta_1\left(Returns_{mkt,t} - RF_t\right) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 \Delta ESGscore_i + \\ + \beta_5 ESGmat_i + \in_{ijst} \quad (4), (5), (6)$$

where $ESGmat_i$ = industry - specific ESG materiality characteristics of each stock (*IMII, IFRI, IFII*)

Finally, we estimate the combined effect of quantity (*IMII*) and quality (*IFRI* and *IFII*) of financial materiality with equation (7), where the Gini index of ESG materiality is added to the Fama-French three-factor model

$$Returns_{i,t} - RF_t = \alpha + \beta_1\left(Returns_{mkt,t} - RF_t\right) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 \Delta ESGscore_i + \\ + \beta_6 ESG\_Gini_i + \in_{ijst} \quad (7)$$

where

ESG_Gini_i = Gini index of ESG materiality by industry

The expected value of the *ESG_ Gini* regression coefficient is uncertain: on the one hand, a negative value means that it is better for a company to have more material issues to act on in order to exploit a broad spectrum of materiality in its sustainability-oriented decisions, therefore diversifying the ESG risk of the company. On the other hand, a positive value means that the market rewards those companies that, all other factors being equal (including their ESG performance), have fewer and financially stronger material issues and therefore can focus sustainability policies on fewer factors with a more relevant expected result—better fewer, but better.

We orthogonalized our set of independent variables, creating a new set of orthogonal variables, using a modified Gram–Schmidt procedure (Golub and Van Loan, 1996). This methodology allows us to create a set of variables such that the effects of all the preceding variables have been removed from each variable, easing the interpretation of outcomes.

4. Results and Discussion

In this section we focus on the explanatory model for the formation of the return (and particularly of the premium) paid by individual shares listed in the U.S. market. The goal is to identify the contribution of the variables attributable to the ESG dimensions, distinguishing between the score (already studied in previous contributions) and the variables that assess the financial relevance and financial intensity of material issues, based on the results emerging from the equations described in the previous section.

Descriptive statistics of the variables used in our analysis are presented in Table 3; correlation matrix is presented in Table 4.

Table 3 - Descriptive Statistics of the Calculated Indices

	Mean	Std. Dev.	Min	Max
$Returns_{i,t} - RF_t$	0.003	0.030	-0.184	0.466
$Returns_{mkt,t} - RF_t$	0.003	0.012	-0.055	0.036
SMB_t	0.000	0.008	-0.015	0.019
HML_t	-0.001	0.008	-0.036	0.026
$\Delta ESGscore_i$	0.000	0.014	-0.099	0.216
MII_t	0.208	0.072	0.077	0.346
$IFRI_t$	0.383	0.067	0.185	0.538
$IFII_t$	0.464	0.149	0.133	0.794
ESG_Gini_i	0.812	0.071	0.646	0.921

From Table 4 we can observe that all variables exhibit low correlations, significant at the five per-cent level, and with the expected sign.

Table 4 – Correlations
Pearson correlation coefficients for explanatory variables used in the panel regressions.

	$Returns_{i,t} - RF_t$	$Returns_{mkt,t} - RF_t$	SMB_t	HML_t	$\Delta ESGscore_i$	MII_t	$IFRI_t$	$IFII_t$	ESG_Gini
$Returns_{i,t} - RF_t$	1.0000								
$Returns_{mkt,t} - RF_t$	0.1719	1.0000							
SMB_t	0.0734	0.3310	1.0000						
HML_t	0.0379	0.1177	0.0997	1.0000					
$\Delta ESGscore_i$	0.0088	0.0010	0.0053	-0.0071	1.0000				
MII_t	0.0116	0.0021	0.0029	0.0023	0.0010	1.0000			
$IFRI_t$	-0.0050	0.0005	0.0006	0.0011	-0.0013	0.1898	1.0000		
$IFII_t$	0.0047	-0.0023	0.0048	0.0000	-0.0158	-0.0650	-0.1067	1.0000	
ESG_Gini_i	0.0191	0.0004	0.0012	0.0012	-0.0016	-0.3078	-0.2309	0.3146	1.0000

Table 5 show all the outcomes for each model estimated by single stock. Models in equations (1) and (2) represent the classical CAPM and Fama–French three-factor model. In this case, we aim to verify that the stock panel considered in the post-crisis period (2008-2019) is consistent with the mainstream approaches. Both models show a high significance of the factors and the signs of coefficients are consistent with expectations. The CAPM appears robust and with positive signs of the coefficients. We also find the expected empirical sensitivity of the Fama–French factors (Model 2). As proved in the original Fama–French contribution, our findings show positive returns from small size as well as value factors, i.e., high book-to-market ratio. Examining β and size, we find that higher returns, small size, and higher β are all correlated. We can confirm that U.S. stocks in our sample provide excess returns over risk-free alternatives, small stocks provide excess returns over big stocks, and value stocks boast higher returns than growth stocks.

The introduction of the ESG momentum factor in the model (Model 3) shows some interesting results. First, the introduction of the new factor does not affect the robustness of the orthodox factors of the CAPM and Fama-French. Second, the ESG momentum factor is statistically significant and with a positive sign, as expected. Stock returns are therefore positively influenced by an improvement in the ESG score and, indirectly, in the underlying components of the score.

