Implied Tail Risk and ESG Ratings

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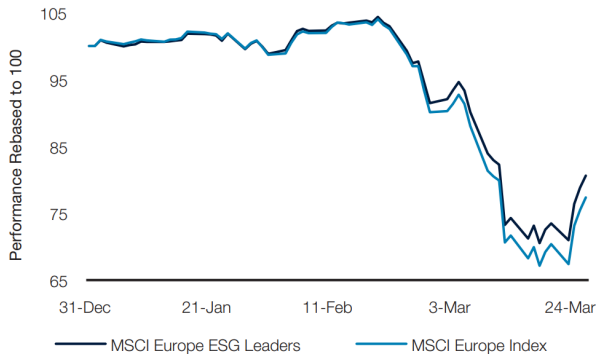KU Leuven

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0   Outline

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1 Outline

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1   Backgroud

▶ ESG Rating: Environmental, Social and Governance performance of a company;

▶ Taking into account, ESG aspects into the investment decision process and the risk-management of it has been an increasing trend over the past decade;

▶ ESG funds show resilience in the downside economy.

1   Backgroud

Figure: MSCI Europe ESG Leaders index and its non-ESG benchmark

1   Background

▶ Lins, Servaes, and Tamayo (2017) indicate that a good ESG score serves as a form of insurance during the financial crisis;

▶ Ashwin Kumar et al. (2016) and De and Clayman (2015) focus on the correlation between ESG levels and volatility of stock returns;

▶ Some research explores the correlation between ESG performance and tail risk (Shafer and Szado, 2018; Hoepner et al., 2018; Diemont, Moore, and Soppe, 2016).

1   Background

Aim: Explore the connection between ESG performance and financial risks.

Method: Exam the relations between ESG ratings and option-implied moments of the return distribution.

- ▶ Common risk: standard deviation of equity return distribution;
- ▶ Tail risks: higher moments of the distribution.

2 Outline

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2 Option-Implied Moments

▶ Moments: Volatility, Skewness and Kurtosis of a distribution;

▶ Option-implied moments: moments deduced from the pricing return distribution via derivatives data;

▶ Any twice-differentiable payoff can be spanned by a portfolio of bonds, the underlying asset and out-of-the-money vanilla (put and call) options(Carr, Geman, and Madan, 2001; Bakshi, Kapadia, and Madan, 2003);

▶ Forward looking estimation (30 days).

2   Option-Implied Moments

The model-free approximation of option-implied moments from option prices (Madan and Schoutens, 2016):

$$E_Q[(log(\frac{S_T}{S_0}))^N] = (log(\frac{K_0}{S_0})^N) + (log(\frac{K_0}{S_0})^{N-1})(\frac{F_0}{K_0} - 1)$$
$$+ exp(rT)N\sum_{i=1}^{M}\frac{\Delta K_i}{K_i^2}((N-1)(log(\frac{K_i}{S_0})^{N-2})$$
$$-(log(\frac{K_i}{S_0})^{N-1}))Price(K_i, T)$$

2 Option-Implied Moments

The option-implied moments of the distribution of the log-asset return X ($X = log(\frac{S_T}{S_0})$), are defined as follows:

$$\begin{cases} Var(X_T) = E_Q[X_T^2] - (E_Q[X_T])^2; \\\\ Skewness(X_T) = \frac{E_Q[X_T^3] - 3E_Q[X_T]E_Q[X_T^2] + 2(E_Q[X_T])^3}{(Var(X_T))^{3/2}}; \\\\ Kurtosis(X_T) = \frac{E_Q[X_T^4] - 4E_Q[X_T]E_Q[X_T^3] + 6(E_Q[X_T])^2 E_Q[X_T^2] - 3(E_Q[X_T])^4}{(Var(X_T))^2} \end{cases}$$

3 Outline

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3 Data Source

- Option Data:

  - OptionMetrics;

  - Firms in the energy sector;

  - Each day: calculate the 30-day option-implied moments;

  - Each firm: calculate daily option-implied moments and compute the average value per month;

  - Time period is from 2011-01 to 2018-11;

