

The Carbon Reduction Index Funds: Evidence of a Double Bottom Line Effect in the Japanese Stock Market

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Overview

Global efforts to achieve net-zero carbon emissions by 2050 and mitigate climate change are being driven intensively by the functions of capital markets, including ESG investing. In this context, carbon emissions are expected to be reflected in stock prices. Bolton and Kacperczyk (2021a) show that there is a significant carbon risk premium in the U.S. stock market, meaning that companies with higher carbon emissions have higher stock returns. Bolton and Kacperczyk (2021b) also conducted an empirical analysis showing that the carbon risk premium exists not only in the U.S. stock market, but also in the stock markets of many other countries, including China.

On the other hand, Ishijima et al. (2021b) showed that in the Japanese stock market, firms with high carbon emissions have lower stock returns - there is a significant negative carbon risk premium in the Japanese stock market. The existence of a negative carbon risk premium in the Japanese stock market was demonstrated by Oshika et al. (2009) and Saka and Oshika (2011) more than a decade before Bolton and Kacperczyk (2021a,b). The results of these earlier studies suggest that in the Japanese stock market, firms that reduce carbon emissions have higher stock returns. In other words, firms can achieve a double bottom line by reducing carbon emissions and increasing their stock price at the same time.

Therefore, in this study, we measure the percentage increase in the stock price of a company listed on the Japanese stock market if it reduces its carbon dioxide emissions by 1%. This index can also be interpreted as the return of the Carbon Reduction Index Fund (CRIF), an investment fund for companies that reduce carbon emissions. We show that this fund outperforms well-known index funds. In other words, this study shows that investing in companies that are committed to reducing carbon dioxide emissions in the Japanese stock market produces very good investment performance.

Methods

We elaborate on how to quantify the return on investment of CRIFs. We assume that n assets are traded at discrete points in time $t (= 0, \dots, T)$. We conduct a cross-sectional regression with respect to the stock return observed in the market, $R_{i,t}$ ($i = 1, \dots, n; t = 1, \dots, T$):

$$R_{i,t} = \alpha_t \cdot CO2_{i,t} + c'_t CTRL_{i,t} + \tau \cdot \mathbf{1}_{\{TIME\ t\}} + \gamma \cdot \mathbf{1}_{\{SECTOR\ j\}} + \eta \cdot \mathbf{1}_{\{FIRM\ i\}} + \varepsilon_{i,t} \quad (1)$$

The explanatory variable of interest is $CO2_{i,t}$, the rate of reduction of the firm's carbon dioxide emissions over the period. The regression coefficient, α_t , represents the percentage increase in the stock price of a company listed on the Japanese stock market if it reduces its carbon dioxide emissions by 1%. This regression coefficient can also be interpreted as the return on investment of CRIF, a fund that invests in companies that reduce carbon dioxide emissions. Note that it is still significant even when we control for known explanatory variables explaining stock prices, time dummies $\mathbf{1}_{\{TIME\ t\}}$, industry dummies $\mathbf{1}_{\{SECTOR\ j\}}$, and firm dummies $\mathbf{1}_{\{FIRM\ i\}}$. According to Ishijima et al. (2021a,b), there are two types of carbon dioxide emission data reported by Japanese companies: ONTAI and SCOPE3. The former, reported under the Act on Promotion of Global Warming Countermeasures, is the sum of direct and indirect emissions and can be regarded as the sum of Scope 1 and 2 of the Greenhouse Gas Protocol (GHG Protocol). The latter is reported in accordance with the GHG Protocol. The latter are the so-called supply chain emissions reported under the GHG Protocol. This data was obtained from the Toyo Keizai Shinposha CSR Database, Environment section. However, since this database contains anomalous values, we made the correction described in Ishijima et al. The reduction rate from the previous year to the current year was then obtained for each of the two types of carbon dioxide emissions data over the 72-month period from October 2014 to September 2020. Equation (1) is estimated monthly for each of the two types of CRIFs to obtain monthly time series of the investment returns of the two types of CRIFs. In the following, the two types of CRIFs are referred to as ONTAI-CRIF and SCOPE3-CRIF, respectively.