Table 5 – U.S. Equity Premia, Asset Pricing Models and ESG Dimensions Estimated by Single Stocks

This table shows the panel regressions of the U.S. equity premia explained by asset pricing models and ESG parameters. Seven equations have been estimated: (i) the Capital Asset Pricing Model; (ii) the Fama–French three-factor model (FF); (iii) the Fama–French model and the ESG score dynamics; (iv) the Fama–French model and the Industry Materiality Intensity Index (IMII); (v) the Fama–French model and the Industry Financial Relevance Index (IFRI); (vi) the Fama–French model and the Industry Financial Intensity Index (IFII); and (vii) the Fama–French model and the Gini index of the materiality. Heteroscedasticity robust standard errors are reported in brackets. * means significantly different from zero at 10% level (two-tail t-test), ** at the 5% level, and *** at the 1% level.

$Returns_{i,t} - RF_t$	**MODEL 1 CAPM**	**MODEL 2 FF**	**MODEL 3 FF+SCORE**	**MODEL 4 FF+SCORE +MII**	**MODEL 5 FF+SCORE +IFRI**	**MODEL 6 FF+SCORE +IFII**	**MODEL 7 FF+SCORE +GINI**
CONSTANT	-0.005	-0.004	-0.005	-0.005	-0.005	-0.005	-0.005
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
$Returns_{mkt,t} - RF_t$	0.171***	0.163***	0.164***	0.164***	0.164***	0.164***	0.164***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
SMB_t		0.016***	0.017***	0.017***	0.017***	0.017***	0.017***
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
HML_t		0.017***	0.016***	0.017***	0.017***	0.016***	0.017***
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$\Delta ESGscore_i$			0.008**	0.008**	0.008**	0.008**	0.008**
			(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
MII_t				0.014***			
				(0.004)			
$IFRI_t$					-0.005		
					(0.005)		
$IFII_t$						0.005	
						(0.005)	
ESG_Gini_i							0.019***
							(0.005)
Observations	56,969	56,969	56,969	56,969	56,969	56,969	56,969
Groups (stocks)	731	731	731	731	731	731	731
Wald test	1052.36	1045.96	1038.97	1039.37	1042.40	1044.54	1072.00
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000

When we introduce the different dimensions of materiality described in Section 2 (Models 4, 5 and 6), their contribution appears mixed. The "quantity" of materiality measured by the *Industry Materiality Intensity Index* (*IMII*) – i.e., the ratio between the number of material issues and the total number (26) of SASB issues – provides a positive contribution to the explanation of the stock premium (Model 4). The coefficient of the *IMII* is positive and statistically significant (p-value test equal to 0.001). expressing the market's ability to reward investments in companies operating in industries with a higher number of material issues. Contrary to this result, neither financial relevance (*IFRI*) nor financial intensity (*IFII*) – or "quality" of materiality – alone seem to contribute to the explanation of the share premia (Models 5 and 6) as the coefficients are statistically insignificant.

In order to check the combined effect of the three different dimensions of materiality, we introduced the Gini coefficient, an indicator widely used in the literature on inequality. Low values of the coefficient indicate a fairly homogeneous distribution, with the value 0 corresponding to a completely equal distribution, i.e., the situation where everyone receives exactly the same income. High values

of the coefficient indicate a more unequal distribution, with the value 1 corresponding to the highest concentration (i.e. the situation where one person receives all the income of the country while all the others have zero income). The result, as anticipated in the research design section, may imply either a dispersion effect, if a low Gini index (therefore with more issues per industry with modest financial relevance and financial intensity) corresponds to a benefit in terms of stock returns, or a concentration effect where an industry that has a lower number of issues with high financial relevance and financial intensity corresponds to a benefit in terms of stock returns.

Model 7 first shows a very robust significance test (p-value = 0.000) and a positive regression coefficient (0.019) to support the assumption that the concentration factor is dominant. The first contribution of our analysis is that ESG score momentum being equal, what most determines the equity premium - beyond the factors contained in the Fama-French model - is the concentration effect of material issues. In other words, it rewards having a high Gini index – few material issues with strong financial relevance and financial intensity – driving a firm's ESG performance. Better fewer, but better. Secondly, our evidence shows, in a less surprising way, that with the same Gini index, a higher ESG momentum contributes to a higher financial performance. Most importantly, the equity premium of listed companies is explained more by the concentration of material issues (i.e., the Gini index) than by the momentum of the ESG score, both in terms of sensitivity and the statistical significance of the result. A mean variance inflation factor (VIF) equal to 1.6 confirms the absence of multicollinearity effects in our analysis (see Diamantopulos and Siguaw, 2006).

As a robustness check, we tested our models at SASB's sector level (Consumer Goods, Extractives & Minerals Processing, Financials, Food & Beverage, Health Care, Infrastructure, Renewable Resources & Alternative Energy, Resource Transformation, Services, Technology & Communications, and Transportation) (Table 6).

Table 6 - U.S. Equity Premia, Asset Pricing Models and ESG Dimensions Estimated by Sectors

This table shows the panel regressions of the U. S. sector premia explained by capital asset pricing models and ESG parameters. Seven equations have been estimated: (i) the Capital Asset Pricing Model; (ii) the Fama–French three-factor model (FF); (iii) the Fama–French model and the ESG score dynamics; (iv) the Fama–French model and the Industry Materiality Intensity Index (IMII); (v) the Fama–French model and the Industry Financial Relevance Index (IFRI); (vi) the Fama–French model and the Industry Financial Intensity Index (IFII); and (vii) the Fama–French model and the Gini index of the materiality. Heteroscedasticity robust standard errors are reported in brackets. * means significantly different from zero at 10% level (two-tail t-test), ** at the 5% level, and *** at the 1% level.

