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Investment under uncertain climate policy: A practitioners' perspective on carbon risk

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HIGHLIGHTS

- A new model of carbon risk that incorporates payment probability is presented.
- A survey of 700 U.S. energy professionals conducted in 2006 provides data on beliefs about future climate policy.
- The vast majority of respondents expected climate policy to be enacted, but also expected it to be lax.
- This data is used to analyze investor attitudes toward carbon risk.

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ABSTRACT

This paper introduces the concept of *payment probability* as an important component of carbon risk (the financial risk associated with CO_2 emissions under uncertain climate policy). In modeling power plant investment decisions, most existing literature uses the expected carbon *price* (e.g., the price of traded permits or carbon tax) as a proxy for carbon risk. In contrast, this paper identifies expected carbon *payment* as a more accurate measure of carbon risk as perceived by industry practitioners. This measure of carbon risk incorporates both expected price and the probability that this price would actually be faced in the case of a particular investment. This concept helps explain both the surge of activity in 2005–2006 and the subsequent decline in interest in coal-fired power plant development in the U.S. The data for this case study comes from an extensive online survey of 700 U.S. energy professionals completed in 2006, as well as interviews conducted with industry representatives from 2007 to 2009. By analyzing industry views on policy uncertainty and future carbon legislation, we gain a better understanding of investor attitudes toward carbon risk. This understanding will help policy makers design better incentives for investing in low-carbon technologies.

1. Introduction

With the outcome of future international climate negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) unclear and with varying levels of commitment by individual member states to implement their own policy measures that combat climate change, there is significant uncertainty, both internationally and at the level of individual nations, about future legislation on greenhouse gas emissions. In the U.S., ever since the failure of the Senate to pass a cap-and-trade bill during the 2009–2010 legislative season, followed by the loss of a Democratic majority in the House of Representatives, prospects for the adoption of federal climate change policy have been dismal. However, even though climate change is not front-and-center in the current national energy debate, it is bound to return at some point. Meanwhile, initiatives to address climate change are gaining momentum at the local, state, and regional levels. When and where the debate returns, it will be useful to have learned what we can from the past.

This research examines the perspectives of industry practitioners on this debate.

Among the many post-mortems on the cap-and-trade effort, Skocpol (2013) stands out as a particularly in-depth empirical analysis. Pooley (2010), in his book, *The Climate War*, provides a detailed account of the policy debate as it was happening. Both these accounts, which focus on the political landscape and political battles, are worthy of close examination by policy makers and climate change campaigners.

While the policy literature has focused on political actors, the investment decision-making literature (e.g., Sekar et al., 2007; Bergerson and Lave, 2007; Patino-Echeverri et al., 2007, 2009; Reinelt and Keith, 2007; Blyth et al., 2007; Fuss et al., 2008; Szolgayova et al., 2008; Hoffmann and Szklo, 2011; İşlegen and

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Reichelstein, 2011; Cristóbal et al., 2012; Brauneis et al., 2013) has generally sought to model investment decisions mathematically based on various assumptions and scenarios.

Missing in both the policy literature and the investment decision-making literature in the area of climate change legislation has been analysis of investors' views on policy. This research addresses that omission.

For energy sector investors, the term *carbon risk* refers to the financial risk associated with uncertainty about future carbon policy (any climate change legislation which imposes a cost on CO_2 emissions). Any new investment in fossil fuels, or in assets that burn fossil fuels and therefore emit CO_2, is subject to carbon risk. A common way to incorporate the notion of carbon risk into investment decision-making is to include a cost of carbon in the budget analysis (Bokenkamp et al., 2005). The usual proxy for cost in the investment decision-making literature is carbon *price*: either the price of traded permits or the level of a carbon tax, depending on the type of policy. The notion of uncertainty (hence risk) is incorporated by using *expected* price (the probability-weighted average of various scenarios, often comparing policy proposals).

This paper takes a different approach from that typically reflected in the literature – survey research instead of scenario-based modeling – and results in a different proxy for the cost of carbon: expected *payment*, instead of expected *price*.

In order to investigate investor attitudes toward carbon risk, this paper first examines the 2005–2008 reemergence of coal plant development in the U.S. electricity sector. One advantage of looking at historical data is that it gives a clearer picture of what investors were really thinking at the time – free from a biased look-back perspective.

