DO ESG METRICS REFLECT CRISIS RESILIENCE OF EQUITIES DURING THE COVID-19 PANDEMIC?¹

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ABSTRACT
We examine the role of ESG metrics in explaining crisis resilience during the COVID-19 pandemic. ESG refers to Environmental, Social, and Governance aspects of companies, collectively known as ESG factors, and has gained popularity in investments. Our empirical tests cover a database of 971 company members of the MSCI World Index and examine the COVID Crisis period from February 2020 – May 2020. We performed linear regression and Owen-Shapley decomposition in our study, like the literature. Our results show that ESG is not an “equity vaccine” but is a statistically significant and economically important variable in explaining returns during the pandemic. Our findings highlight the increasing importance of sustainability aspects in finance and in investing.

JEL codes: G01, Q56, G30

Keywords: ESG, crisis resilience, pandemic, linear regression, Owen-Shapley decomposition

1 INTRODUCTION
The global crisis induced by the COVID-19 pandemic caused a sharp and severe shock to global equity markets on 20 February 2020. That shock lasted for almost three months, but international equity indices soon recovered with the reassurances of central banks that provided liquidity to the markets. As the long-term impact of the pandemic is yet to unfold, this paper examines the effects of the

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The crisis of COVID-19 from the perspective of ESG equity investments at macro and company level.

While in general, almost all asset classes and equity investments uniformly took a sudden hit (correlation tended to 1) as news of the global scale of the pandemic surfaced, the impact was more diverse, with some sectors emerging as beneficiaries of the crisis, while others remain challenged. According to Günther et al. (2020), firms, such as Lufthansa, Adidas, or US airlines, sought financial support from their governments to remain liquid. On the other hand, beneficiaries of the crisis include technology companies and healthcare sector players. Fears of the crisis spiralling towards an economic recession were dispelled by the swift and colossal liquidity central banks provided to the markets, supported by a lenient fiscal policy across the globe. Hence, we refer to the short period between 20 February 2020 – 5 May 2020 as the “COVID Crisis” (CC). This paper focuses on the crisis resilience of companies during the CC with attention to the role of ESG metrics.

In this research, the sustainability of companies is measured by ESG metrics. Sustainable finance is one of the latest trends in finance literature today, lagging behind the other sciences in researching the problem of sustainability (Naffa–Fain, 2020; Tamásné Vőneki–Lamanda, 2020). In contrast, macroeconomists have previously addressed sustainability and climate risk (Naffa–Fain, 2020; Németh-Durkó, 2020). Several studies examine the relationship between environmental (E), social (S), and governance (G) factors (Primecz–Havran–Lakaš, 2019; Berlinger, Keresztúri–Tamásné Vőnek, 2019). Nowadays, sustainability considerations are taking centre stage, with asset owners becoming increasingly aware of ESG aspects. However, transition to a sustainable economy is not a clear and easy path for investors and companies. Long-term value creation contrasts with the traditional investment approach, which focuses on short-term profit-taking and considers financial risk only. In contrast, long-term value creation integrates economic, social, and environmental values and addresses financial and sustainability risks (Schoenmaker and Schramade, 2019). In this paper, we identified sustainability aspects using the ESG indicators of companies. Environmental, Social, and Governance aspects are collectively known as ESG factors, which have recently gained significant importance in finance. According to MSCI ESG Research (MSCI, 2016), these are unique performance indicators that measure an investment’s sustainability and societal impact. ESG factors and ratings apply both to companies and countries, similarly to credit ratings.

During the COVID pandemic, many suspected that a good ESG rating would provide a kind of protection for companies; in the media ESG was termed an “equity vaccine” against the CC. This theory based on corporate social responsibility activities helps build social capital and trust in corporations. The bond will motivate a company’s stakeholders to remain loyal (Demers, 2021). Many studies support this theory, such as Albuquerque et al., 2020; Bouslah et al., 2018; Cornett et al., 2016; Ding et al., 2020, 2021. On the other hand, based on agency theory, researchers found the opposite: ESG does not provide downside risk protection (Lys et al., 2015).