$Returns_{i,t} - RF_t$	MODEL 1 CAPM	MODEL 2 FF	MODEL 3 FF+SCORE	MODEL 4 FF+SCORE +MII	MODEL 5 FF+SCORE +IFRI	MODEL 6 FF+SCORE +IFII	MODEL 7 FF+SCORE +GINI
CONSTANT	-0.001	-0.001	-0.002	-0.002	-0.003	-0.002	-0.001
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.007)
$Returns_{mkt,t} - RF_t$	0.171***	0.164***	0.164***	0.164***	0.164***	0.164***	0.164***
	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
SMB_t		0.016***	0.017***	0.017***	0.017***	0.017***	0.017***
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
HML_t		0.017	0.017	0.017	0.017	0.017	0.017
		(0.011)	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)
$\Delta ESGscore_i$			0.009**	0.008**	0.009**	0.009**	0.009**
			(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
MII_t				0.012***			
				(0.005)			
$IFRI_t$					-0.007		
					(0.008)		
$IFII_t$						0.003	
						(0.007)	
ESG_Gini_i							0.018**
							(0.009)
Observations	56,969	56,969	56,969	56,969	56,969	56,969	56,969
Groups (stocks)	11	11	11	11	11	11	11
Wald test	248.89	275.68	283.10	311.56	293.76	283.66	541.22
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000

In general, the results obtained with the estimates for individual company stocks are confirmed. Specifically, the CAPM and the Fama-French model are confirmed, except for the value premium variable which is not statistically significant. This is due to the fact that within sectors the variable book-to-market value (*HML*) offsets the single stock observations and, consequently, reduces its variance. On the contrary, the expected positive sign of the ESG score momentum is confirmed. The sensitivity is the same as for securities: diversifying by sectors and stocks does not seem to give different equity premium benefits.

5. Does the Gini Diversification Really Perform Better?

In this section we apply the results of the empirical analysis contained in Tables 5 of the previous Section to verify if it is possible to obtain in a robust way a performance higher than the average market performance with an investment strategy based on the relevance and intensity of financial materiality. Starting from our evidence where the performance of the constituents of the Russell 3000

included in our analysis (see Section 3 on Data and Methodology) is explained by the three factors of the Fama-French model and, in addition, by the ESG momentum and the concentration of financial relevance and intensity of materiality (defined by the Gini index), we used these factors to build some indices that could be easily replicated by portfolio managers. We hypothesize that the performance of portfolios that are based on our model's explanatory factors outperform the standard capitalization-based benchmark.

To this end, using data from the same panel of securities as the empirical analysis contained in Section 3 of the paper, we built two portfolios applying weights that take into account the momentum of the ESG score and the Gini index of financial relevance and intensity of materiality. These weights are associated with the standard capitalization-based weighting (*MV* benchmark). For each month *t* the benchmark portfolio's performance ($R_{MV,t}$) is given by equation (8):

$$R_{MV,t} = \sum_{i=1}^{all\ stocks} R_s * \frac{MV_{s,t-1}}{\sum_{i=1}^{all\ stocks,t} MV_{s,t-1}} \qquad (8)$$

where,

$R_{MV,t}$ = Capitalization-Weighted Portfolio return in month *t*

$R_{s,t}$ = return of security *s* in month *t*

$MV_{s,t-1}$ = market capitalization of security *s* at the beginning of month *t*

To test the effect of ESG momentum on portfolio performance we adjusted market capitalization weights with the relative ESG momentum. For each month *t* of the analysis, the return of the *MV&ESGmom* index ($R_{MV\&ESGmom,t}$) is given by equation (9).

$$R_{MV\&ESGmom,t} = \sum_{s=1}^{all\ stocks} R_s * \frac{MV_{s,t-1}}{\sum_{i=1}^{all\ stocks,t} MV_{s,t-1}} * \frac{ESGmom_{s,t-1}}{\sum_{s=1}^{all\ stocks,t} MESGmom_{s,t-1}} \qquad (9)$$

where $ESGmom_{s,t}$ = ESG momentum of security *s* at the beginning of month *t*[4]

Given the results presented in Section 4, we expect (2) to produce returns higher than the benchmark index (*MV*). To test the combined effect of ESG momentum and financial relevance and intensity of

[4] For each firm, the ESG momentum included in the weighting has been standardized at the industry level.

materiality, we modified equation (9) adding the Gini index as an additional weight. For each month *t*, the return of the *MV&ESGmom+Gini* index ($R_{MV\&ESGmom+Gini,t}$) is given by equation (10):

$$R_{MV\&ESGmom+Gini,t} = \sum_{i=1}^{all\ stocks} R_s * \frac{MV_{s,t-1}}{\sum_{i=1}^{all\ stocks,t} MV_{s,t-1}} * \frac{ESGmom_{s,t-1}}{\sum_{s=1}^{all\ stocks,t} MESGmom_{s,t-1}} * \frac{Gini_i}{\sum_{i=1}^{all\ stocks,t} Gini_i} \quad (10)$$

where $Gini_{i,s}$ = Gini index of industry *i* of firm *s*

For the results obtained in models (2), (3), and (7) of Table 5 we expect the yields of equation (10) to be higher than those of equation (9) as this portfolio replicates the explanatory factors of model (7) of Table 4 which appears to be empirically the best result we got running the regression models with the Fama-French three-factors and ESG variables.

It is worth noting that in our methodology the industry diversification is unchanged and the potential gains from the ESG momentum and the Gini index are not offset by the potential losses resulting from the diversification reduction. Figure 3 shows the evolution of the indices constructed on equations (8) to (10) with compound yields for the period (2009-2019). When considering the momentum magnitude of the ESG score as a weighting factor (*MV&ESGmom*), a structural performance is observed that is higher than the standard index based solely on the market capitalization of securities (*MV*). In addition, when financial relevance and intensity of materiality are included in the weighting methodology (*MV&ESGmom + Gini*) we see a further improvement in performance compared to what we have only by including the ESG momentum factor.

