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Valuing the carbon exposure of European utilities. The role of fuel mix, permit allocation and replacement investments

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ABSTRACT

This paper assesses the carbon exposure of European electric utilities covered by the EU Emissions Trading System (EU ETS). First, we rely on an asset pricing model to empirically determine the effect of carbon price risks on firm-specific cost of capital for a sample of 20 European utility stocks during the period 2005–2010. Second, we employ a discounted cash flow framework to simulate carbon-adjusted equity values for three selected utilities and their investment strategies from 2009 to 2020. We show that company-specific carbon risks are asymmetrically distributed to a few utility firms: While for the great majority of power producers carbon price movements are not a relevant risk factor, we find that utilities with an extremely high-emitting fuel mix bear significant risk premiums for carbon which translate to higher cost of capital and a loss of equity value. In contrast, we find no evidence that low-emitting utilities benefit from reduced capital costs. We further reveal that, in addition to the firm's fuel mix, permit allocation rules and replacement investment decisions in terms of fuel technology choice are the driving forces behind the carbon exposure of the utilities. The carbon-related loss of equity value is substantially reduced by implementing an investment strategy directed towards a carbon-free generation mix. The derogations from full permit auctioning in Eastern European member states provide insurance against carbon risks of utilities.

1. Introduction

European electric utilities covered by the EU Emissions Trading System (EU ETS) show significant exposures to carbon risks. The latter mainly materialize as price risk resulting from a company's need to buy carbon dioxide (CO_2) emission allowances as well as from uncertainty surrounding the implementation of the EU ETS (Neuhoff, 2007). The pricing of carbon influences company business strategies, on the one hand, and investor decisions, on the other hand. Utilities adapt their future generation portfolios to the restrictive emission regulations in coming EU ETS trading periods in order to minimize carbon price risk (Blyth et al., 2007). Investors and financial analysts are confronted with difficulties in incorporating carbon risks into utility valuation processes (Busch and Hoffmann, 2007).

In this paper, we introduce a framework to evaluate and quantify the carbon exposure of European electric utilities that result from the EU ETS. We address two questions: Firstly, we determine the firm-specific cost of capital effect of carbon risks. Secondly, we simulate equity values for three selected utilities by explicitly controlling for carbon risks. Ultimately, the approach allows us to compare the carbon-related loss of equity value, which we call equity value at risk from carbon. [1] We then explore three driving forces of utilities' carbon exposure — fuel mix, permit allocation and replacement investments — and quantify their contribution to the loss of firm value. In this respect, to our best knowledge, this paper is the first to provide an empirical analysis of company-specific financial carbon exposures of electric utilities.

The valuation of energy stocks has spurred extensive research and still is the subject of controversy in the academic literature. Much recent effort has been made to develop multifactor asset pricing models that relate share price exposure to various risk factors. For instance, Sadorsky (2001) and Boyer and Filion (2007) show that crude oil and natural gas prices, among other factors, constitute significant sources of risk for energy stocks. The paucity of research on the exposure of electric utility stocks to emission allowance prices in the EU ETS is hardly understandable given this background of controversial evidence coupled with the fact that the power sector represents the most important EU ETS sector. The EU ETS is a compliance market, which means that each covered installation from CO_2-intensive industrial sectors each year must surrender a certain number of so-called European Union Allowances (EUAs) equal to its verified emissions. Several studies

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[1] It is important to note that this notion has no relation to the well known Value at Risk (VaR) concept.

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underline that electric utilities are forced to include the cost of EUAs in their operative decisions for existing power plants and their investment decisions (e.g. Delarue et al., 2008; Yang et al., 2008). Consequently, the price of carbon is likely to be an additional source of risk for utility stock returns which may increase firms' cost of capital with a material impact on firm value.

Empirical evidence on the potential carbon exposure of utilities resulting from the EU ETS is, in contrast, limited. To our best knowledge, only Oberndorfer (2009a) and Veith et al. (2009) provide an initial econometric analysis on the financial impact of carbon risks. They examine the effect of carbon price movements on stock market returns of utilities throughout the EU ETS trading period 2005–2007 (Phase I) within an equal-weighted portfolio and a pooled panel data framework. While these studies suggest that EUA price developments matter for the stock performance of utility portfolios, they do not look at the individual economic effects for firms within the European utility industry. Also, due to the necessarily short sample period 2005–2007 and given that the goal of the so-called trial period was to implement the scheme, rather than to achieve much abatement (Ellerman and Joskow, 2008), the early ex-post evaluations are obviously limited. In contrast, we conduct a firm-level analysis and shed new light on the link between the individual utility carbon exposure and the composition of utility firms' fuel mix. In this respect, we expand existing research by conducting an empirical analysis for individual firms. Furthermore, we draw on an extended sample period (2005–2010) covering the trial period and, for the first time, the second commitment period of the EU ETS.

In a nutshell, we conduct a company valuation based on a traditional discounted cash flow (DCF) framework, which is characterized by two distinctive features. First, using an asset pricing model to adjust the corresponding cost of capital, we estimate the company-specific carbon risk premiums for utilities, that is the incremental return that shareholders require to hold a risky, carbon-intensive utility stock rather than a risk-free security.