This paper’s research question uncovers how ESG aspects played a role in the resilience of firms during the first shock of the global pandemic from 1 February 2020 to 1 May 2020 and whether a relationship exists between the ESG performance of firms and their crisis resilience. First, we investigated the determinants of crisis resilience and examine whether including ESG indicators improve the model’s explanatory power. Then we analysed the decomposition of the R-square of each regression to determine the exact contributions of the explanatory variables to the R-Square of a linear regression (Israeli, 2007). We performed linear regression and Owen-Shapley decomposition in our study. Our results have shown that ESG is not an “equity vaccine” but it is a statistically significant and economically important variable in explaining returns during the pandemic.

The paper is structured as follows: we summarize the literature and introduce the investment market background. Next, we present the hypotheses, the user database and outline the applied methodology. We conclude with the results of our research and discussion.

2 LITERATURE REVIEW

Crisis resilience was addressed in the literature in the context of countries as well as companies. Papers (Oprea et al., 2020; Alessi et al., 2020) studied crisis resilience at regional or country level, but there is a lack of research to uncover crisis resilience at company level. ESG and the relationship between returns and stock value have long been a research topic in the literature (Demers et al., 2021; Li-ang–Renneboog, 2020). The novelty of this paper lies in examining the ESG aspect of corporate-level crisis resilience and addressing the exact contributions of the explanatory variables, which have not been discussed in the literature thus far.

Sabatino (2016) identified seven characteristics that define corporate crisis resilience: “1) Product focalization; 2) geographic focalization; 3) quickness in the decision; 4) organizing structure based on the clan model; 5) strong national imprinting–business values; 6) "customer centricity"; 7) an efficient system of incentives for strategic aims”.

Armea et al. (2017) examined the risk management aspects of crisis resilience. They believed that good corporate governance upholds effective risk management, allowing flexibility to respond to unpredicted threats and to benefit from
opportunities. Therefore, risk management affords corporate resilience that gives rise to competitive advantage due to the capacity to circumvent, deter, defend, react, and adjust to any disturbance, besides recovering quickly. They examined listed companies of Romania and found that the gender of the CEO, the size of the Board, and the Audit Committee are in negative relationship in connection with business failure risk.

Castro and Zermeno (2020) studied the resilience factors such as attitudes adopted towards the crisis, the characteristics of the business and the entrepreneur, the relationships with institutions, human and social capital, and strategic management. They believe that these factors can be considered in training programmes for resilient entrepreneurs and by the different actors in the entrepreneurial ecosystem, including universities and public policymakers, who support them. Several researchers have also examined financial resilience in recent years.

Soroka et al. (2020) examined the QuiScore credit score to measure corporate and regional economic resilience. A single study examined the usefulness of the indicator, and the results showed that QuiScore is an effective indicator of the financial resilience of firms.

Markman and Venzin (2014) argue in their article that there are basically few good examples in the literature that would be robust measures of the economic resilience of firms. Their study developed a unique crisis resilience indicator that combines financial performance metrics with firm volatility data. Their results suggest that the resilience of these firms is driven by a combination of their resource capacity, market context, and industrial conditions. One of the objectives of our research is to examine the current situation and expand the literature on the economic resilience of companies.

Many academic studies focused on the role of ESG as a mitigator of downside risk during a crisis period. According to Godfrey et al. (2009), some types of CSR activities will be more likely to create goodwill and offer insurance-like protection against downside risk, especially during a crisis.

Some researchers have found evidence that higher investments in ESG may result in socially responsible firms becoming less vulnerable during a crisis. For example, Ding et al. (2020) evaluated the connection between corporate characteristics and stock price reactions to COVID-19 cases. They found that the pandemic-induced drop in stock prices was milder among firms with (a) stronger pre-2020 finances (more cash, less debt, and more significant profits), (b) less exposure to COVID-19 through global supply chains and customer locations, (c) more CSR activities, and (d) less inveterate executives. Furthermore, they found that the stock returns of firms controlled by families, large corporations, and governments performed better, while those owned by hedge funds and other asset management compa-
3 THEORETICAL FRAMEWORK

In our study, we build on the economic resilience model of Martin (2012). He developed the idea of flexibility, examined its use in understanding how regional economies responded to significant recession shocks, and cited British regions as exploratory examples. Martin defined economic resilience as a shock-triggered process and distinguished four phases: resistance, recovery, reorientation, and diversion. Resistance refers to the first direct response to a recession and measures the intensity and extent of the decline. In comparison, it relates to the speed and volume of how an economy can recover from a downturn and return to its original growth path.