To check the robustness of the analysis, we compared performance, volatility, and risk-adjusted return indicators for each year and for two subperiods (2008-2013 and 2014-2019). The results obtained for the monthly average returns, standard deviations, and Sharpe Ratio (SR) of the four portfolios are presented in Table 7. On a yearly basis, we can observe that the index weighted using ESG momentum and Gini outperforms the MV benchmark in nine out of 12 years, whereas if we only include the ESG momentum factor, the index beats the MV benchmark eight times out of 12. Moreover, in nine out of 12 years the ESGmom and Gini weighted index beats the one weighted only with ESG momentum.

Figure 3 - Compound returns 2009-2019

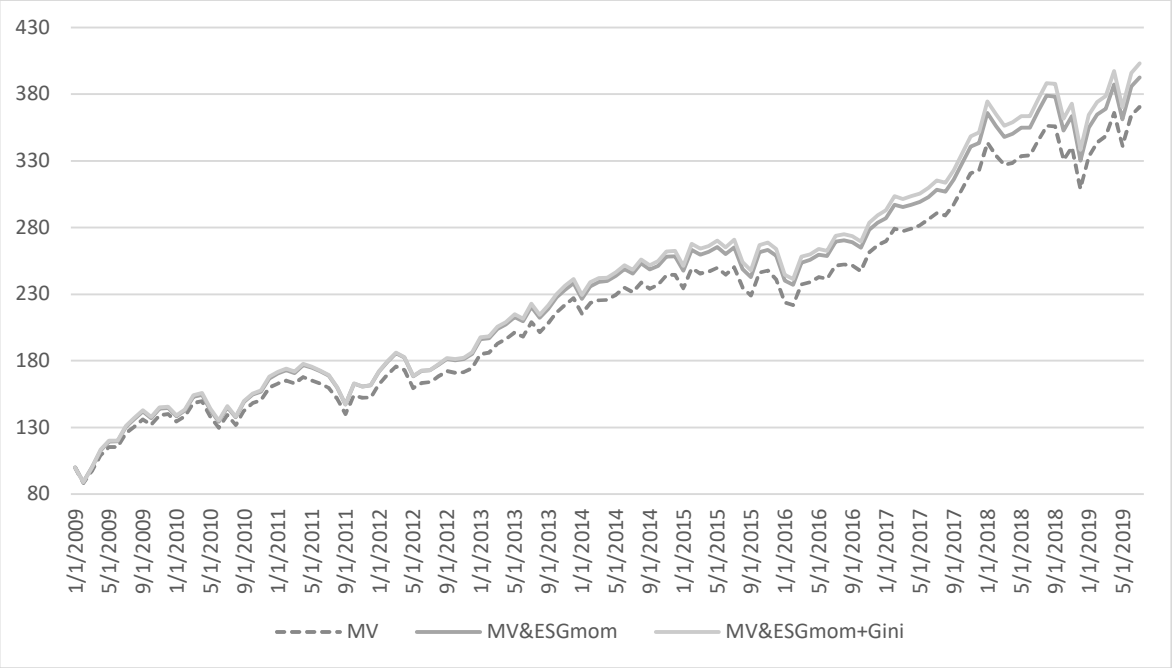


Table 7 – Yearly Performance Characteristics of the Calculated Indices (2008-2019)

	MV			MV&ESGmom			MV&ESGmom+Gini		
	avg.ret	*st.dev.*	*SR*	*avg.ret*	*st.dev.*	*SR*	*avg.ret*	*st.dev.*	*SR*
2008	-4.89%	7.71%	-64.77%	-4.71%	7.60%	-63.35%	-4.82%	7.77%	-63.34%
2009	2.10%	7.69%	27.16%	2.44%	7.82%	31.18%	2.47%	8.03%	30.68%
2010	1.27%	5.82%	21.63%	1.35%	5.82%	23.05%	1.37%	5.93%	22.99%
2011	-0.31%	4.39%	-7.18%	-0.18%	4.56%	-3.91%	-0.23%	4.62%	-5.07%
2012	1.20%	3.63%	32.79%	1.21%	3.58%	33.62%	1.26%	3.64%	34.64%
2013	2.24%	2.71%	82.74%	2.15%	2.70%	79.63%	2.21%	2.74%	80.47%
2014	0.65%	2.55%	25.63%	0.70%	2.47%	28.53%	0.73%	2.48%	29.43%
2015	-0.06%	4.01%	-1.40%	0.09%	4.01%	2.16%	0.13%	4.05%	3.11%
2016	0.91%	3.67%	24.45%	0.83%	3.65%	22.18%	0.82%	3.73%	21.52%
2017	1.78%	2.36%	72.68%	1.78%	2.35%	73.12%	1.81%	2.37%	73.87%
2018	-0.27%	4.46%	-9.41%	-0.24%	4.46%	-8.68%	-0.22%	4.49%	-8.24%
2019	2.72%	4.85%	52.10%	2.61%	4.81%	50.19%	2.63%	4.85%	50.30%
2008-2013	0.60%	5.68%	10.64%	0.70%	5.73%	12.18%	0.70%	5.85%	12.05%
2014-2019	0.81%	3.63%	22.30%	0.82%	3.60%	22.90%	0.85%	3.64%	23.28%
2008-2019	0.70%	4.80%	14.68%	0.76%	4.82%	15.77%	0.77%	4.90%	15.78%