Second, we model the firm-specific power plant infrastructure as well as investment strategy of three European utilities using data from Platts and EU's Community Independent Transaction Log (CITL). The modeling approach sets out to provide insights into the extent to which equity value is dependent on power plant technology, permit allocation and investment strategy. This endeavor is motivated by the fact that the European power plant park is rather old, thereby requiring significant replacement investments in the near future (Kjärstad and Johnsson, 2007). Also, from the year 2013, most power companies have to buy all their emission allowances at an auction, bringing the phase of free allocation to an end (EU, 2009). In view of the emerging changes, we expect that the investment strategy of utility firms in terms of fuel technology choice is an essential driver of equity value at risk from carbon. Therefore, we simulate equity values for two distinct investment scenarios: In the first — fuel-by-fuel — scenario each retiring plant is replaced by a plant with the same fuel technology. In the second — vision — scenario the replacement decision is determined by the communicated target fuel mix of each utility. A comparison of simulated equity values allows us to evaluate the success of utilities in minimizing carbon risks by adapting their future generation portfolios.

We restrict the DCF analysis to the plant-specific data for a subsample of three utilities, namely, RWE, CEZ and Iberdrola (including 67 fossil/nuclear plants and 392 renewable plants). We select these utilities because various characteristics suggest that their equity carbon exposure could diverge significantly. First, the current fuel mixes differ considerably. While the power plant park of the German utility firm RWE and its Czech competitor CEZ is dominated by carbon-intensive coal-fired plants (41% and 60%), in contrast, their Spanish counterpart Iberdrola operates a low-carbon plant portfolio that is dominated by renewable technologies (55%). Second, all utilities face major replacement investment needs but large differences exist in the targeted fuel mixes for 2020. Iberdrola commits itself to an active strategy towards a carbon-free fuel mix, whereas RWE and, to a lesser extent, CEZ still intend to build on a certain share of coal-fired plants (36% and 22%). Third, notable differences in the allocation rules for allowances justify the choice. CEZ currently benefits from a free EUA allocation and stands to particularly profit from exemptions for full auctioning in the coming EU ETS trading Phase III (i.e., 2013 to 2020) (CEZ, 2009:23), since the auctioning rate for existing power plants in Eastern European countries can be 30% and will only progressively rise to 100%. In contrast, RWE and Iberdrola will be obligated to buy 100% of their needed emission allowances from 2013 on. Thus, using the DCF framework, the selected subsample is particularly suitable for quantifying the contribution to the equity value at risk from carbon triggered by differences in (i) the carbon-adjusted cost of capital, (ii) the investment strategy and (iii) the allocation procedure.

The most important findings of the analysis are as follows: First, we find that company specific carbon risks are asymmetrically distributed to a few utility firms, while for the great majority of European utilities carbon price movements are not a relevant additional risk factor. The insignificance of carbon risks might be explained by the ability of generators to pass through carbon prices into electricity prices, which compensates compliance costs and averts adverse effect for the utility firm. Second, our results suggest, however, that extremely high-emitting utilities bear carbon risk premiums and higher cost of capital, whereas low-emitting power producers seem not to benefit from a carbon risk discount. Finally, we document that the higher costs of capital translate to a carbon-related loss of equity value of about 4-6% for the sample of high-emitting utilities at hand. We further reveal that firm investment strategy and the degree of allowance auctioning substantially determine firm fair value. The bottom line is that the equity value at risk from carbon is significantly reduced by an active strategy directed towards a carbon-free generation mix.

The remainder of this paper is structured as follows. Section 2 presents the three main hypotheses tested in the paper. In Section 3, we introduce our valuation approach and provide our empirical results. Section 4 concludes.

2. Hypothesis development

Our first two hypotheses pertain to the link between carbon risks and utility firms' cost of capital. If carbon prices are a systematic risk factor for European utility corporations, on the one hand, investors should require a carbon price risk premium; on the other hand, from a valuation perspective, the additional carbon premium should raise the equity cost of capital for utilities.

Prior research suggests that the price of carbon is an additional source of risk for European utilities. Borak et al. (2006) and Benz and Trück (2009) argue that emission allowances constitute an input factor in the production process that generates additional costs for companies in the EU ETS. In the same vein, Reinaud (2003) shows that the introduction of emission allowances alters operating costs in the power generation sector, and influences the operation of existing generating capacity (Delarue et al., 2008) as well as the composition of future investment (Hoffmann, 2007). Yang et al. (2008) and Blyth et al. (2007) reveal that also long-term investment decisions are exposed to carbon price risk and policy uncertainty. In theory, the additional cost due to carbon pricing exists whether the allowances were grandfathered (by accounting the opportunity cost) or auctioned (by purchasing allowances). Indeed, according to the CITL, power companies are short of permits and, consequently, high compliance costs, i.e. internal abatement costs plus allowance costs, may arise for under-allocated utilities. The gap between EUAs allocated and required to cover existing emissions was approximately 7% over the period 2005–2010; the net shortage is even more pronounced in Phase II with 12% compared to 1.4% in Phase I.

In contrast, other studies in this research area argue that the price of carbon has no adverse effects for utility firms. Sijm et al. (2005, 2006) show that electricity generators can effectively pass on a large share of