Results

Figure 1 shows the trajectory of the investment balance for a one-yen investment in ONTAI/SCOPE3-CRIF in September 2014 and its performance over the 72-month follow-up period ending in September 2020. For comparison, we also show the investment performance of nine index funds which are known to be common explanatory variables for corporate stock returns in finance research. The nine index funds are {MKTRF, SMB, HML, MOM, CMA, BAB, LIQ, NET ISSUANCE, IDIO VOL}, as listed in Table 1 of Bolton and Kacperczyk (2021a).

Since the Paris Agreement entered into force in November 2016, ONTAI-CRIF's investment returns have risen sharply. The Paris Agreement was adopted at COP21 (UNFCCC) and sets carbon dioxide reduction targets for countries. Accordingly, the Japanese stock market has recognized the efforts of listed companies to reduce ONTAI carbon dioxide emissions, and ONTAI-CRIF's investment returns are likely to have risen sharply.

Meanwhile, investment returns on SCOPE3-CRIFs have shown a steady increase from the release of the TCFD Final Report in June 2017 to the IPCC 1.5°C Special Report in October 2018. For financial institutions, the carbon dioxide emitted by the companies they finance and invest in falls under SCOPE 3 of the GHG Protocol. Against this background, it is likely that the Japanese stock market

appreciated the efforts of listed companies to reduce their SCOPE3 CO2 emissions after the release of the TCFD Final Report, and investment returns on SCOPE3-CRIFs rose sharply.

The investment performance of ONTAI/SCOPE3-CRIF is analyzed in detail in terms of risk and return. Figure 2 shows the risk and return for ONTAI/SCOPE3-CRIFs and nine index funds over the 72-month period from October 2014 to September 2020. Looking at the returns, we can divide them into three groups: a high-return group with returns of 7%, a low- and medium-return group with returns between 0% and 5%, and a negative-return group.

The market index fund MKTRF, which has benefited from Abenomics since December 2012, belongs to the high-return group, offering good returns (7.14%) with acceptable risk (15.6%). On the other hand, ONTAI/SCOPE3-CRIFs (as represented by ONTCO2 and SC3CO2, respectively) offer better returns (7.79%, 10.65%) with lower risk (11.13%, 12.32%). This can be interpreted to mean that the Japanese stock market values companies that are committed to reducing carbon emissions highly, and that investing in such companies offers a better risk premium than the market as a whole.

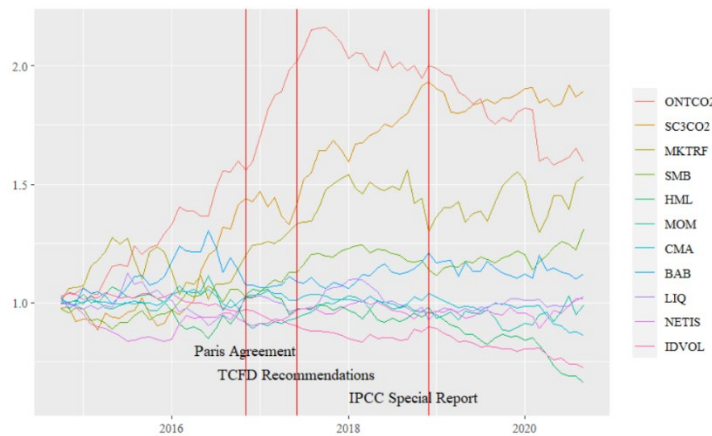


Figure 1.



Figure 2.

Conclusions

In the U.S. and Chinese stock markets, there is a significant carbon risk premium, i.e., companies with high carbon emissions have high stock price returns (Bolton and Kacperczyk, 2021a,b). On the other hand, in the Japanese stock market, companies with high carbon emissions have low stock price returns—a negative carbon risk premium is significant (Ishijima et al., 2021b). Based on the results of these previous studies, we have quantified the percentage increase in the stock price of a company listed on the Japanese stock market if it reduces its carbon dioxide emissions by 1%. This index can also be interpreted as the return of the Carbon Reduction Index Fund (CRIF), an investment fund for companies that reduce carbon emissions. We showed that the CRIF outperformed well-known index funds. In other words, this study showed evidence of a double bottom line effect in the Japanese stock market, meaning that investing in companies that are committed to reducing carbon dioxide emissions in the Japanese stock market produces very good investment performance.

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