Our results are particularly interesting when analyzing the volatility of the various portfolios. The index weighted with the ESG momentum is less volatile than the MV index seven years out of 12. On the other hand, if the Gini coefficient is used as an additional weighting factor the index that prefers industries with few material issues appears more volatile than the standard index (MV) in 11

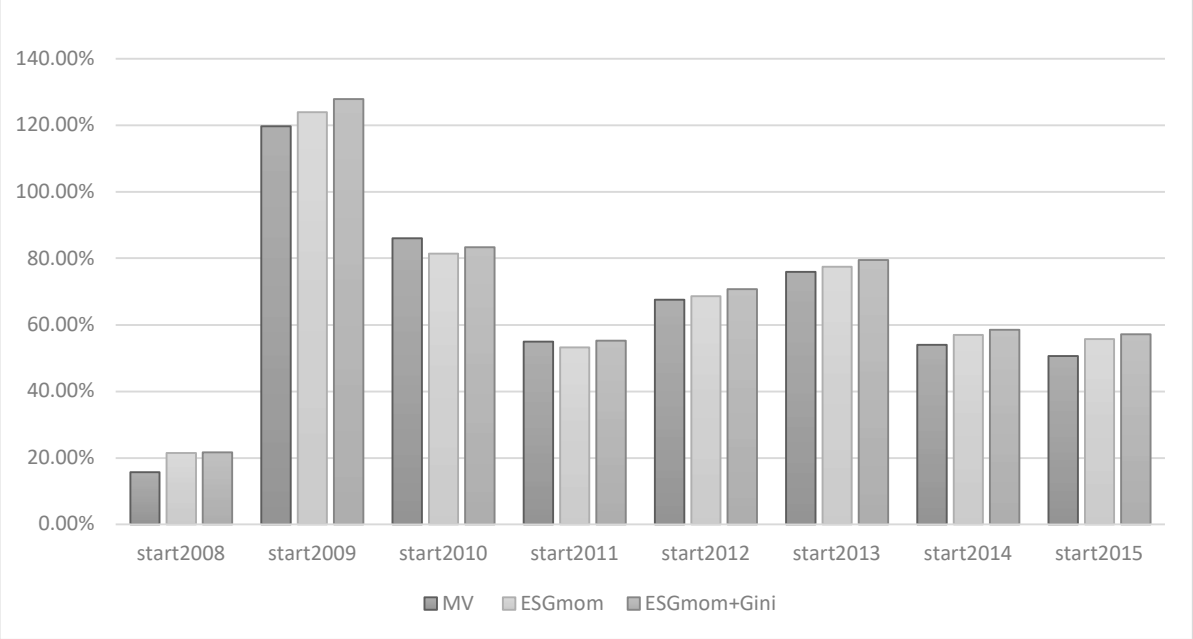
years out of 12. This finding can be explained by the higher concentration of ESG materiality embedded in the Gini factor.

Finally, the results obtained on a risk-adjusted (Sharpe Ratio) basis shows that portfolio that weight with the ESG and Gini score beats the MV benchmark nine years out of 12. If we consider the performance over five years in different sub-periods starting from 2008 (Table 8 and Figure 4), the portfolios weighted with ESG momentum and Gini scores outperform the standard MV index in all cases (eight out of eight).

Table 8 - 5-Year Compound Returns

	MV	ESGmom	ESGmom+Gini
start2008	4.43%	12.48%	11.79%
start2009	127.08%	138.28%	141.34%
start2010	82.01%	86.85%	88.72%
start2011	47.87%	51.81%	53.71%
start2012	63.96%	64.87%	67.87%
start2013	74.56%	75.05%	77.75%
start2014	58.09%	60.43%	62.51%
start2015	57.93%	58.68%	60.50%

Figure 4 - 5-Years Compound Returns



The results above are confirmed when we consider the returns of each index against the MV benchmark. As shown in Table 9, average active monthly returns, measured as the difference between index and benchmark (MV) returns, are positive for all holding periods in the case of both ESG momentum and ESG momentum plus Gini weighted index, the latter showing a higher Tracking Error Volatility in six out of eight holding periods. Finally, in all holding periods except the first one, the Information Ratio of the ESG momentum plus Gini weighted index is higher than the ESG momentum weighted index.

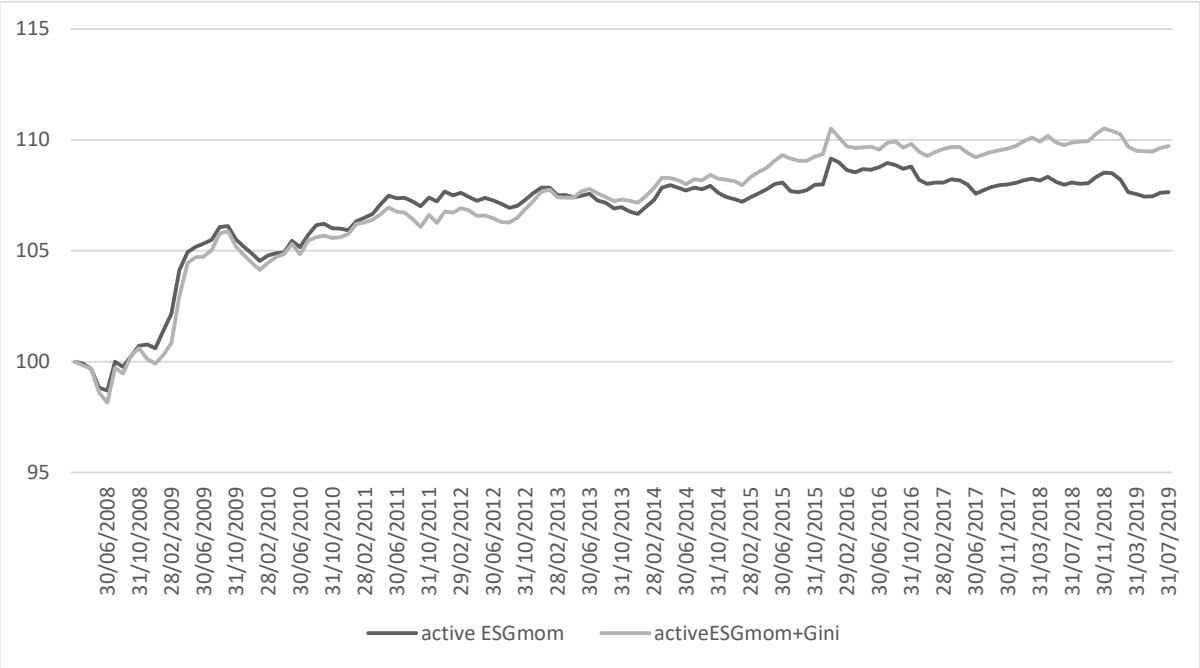
Table 9 - 5-Years Active Returns, Tracking Error Volatility and Information Ratio

