Corporate Carbon Efficiency and the Cost of Capital

Arjan Trinks, University of Groningen, The Netherlands, +31(0)50 36 38139, p.j.trinks@rug.nl
Machiel Mulder, University of Groningen, The Netherlands, +31(0)6 3103 5729, machiel.mulder@rug.nl
Bert Scholtens, University of Groningen, The Netherlands, +31(0)50 36 37064, l.j.r.scholtens@rug.nl

Overview

Large-scale investment in low-carbon technologies is crucial to achieve the climate goals of the Paris Agreement. Financial markets play a key role in efficiently allocating capital to low-carbon activities by discriminating the access to and cost of capital. Interestingly, there is growing market interest for corporate disclosure and reduction of carbon emissions (Eccles et al., 2011), mainly stemming from a need to manage perceived financial risks posed by climate change regulation and consumer- and market pressures for carbon emissions reductions (Ansar et al., 2013; Busch and Hoffmann, 2007; Dietz et al., 2016). On the regulatory side, the Financial Stability Board's Climate Disclosure Taskforce (TCFD) has aimed to better inform markets about climate-related financial risks. Some jurisdictions have mandatory climate risk reporting to asset owners. So far, however, the relationship between firm-level carbon emissions and costs of capital has been scarcely studied. As such, much is unknown about the relation between climate change and the financial market capital-allocation function, corporate risk management, and investment management.

This paper investigates whether firms' emissions-reduction practices affect the cost of attracting equity capital (CoE). We hypothesize that the ability of firms to minimize carbon emissions given their production processes impacts their CoE as it determines investor perceptions about financial risks (and opportunities), such as regulatory, litigation, and reputational risks, and competitive opportunities related to the global transition towards low-carbon energy systems (see Trinks et al., 2017 and references therein).

The paper has two parts. First, we introduce a measure of corporate carbon performance, based on a Total Factor Productivity (TFP) framework: *carbon emissions efficiency*. This fills a gap in the literature studying the cost of capital-effects of environmental sustainability ratings (e.g., Chava, 2014; Sharfman and Fernando, 2008) and carbon intensity (e.g., Trinks et al., 2017). By contrast, a multiple criteria-, efficiency-based measure better models firms' performance in terms of their use of inputs to produce a total economic output, i.e. accounting for desirable outputs (sales/contribution to economic growth) as well as undesirable outputs (emissions/contributing to ecological decline) (Dyckhoff and Allen, 2001). By building on production and benchmarking theory (Charnes et al., 1987), we are able to adequately account for differences in production processes (substitution between production factors) and score firms on their actual efforts to minimize emissions given their production activities. Secondly, we apply the measure to test whether carbon efficiency impacts the cost of equity capital (cf. Trinks et al., 2017).

Methods

The paper applies two methods. First, we construct a measure of carbon efficiency of an international sample of about 1500 publicly listed firms in different sectors over the years 2008-2016. Carbon emissions data are obtained from public sources and the CDP survey. We apply Data Envelopment Analysis (DEA) to 1) identify the firm in each sector which best uses its production factors (capital, labor) to generate economic output, desirable (i.e., sales) and undesirable (i.e., carbon emissions), and 2) assign inefficiency scores to firms based on their distance to the sector best-practice. Given the differences in modelling assumptions, we model carbon emissions as a free disposable input (Dyckhoff and Allen, 2001; Yang and Pollitt, 2010) as well as weakly disposable undesirable output (Fare and Grosskopf, 2009). Second, we study the impact of carbon efficiency on the cost of equity capital (CoE) using panel regression techniques. Specifically, we test whether the B_1 coefficient in the following regression is different from 0:

$$CoE_{i,t} = \beta_0 + \beta_1 Carbon\ efficiency_{i,t-1} + \beta_2 X_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

Where X is a set of control variables (Trinks et al., 2017), including year- and country-fixed effects. CoE is estimated using the Capital Asset Pricing Model (CAPM), and is based on different estimation methods (estimation windows, market factors, pricing models, etc.).

Results

We obtain a carbon efficiency measure (score) for an international sample of 1500 firms over the period 2008-2016. Results provide a new indicator of investment objects that maximize societal (economic plus ecological) welfare. Carbon efficiency scores can be used in corporate risk management and investment management to determine exposure to financial risks associated with, i.a., climate change regulation. Furthermore, we show to which extent climate-related risks are priced and affect the cost of equity financing.

Conclusions

We conclude about the effects of firm-level carbon efficiency on the cost of equity financing. If B1 in (Eq. 1) is significantly negative, this would show that improved corporate carbon efficiency would have a capital-cost reducing impact (cf. Trinks et al., 2017). By contrast, a significantly positive effect would indicate that voluntary emissions-reductions would be an inefficient, value-destructing activity (Bhandari and Javakhadze, 2017). The results of this paper have important implications for corporate risk management practice, low-carbon investment, and the need for (additional) regulation of capital markets in the area of climate change.

References

Ansar, A., Caldecott, B., Tilbury, J., 2013. Stranded Assets and the Fossil Fuel Divestment Campaign: What Does Divestment Mean for the Valuation of Fossil Fuel Assets?. Smith School of Enterprise and the Environment, University of Oxford.

Bhandari, A., Javakhadze, D., 2017. Corporate social responsibility and capital allocation efficiency. Journal of Corporate Finance, 43, 354-377.

Busch, T., Hoffmann, V. H., 2007. Emerging carbon constraints for corporate risk management. Ecological Economics, 62(3), 518-528.

Charnes, A., Cooper, W. W., Rhodes, E., 1978. Measuring the efficiency of decision making units. European journal of operational research, 2(6), 429-444.

Chava, S., 2014. Environmental Externalities and Cost of Capital. Management Science, 60(9), 2223-2247.

Dietz, S., Bowen, A., Dixon, C., Gradwell, P., 2016. Climate value at risk of global financial assets. Nature Climate Change, 6(7), 676-679.

Dyckhoff, H., Allen, K., 2001. Measuring ecological efficiency with data envelopment analysis (DEA). European Journal of Operational Research, 132(2), 312-325.

Eccles, R. G., Serafeim, G., Krzus, M. P., 2011. Market interest in nonfinancial information. Journal of Applied Corporate Finance, 23(4), 113-127.

Färe, R., Grosskopf, S., 2009. A comment on weak disposability in nonparametric production analysis. American Journal of Agricultural Economics, 91(2), 535-538.

Sharfman, M. P., Fernando, C. S., 2008. Environmental risk management and the cost of capital. Strategic Management Journal, 29(6), 569-592.

Trinks, A., Ibikunle, G., Mulder, M., Scholtens, B., 2017. Greenhouse Gas Emissions Intensity and the Cost of Capital. SOM Research Reports; No. 17017-EEF. Groningen: University of Groningen, The Netherlands.

Yang, H., Pollitt, M., 2010. The necessity of distinguishing weak and strong disposability among undesirable outputs in DEA: environmental performance of Chinese coal-fired power plants. Energy Policy, 38(8), 4440-4444.