Given that our research is fundamentally short-term, we will examine the first components of the model. We enhance Martin’s (2012) model to include sustainability aspects: ESG aspects as determinants. On this page, the present study model is structured as follows (Figure 1):

Figure 1
Our model, based on Martin’s (2012) resilience model

4 RESEARCH DESIGN

4.1 Research question and hypotheses

Based on the literature and the theoretical framework, we examine the following question and hypotheses.

Question:
• RQ: Do ESG metrics improve the measurement of crisis resilience?

Hypotheses:
• H1: ESG indicators are significant, primary variables in estimating the crisis resilience of a given firm.
• H2: Better ESG performance can improve the crisis resilience of companies.

4.2 Data

Our research focuses on examining crisis resilience, highlighting the relative contribution of identified factors to explaining crisis resilience. For this, we performed calculations on companies included in the MSCI World index, 971 companies altogether. At present, this pattern can be considered homogeneous, as the initial downturn during the crisis caused by the coronavirus took place in all capital markets in a similar way, as shown in Figure 2. The chart shows the performance of significant indices between March 2019-March 2021. Euronext 100 is a European equity index, NYSE Amex Composite, and Russel 2000 are indices from the USA, the Shenzen Component is a Chinese equity index, and IPC Mexico is a Mexican index.
Table 1

<table>
<thead>
<tr>
<th>Type of variable</th>
<th>Variable name</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resilience indicator</td>
<td>Maximal drawdown</td>
<td>The decrease from the highest point to the bottom during COVID-19 (between 20 February 2020 and 1 May 2020). All values are negative.</td>
</tr>
<tr>
<td>Market capitalization</td>
<td>The company’s stock market value is used to measure company size (USD million)</td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>Natural logarithm of company’s market capitalization</td>
<td></td>
</tr>
<tr>
<td>P/E ratio (z score)</td>
<td>The P/E ratio is the standardized monthly PE data of the company’s blended forward earnings expectation for the past three years, considered as the average, and then we took the latest value from this average</td>
<td></td>
</tr>
<tr>
<td>Financial Leverage</td>
<td>Measures the average assets to average equity</td>
<td></td>
</tr>
<tr>
<td>Tobin Q</td>
<td>The ratio of the market value of a firm to the replacement cost of the firm’s assets calculated according to Bloomberg.</td>
<td></td>
</tr>
<tr>
<td>Calmar ratio</td>
<td>A comparison of the average annual compound rate of return and the maximum drawdown risk. The higher the Calmar ratio, the better the performance.</td>
<td></td>
</tr>
<tr>
<td>Implied five-year CDS</td>
<td>Risk measure based on Bloomberg’s model. The key assumptions employed in the Bloomberg model include ongoing as a fraction of par, piecewise constant risk-neutral hazard rates, and default events being statistically independent of changes in the default-free yield curve. (Wen and Kinsella, 2013)</td>
<td></td>
</tr>
<tr>
<td>Volatility</td>
<td>The 360-day price volatility equals the annualized standard deviation of the relative price change for the 360 most recent trading days’ closing price.</td>
<td></td>
</tr>
</tbody>
</table>

Notably, recovery from the crisis has varied across different regions and sectors depending on the recovery rate.

We used financial data from Bloomberg and ESG data from Sustainalytics. The timeframe covered the period from 1 February 2020 to 1 May 2020. We included the following explanatory variables based on the relevant literature, seen in Table 1 below.

**Figure 2**
Indices worldwide between March 2019 - March 2021

Source: Yahoo Finance, 2021
4.3 Methodology

In this research, we applied a linear regression model to uncover the predictive power of ESG indicators for crisis resilience. We handled the nonlinearity in our model with algebraic linearization, which means that we took the logarithm of the variables if the variables had a positive value (Ferenczi, 2008).

We performed linear regressions in IBM SPSS statistics and Gretl 2021d. Then, we used Owen-Shapley decomposition to determine the exact contributions of the explanatory variables to the R-square of a linear regression. (Israeli, 2007) We performed the Owen-Shapley decomposition in the KNIME workspace, and we used Python language.