	5-Years Avg. Monthly Active Returns		5-Years Tracking Error Volatility		5-Years Information Ratio	
	ESGmom	**ESGmom+Gini**	**ESGmom**	**ESGmom+Gini**	**ESGmom**	**ESGmom+Gini**
start 2008	0.131%	0.129%	0.434%	0.518%	0.30	0.25
start 2009	0.098%	0.118%	0.378%	0.423%	0.26	0.28
start 2010	0.039%	0.058%	0.230%	0.241%	0.17	0.24
start 2011	0.033%	0.057%	0.208%	0.221%	0.16	0.26
start 2012	0.005%	0.039%	0.241%	0.243%	0.02	0.16
start 2013	0.004%	0.033%	0.240%	0.231%	0.02	0.14
start 2014	0.029%	0.051%	0.235%	0.232%	0.12	0.22
start 2015	0.006%	0.027%	0.236%	0.238%	0.02	0.11

These last results are confirmed by Figure 5 that shows the compound active returns of the two indices. In the first five years (2008-2012) we can observe that overweighting industries with a high concentration of the financial relevance and intensity of materiality is not rewarding compared to the simple ESG momentum weighting. Starting from 2013, we can observe an opposite trend with a greater impact of financial relevance and intensity of materiality, leading to an increasing outperformance of the ESG score momentum plus Gini weighted index.

In conclusion, our analysis shows that portfolios weighted for ESG momentum have a performance and volatility on average better than the standard stock market capitalization-only equity index. When the Gini index is added in the weighting, we observe a higher performance, but also a higher risk, given by the concentration of material issues. Nevertheless, since the premium paid by the industries with a more concentrated ESG materiality is still higher than the increased risk, the risk-adjusted performance is higher than that of the standard MV index.

Figure 5 - Compound Active Returns



6. Conclusions

This paper investigates the role of the financial relevance and financial intensity of ESG materiality on stock market performance. Building on the previous empirical evidence that ESG financial materiality has a positive impact on financial performance, we aim at assessing if quantity and quality of materiality might represent an additional input in the selection and optimization of a financial portfolio. Using the identification of industry-specific material issues provided by the Sustainability Accounting Standards Board (SASB), this paper introduces the concepts of financial relevance and financial intensity of ESG materiality and estimate how they explain equity returns. As the number of material issues varies across industries and there is also variation in the impact of material issues on financial performance, we defined three indices able to assess, at the industry level, either the quantity (i.e., the *Industry Materiality Intensity Index – IMII*) and the quality of materiality, the latter referring to its financial relevance (i.e., the *Industry Financial Relevance Index – IFRI*) and financial intensity (i.e., the *Industry Financial Intensity Index – IFII*).

To verify the existence of a dispersion or concentration effect of material issues, we used the Gini index of ESG materiality that summarizes the different patterns of materiality across industries. As the concentration of material issues increases, the index increases. The results of our analysis, based

on a large sample of U.S.-headquartered companies included in the Russell 3000 from January 2008 to June 2019, show that not only does ESG performance have a positive effect on stock returns, but also that, when financial relevance and financial intensity of materiality is taken into account, the market seems to reward more those companies operating in industries with a high level of concentration of ESG materiality. This suggests that when the impact of materiality on the value drivers is dispersed across many issues, it does not act as a separate factor.

We tested this result simulating an active investment strategy based on the relevance and intensity of financial materiality. Using data from the same panel of securities, we built two portfolios applying weights that take into account the ESG momentum factor and the Gini index of materiality and compared them with a standard capitalization-weighted portfolio. Our evidence confirms the results of the panel analysis. In particular, we observe that portfolios managed weighting for ESG momentum and the Gini index outperform both the market capitalization weighted benchmark and the ESG momentum weighted portfolio both in terms of absolute returns, active returns, and risk-adjusted returns, particularly starting from 2013. Moreover, portfolio volatility increases when the Gini index is included in the weighting, showing that the concentration of ESG materiality acts as a concentration risk factor.

The results of our analysis have implications both for companies and investors. For companies in industries which SASB identifies as having many material issues, our results raise the interesting question of whether they should choose a subset of them to focus on and communicate to investors. For investors, our results show that when they consider ESG momentum, they also need to focus on the concentration of material issue as one of the criteria for portfolio management. The market does not believe that having too many material targets is credible. Better fewer, but better.