3 Data Source

▶ ESG Rating Data:
  - Sustainalytics;
  - Domain: [0,100];
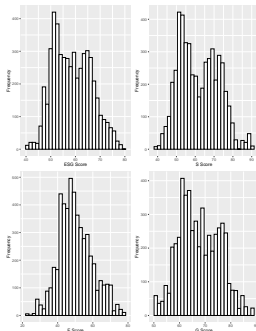 - Time period is from 2011-01 to 2018-11;

Figure: ESG and ESG pillar ratings histogram

3   Results

A less negative option-implied skewness and a lower option-implied kurtosis with higher ESG ratings.
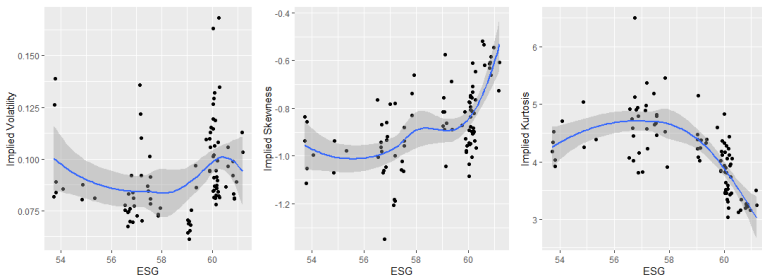

Figure: Scatter plot of ESG rating and option-implied moments

3   Results

▶ High ESG rating group: higher option-implied volatility;

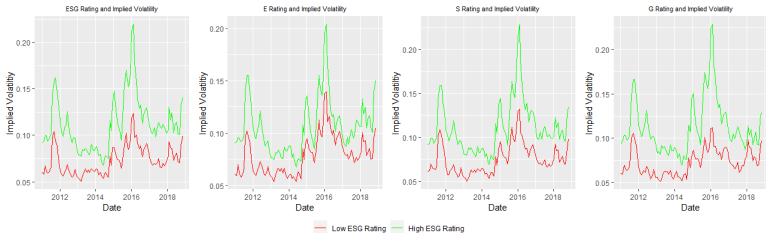▶ The difference of option-implied volatility between two groups is rather constant over time.

Figure: Smoothed Option-implied Volatility for Firms of High ESG Rating Group and Low ESG Rating Group

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3   Results

▶ High ESG rating group: less negative option-implied skewness;

▶ Low ESG rating group: more rapidliy increasing trend;

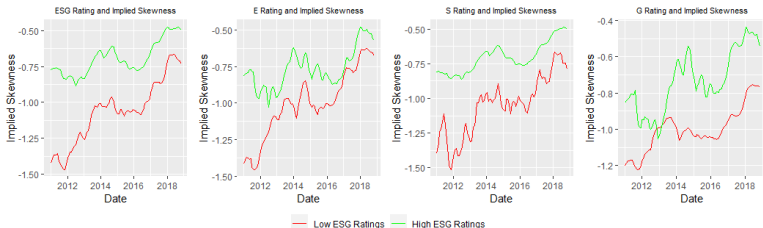▶ The difference of option-implied skewness is skrinking between two groups as time goes by.

Figure: Smoothed Option-implied Skewness for Firms of High ESG Rating Group and Low ESG Rating Group

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3   Results

▶ High ESG rating group: lower option-implied kurtosis;
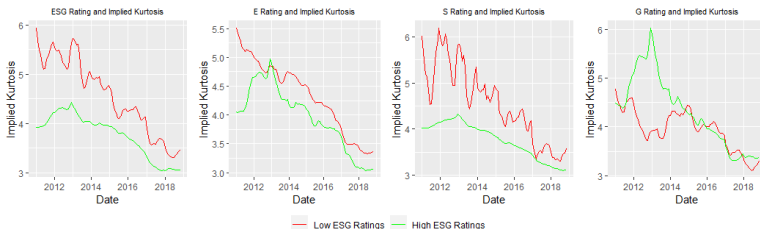▶ For the G rating, this trend is not obvious after 2015.

Figure: Smoothed Option-implied Kurtosis for Firms of High ESG Rating Group and Low ESG Rating Group

4 Outline

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4 Conclusion

▶ This study uses a forward-looking measure to assess the firm's risks which are represented by option-implied moments;

▶ Firms with a high ESG rating will have on average a higher option-implied volatility but less negative option-implied skewness and lower option-implied kurtosis in the energy industry;

▶ Further study: expand the current work to other industries.

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Thanks!