5 RESULTS

To uncover the determinants of crisis resilience, we performed a linear regression, where the dependent variable was the maximal drawdown. Firstly, we excluded the ESG variables and then we included them in our regression. We applied the forward method in all cases because this approach includes the significant variables only in the regression model. A forward algorithm is a stable approach; in each case, it can significantly increase the model's explanatory power, while it is as accurate as the other algorithms ((Bendel–Afifi, 1977).

The results of the first regression, when only financial variables were in the equation, are shown in Table 2.

Table 2

<table>
<thead>
<tr>
<th>Type of variable</th>
<th>Variable name</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESG risk score</td>
<td>Overall Risk ESG score of a company based on the methodology of Sustainalytics, where the lower figure reflects lower risk, i.e., better ESG performance.</td>
<td></td>
</tr>
<tr>
<td>Management score</td>
<td>ESG risk management performance, indicating the total manageable risk exposure, how much management is able to manage appropriately.</td>
<td></td>
</tr>
<tr>
<td>Combined controversies score</td>
<td>Number of corporate ESG incidents</td>
<td></td>
</tr>
<tr>
<td>ESG data</td>
<td>ESG Risk Ratings measure a company's exposure to industry-specific material ESG risks and how well a company is managing those risks. Sustainalytics identifies five categories of ESG risk severity that could impact a company's enterprise value: Negligible, Low, Medium, High, Severe.</td>
<td></td>
</tr>
<tr>
<td>ESG risk category</td>
<td>We termed a company ESG leader if its ESG risk category was Low or Negligible, and ESG laggard if their category was Medium, High, or Severe. We use it as a dummy variable, with the value of 1 if it is an ESG leader and 0 in the case of ESG laggards.</td>
<td></td>
</tr>
</tbody>
</table>

Source: by the author

We selected our variables for the analysis based on the relevant literature. There are various examples of measuring crisis resilience: Cheema-Fox et al. (2020) used the difference between total corporate stock returns and total national stock returns as an explanatory variable in their work. Albuquerque et al. (2020) used three different dependent variables in their work, quarterly abnormal returns, return volatility (total and idiosyncratic volatility), and operating performance (measured by return on assets, operating profit, and asset turnover). Markman and Venzin (2014) developed their metrics for crisis resilience. To measure resilience, VOLARE (Volatility and ROE) was used, which considers volatility (a measure of risk) and long-term ROE (a measure of profitability). VOLARE motivates more objective resource allocation processes, where risky expenditures or strategies are penalized while less risky initiatives are rewarded. We applied maximal drawdown as a dependent variable, based on the definition of De Melo Mendes–Lavrado (2017) and the work of Hassan et al. (2021).

In the case of the independent variables, we chose company financial data and ESG data. The selected company financial data is based on the work of Albuquerque et al. (2020). For ESG, based on the work of Demers et al. (2021), who used MSCI and EIKON refinitiv complex ESG measurements, we decided on the complex measurements of the Sustainalytics database.
The R square was 59.7% in this regression. The implied CDS was not significant; however, all other variables were included in the equation. The VIF values were all under 10; it can be interpreted that there is no multicollinearity in this model. In case we added the ESG indicators, we arrived at the following results.

**Table 3**
Variables in the equation- ESG indicators included (Model 2)

<table>
<thead>
<tr>
<th>Standardized Coefficients</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta</td>
<td>t</td>
</tr>
<tr>
<td>(Constant)</td>
<td>16.44379</td>
</tr>
<tr>
<td>Volatility</td>
<td>-0.664368383</td>
</tr>
<tr>
<td>Calmar ratio</td>
<td>0.238995588</td>
</tr>
<tr>
<td>Overall management score</td>
<td>-0.22030962</td>
</tr>
<tr>
<td>P/E ratio (z score)</td>
<td>-0.18222887</td>
</tr>
<tr>
<td>Tobin Q</td>
<td>0.114121337</td>
</tr>
<tr>
<td>Size</td>
<td>0.132921063</td>
</tr>
<tr>
<td>Financial Leverage</td>
<td>-0.08627008</td>
</tr>
<tr>
<td>Combined controversy score</td>
<td>-0.065715838</td>
</tr>
<tr>
<td>Implied 5-year CDS</td>
<td>0.061521789</td>
</tr>
<tr>
<td>ESG leader/laggard (dummy)</td>
<td>0.003</td>
</tr>
<tr>
<td>ESG Risk score</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Source: by the author

We had most of the significant variables from the last regression, plus the Implied CDS, overall management, and combined controversies. The ESG Leader/Laggard dummy variable and the ESG Risk scores were not significant. The VIF values were all under 10, and it can be interpreted that there is no multicollinearity in this model.