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Appendix I

Industry Materiality Intensity Index (IMII), Industry Financial Relevance Index (IFRI), and Industry Financial Intensity Index (IFII) for SASB's 77 Industries

Industry	IMII	IFRI	IFII
Advertising & Marketing	11.54%	33.33%	55.00%
Aerospace & Defense	26.92%	38.46%	40.24%
Agricultural Products	26.92%	37.50%	47.62%
Air Freight & Logistics	23.08%	37.18%	33.06%
Airlines	15.38%	38.46%	79.38%
Alcoholic Beverages	23.08%	34.62%	36.67%
Apparel, Accessories	11.54%	36.54%	52.56%
Appliance Manufacturing	7.69%	46.15%	51.43%
Asset Management & Custody Activities	19.23%	30.77%	48.00%
Auto Parts	23.08%	34.07%	48.20%
Automobiles	15.38%	33.85%	64.33%
Biofuels	23.08%	39.74%	26.25%
Biotech & Pharma	30.77%	23.93%	51.85%
Building Products & Furnishings	15.38%	40.38%	33.21%
Car Rental & Leasing	7.69%	50.00%	38.10%
Casinos & Gaming	15.38%	38.46%	38.21%
Chemicals	38.46%	43.59%	33.12%
Coal Operations	30.77%	42.74%	58.92%
Commercial Banks	19.23%	43.08%	27.00%
Construction Materials	34.62%	39.32%	43.15%
Consumer Finance	11.54%	35.90%	66.67%
Containers & Packaging	30.77%	41.35%	34.84%
Cruise Lines	26.92%	35.16%	33.50%
Drug Retailers	15.38%	35.38%	52.95%
E-Commerce	19.23%	35.38%	42.48%
Education	11.54%	38.46%	46.67%
Electric Utilities & Power Generators	34.62%	49.57%	27.65%
Electrical & Electronic Equipment	23.08%	39.74%	41.25%
Electronic Manufacturing Services	23.08%	38.46%	28.89%
Engineering & Construction Services	19.23%	39.74%	36.39%
Food Retailers & Distributors	34.62%	41.54%	29.90%
Forestry Management	11.54%	46.15%	55.71%
Fuel Cells & Industrial Batteries	15.38%	30.77%	32.67%
Gas Utilities & Distributors	11.54%	38.46%	30.95%
Hardware	19.23%	40.00%	35.50%
Health Care Delivery	42.31%	17.48%	28.79%
Health Care Distributors	19.23%	18.46%	23.33%
Home Builders	15.38%	36.92%	20.67%
Hotels & Lodging	19.23%	43.08%	36.38%
Household & Personal Products	15.38%	32.69%	35.42%
Industrial Machinery & Goods	15.38%	33.85%	31.33%
Insurance	15.38%	38.46%	65.28%
Internet Media & Services	19.23%	43.08%	54.50%

Investment Banking	15.38%	24.62%	67.62%
Iron & Steel Producers	26.92%	29.67%	57.62%
Leisure Facilities	11.54%	33.33%	37.78%
Managed Care	19.23%	24.62%	13.33%
Marine Transportation	23.08%	39.74%	41.11%
Meat, Poultry & Dairy	38.46%	30.77%	35.36%
Media & Entertainment	11.54%	33.33%	63.33%
Medical Equipment & Supplies	23.08%	23.08%	50.00%
Metals & Mining	38.46%	39.16%	55.32%
Mortgage Finance	7.69%	28.21%	72.22%
Multiline and Specialty Retailers	19.23%	41.54%	32.62%
Non-Alcoholic Beverages	30.77%	34.62%	36.07%
Oil & Gas – Exploration & Production	38.46%	45.45%	54.76%
Oil & Gas – Midstream	19.23%	46.15%	53.33%
Oil & Gas – Refining & Marketing	34.62%	42.74%	49.49%
Oil & Gas – Services	30.77%	31.73%	61.67%
Processed Foods	30.77%	33.65%	44.61%
Professional & Commercial Services	11.54%	43.59%	72.22%
Pulp & Paper Products	19.23%	33.85%	35.67%
Rail Transportation	19.23%	38.46%	46.67%
Real Estate	15.38%	48.08%	32.62%
Real Estate Services	7.69%	34.62%	45.00%
Restaurants	26.92%	29.67%	44.76%
Road Transportation	15.38%	38.46%	37.80%
Security & Commodity Exchg	11.54%	53.85%	34.17%
Semiconductors	34.62%	34.19%	33.33%
Software & IT Services	23.08%	44.87%	57.32%
Solar Technology	23.08%	36.26%	34.97%
Telecommunication Services	23.08%	42.31%	58.43%
Tobacco	7.69%	46.15%	68.75%
Toys & Sporting Goods	7.69%	34.62%	42.50%
Waste Management	23.08%	35.16%	26.94%
Water Utilities & Services	26.92%	34.62%	48.13%
Wind Technologies	11.54%	34.62%	39.58%

Appendix II

Industry composition

SICS Industry	SICS Sector	Firms		Observations	
		abs	%	abs	%
Advertising & Marketing	Services	5	0.7%	440	0.8%
Aerospace & Defense	Resource Transformation	7	1.0%	741	1.3%
Agricultural Products	Food & Beverage	5	0.7%	275	0.5%
Air Freight & Logistics	Transportation	4	0.5%	426	0.7%
Airlines	Transportation	10	1.4%	1,093	1.9%
Alcoholic Beverages	Food & Beverage	5	0.7%	339	0.6%
Apparel, Accessories & Footwear	Consumer Goods	28	3.8%	2,248	3.9%
Appliance Manufacturing	Consumer Goods	5	0.7%	464	0.8%
Asset Management & Custody Activities	Financials	14	1.9%	944	1.7%
Auto Parts	Transportation	2	0.3%	95	0.2%
Automobiles	Transportation	5	0.7%	474	0.8%
Biofuels	Renewable Resources & Alternative Energy	2	0.3%	191	0.3%
Biotechnology & Pharmaceuticals	Health Care	17	2.3%	1,111	2.0%
Building Products & Furnishings	Consumer Goods	13	1.8%	1,140	2.0%
Car Rental & Leasing	Transportation	2	0.3%	248	0.4%
Casinos & Gaming	Services	6	0.8%	557	1.0%
Chemicals	Resource Transformation	9	1.2%	350	0.6%
Coal Operations	Extractives & Minerals Processing	4	0.5%	108	0.2%
Commercial Banks	Financials	33	4.5%	2,421	4.2%
Construction Materials	Extractives & Minerals Processing	3	0.4%	203	0.4%
Consumer Finance	Financials	19	2.6%	1,749	3.1%
Containers & Packaging	Resource Transformation	11	1.5%	860	1.5%
Drug Retailers	Health Care	2	0.3%	253	0.4%
E-Commerce	Consumer Goods	6	0.8%	600	1.1%
Education	Services	3	0.4%	126	0.2%
Electric Utilities & Power Generators	Infrastructure	30	4.1%	2,469	4.3%
Electrical & Electronic Equipment	Resource Transformation	9	1.2%	664	1.2%
Electronic Manufacturing Services & Original Design Manufacturing	Technology & Communications	2	0.3%	118	0.2%
Engineering & Construction Services	Infrastructure	12	1.6%	805	1.4%
Food Retailers & Distributors	Food & Beverage	4	0.5%	261	0.5%
Forestry Management	Renewable Resources & Alternative Energy	1	0.1%	70	0.1%
Fuel Cells & Industrial Batteries	Renewable Resources & Alternative Energy	2	0.3%	229	0.4%
Gas Utilities & Distributors	Infrastructure	8	1.1%	491	0.9%
Hardware	Technology & Communications	20	2.7%	1,447	2.5%
Health Care Distributors	Health Care	5	0.7%	389	0.7%
Home Builders	Infrastructure	6	0.8%	473	0.8%
Hotels & Lodging	Services	3	0.4%	245	0.4%

Household & Personal Products	Consumer Goods	10	1.4%	1,029	1.8%
Industrial Machinery & Goods	Resource Transformation	28	3.8%	2,048	3.6%
Insurance	Financials	13	1.8%	952	1.7%
Internet Media & Services	Technology & Communications	20	2.7%	1,507	2.6%
Investment Banking & Brokerage	Financials	9	1.2%	700	1.2%
Iron & Steel Producers	Extractives & Minerals Processing	5	0.7%	393	0.7%
Leisure Facilities	Services	9	1.2%	690	1.2%
Managed Care	Health Care	1	0.1%	83	0.1%
Marine Transportation	Transportation	1	0.1%	68	0.1%
Meat, Poultry & Dairy	Food & Beverage	6	0.8%	525	0.9%
Media & Entertainment	Services	22	3.0%	1,743	3.1%
Medical Equipment & Supplies	Health Care	26	3.6%	1,686	3.0%
Metals & Mining	Extractives & Minerals Processing	5	0.7%	348	0.6%
Mortgage Finance	Financials	10	1.4%	821	1.4%
Multiline and Specialty Retailers & Distributors	Consumer Goods	37	5.1%	2,845	5.0%
Non-Alcoholic Beverages	Food & Beverage	4	0.5%	404	0.7%
Oil & Gas - Exploration & Production	Extractives & Minerals Processing	22	3.0%	1,781	3.1%
Oil & Gas - Midstream	Extractives & Minerals Processing	8	1.1%	452	0.8%
Oil & Gas - Refining & Marketing	Extractives & Minerals Processing	5	0.7%	309	0.5%
Oil & Gas - Services	Extractives & Minerals Processing	4	0.5%	287	0.5%
Processed Foods	Food & Beverage	12	1.6%	909	1.6%
Professional & Commercial Services	Services	40	5.5%	3,069	5.4%
Pulp & Paper Products	Renewable Resources & Alternative Energy	5	0.7%	393	0.7%
Rail Transportation	Transportation	3	0.4%	390	0.7%
Real Estate	Infrastructure	14	1.9%	937	1.6%
Real Estate Services	Infrastructure	5	0.7%	321	0.6%
Restaurants	Food & Beverage	12	1.6%	1,133	2.0%
Road Transportation	Transportation	4	0.5%	233	0.4%
Security & Commodity Exchanges	Financials	4	0.5%	369	0.6%
Semiconductors	Technology & Communications	6	0.8%	578	1.0%
Software & IT Services	Technology & Communications	28	3.8%	2,240	3.9%
Solar Technology & Project Developers	Renewable Resources & Alternative Energy	5	0.7%	250	0.4%
Telecommunication Services	Technology & Communications	8	1.1%	692	1.2%
Tobacco	Food & Beverage	6	0.8%	543	1.0%
Toys & Sporting Goods	Consumer Goods	4	0.5%	399	0.7%
Waste Management	Infrastructure	8	1.1%	725	1.3%
Total		*731*	*100%*	*56,969*	*100.%*
mean		10	1.4%	780	1.4%
min		1	0.1%	68	0.1%
max		40	5.5%	3,069	5.4%