The R square was 65.2%, which means the ESG aspect may give a plus explanatory power to our model. The results suggest that a company is less resilient if its stock is volatile, and its financial leverage is high. The higher P/E ratio also results in worse outcomes in resilience and the beta of overall management score indicates that if a company’s management’s ability to manage risk exposure properly is better, a company will have a larger maximal drawdown, therefore it will be less resilient. The coefficient of the combined controversy score shows us that if the number of controversies increases, companies will be less resilient. On the other hand, the Tobin Q and Calmar ratio betas suggest that overvalued stocks can be more resilient. The exclusion of the dummy variable indicates no significant difference between ESG leaders and laggards regarding crisis resilience.

To better understand the relative importance of the significant variables in explaining crisis resilience, we applied an Owen-Shapley decomposition as illustrated by Israeli (2007). Using this approach, we estimated the proportion of the explanatory power for returns that each set of variables contributes. Table 4 presents the ratio of 59.7% that is explained by each variable. As shown, volatility contributes the most to the overall R square, as 71.6% of the explained variation is due to this variable. P/E ratio is second at 8.88% of the explained variation. Then come the Calmar ratio at 8.78%, then the other variables, Size at 4.87%, Tobin Q at 4.52%, and Financial Leverage at 1.34%.

In the case of Model 2, when we integrated the ESG variables, we got the following results, presented in Table 5. The total R square was 65.2% which was explained as the follows: volatility contributes the most to the overall R square in that case too, as 56.28% of the explained variation is due to this variable. Overall Management Score was the second at 9.93% of the explained variation. Then come the Calmar ratio at 8.78%, then the other variables, Size at 4.87%, Tobin Q at 4.52%, and Financial Leverage at 1.34%.

To sum up the ESG variable, the Overall management score is second in importance, contributing 9.93% of the total 65.2% explained variation in returns during the first quarter of the COVID crisis. The Combined controversy score contributed at 2.39% of the total explained variation.

Taken together, our results from these regression analyses and the Owen-Shapley decomposition suggest that company, financial, and ESG variables are all important in explaining crisis resilience during COVID Crisis.
Based on these results, we did not reject the H1 hypothesis that ESG indicators were significant and primary variables in estimating the crisis resilience of a given firm. On the other hand, we rejected the H2 hypothesis, i.e., that better ESG performance can improve the crisis resilience of companies.

6 SUMMARY

We examined the role of ESG indicators in explaining the crisis resilience of companies during the COVID-19 crisis. The outbreak of the pandemic in February 2020 acted as a significant external shock to global stock markets. Our findings show that ESG metrics, particularly the overall management score, and the combined controversy score, can be good predictors of company-level crisis resilience. However, our other results suggest that better ESG performance cannot fully improve the crisis resilience of companies.

Our results align with the literature: Ferriani and Natoli (2020) highlighted in their study that the investors took ESG risk significantly into account during the COVID-19 crisis. They also found that E, S, and G factors have not been valued the same, as a particular preference is shown for funds with low governance and environmental risks. Finally, Diaz et al. (2021) showed that ESG is indispensable to understand the factors of investment decisions during uncertain times. The role of ESG metrics in improving crisis resilience is still unclear; further empirical tests are needed to evaluate this question. Demers et al. (2021) and Liang–Renneboog (2020) also highlighted the mixed view of ESG performance on corporate performance in their work.

Our results highlight the importance of sustainability considerations for explaining crisis resilience. Implications of this research support the shift from shareholder to stakeholder capitalism as reflected by global equity market performance during this pandemic, which acted as an external shock. This shift is also visible in the risk management of investments, as more empirical evidence highlights the importance of sustainability-related risk management. The importance of sustainability aspects in finance and investments is increasing, according to Schoenmaker–Schramade (2019). Dijk (2020) provides a reasonable basis for this, which is yet to be further developed in practice.
REFERENCES