The rest of this paper is organized as follows. Section 2 describes the historical case study investigated empirically through qualitative interviews followed by a broad-based, quantitative survey. Section 3 describes the survey results. Section 4 uses the survey results to introduce a new proxy for carbon cost (and hence carbon risk): expected carbon payment. This section describes how expected payment is different from expected price, the usual benchmark found in the carbon risk literature, and includes a review of this literature. Section 4 also relates the relevance of carbon risk to recent developments in the energy landscape. Section 5 summarizes the conclusions of this paper in light of their contribution to both policy design and the investment decision-making literature.

2. Material and methods

2.1. Case study: the resurgence of coal in the mid-2000s

Power plants are capital-intensive with high upfront costs, but relatively low marginal costs, so cost amortization requires that plants be built with the intention to operate over the full 30–40 year lifetime of the power plant. This represents a significant investment environmentally as well as economically, since lifetime emissions are essentially locked in at the time of plant construction. Among investments in the electric power sector, coal-fired power plants are particularly sensitive to carbon risk, since coal is a very carbon-intensive fossil fuel (emitting twice as much CO_2 as natural gas per kilowatthour of electricity generated). CO_2 emissions for a typical coal plant will be 1.2 million tC per year or 47 million tC over the plant lifetime.[1]

During most of its history, coal-related development proceeded based on economic considerations, without respect to carbon risk. From the 1950s until the 1990s, coal dominated power plant construction in the U.S. (except for the brief heyday of nuclear power in the late 1970s and early 1980s). In the 1990s, natural gas overtook coal as the fuel of choice for new power plants, and by the early 2000s coal plant construction had ground to a near halt. Then natural gas prices, which had remained low for well over a decade, began to increase substantially, leading in 2004–2005 to a resurgence of interest in building coal-fired power plants.

Plans for most of these coal plants relied on pulverized coal technology, which is not well suited to carbon capture, thereby precluding low-cost options for retrofitting later. Significantly, enthusiasm for coal plant development continued unabated during 2006 and much of 2007, even as the debate over climate change heated up and legislation began to look more likely – apparently reflecting little concern over the notion of carbon risk.

Typical of this mindset was the enthusiasm demonstrated by developers, utility representatives, and bankers, who came together at an industry conference in June 2005 to discuss prospects for new coal plant development. Presentations did not address carbon policy, and the notion of carbon risk was never raised in discussions.

This led to the initial research question: Why build new coal plants that are not CO_2-capture friendly if carbon policy is possible, indeed (increasingly) probable in the foreseeable future?

To explore the possible reasons, several of the conference participants were asked about the prospect of carbon policy and how that might impact planned investments in coal plants. A few were climate change skeptics who apparently gave no further thought to carbon risk, but most had thought-out reasons for not considering it a significant issue: either they expected existing coal plants to be grandfathered (i.e. exemption for existing plants, with sufficient time remaining for current investments to be included under “existing”); or they assumed that any costs would be treated like most other “unforeseen” fees, taxes, and fuel price increases: as pass-throughs to the ratepayer. A common perspective was the “too big to fail” argument. Coal currently fuels half of U.S. electricity. “You can't just tax everybody – that would cause the entire economy to falter, and no government is going to do that.”

This led to my hypothesis: Industry practitioners in 2005 and 2006 saw many possibilities for investors to avoid paying for the CO_2 emissions associated with new plants they were developing. To test this hypothesis and see if these perspectives were more broadly typical, I designed a survey. All survey questions underwent extensive testing before the survey was launched.

2.2. Survey methods

This survey was conducted online from May to August 2006. An email invitation went to approximately ten thousand[2] individuals who had attended various power sector conferences during the previous year or who were members of various industry associations. About 700 individuals completed the survey, representing an overall response rate of 8%. All questions were voluntary, and most questions were closed-ended (multiple choice). Responses were collected anonymously in order to encourage respondents to be open and honest with their answers. Table 1 provides a profile of the respondents.

In one section of the extensive survey, respondents were asked a series of questions on their beliefs about prospective carbon policy in the U.S. electricity sector, including: (1) whether and when they think carbon policy will eventually be adopted;

[1] Based on carbon intensity of 270 gC/kWh and a 1000 MW power plant operating at 50% capacity factor for 40 years.

[2] 10,003 emails were sent, of which 1303 were undeliverable, resulting in 8700 emails which “arrived” (at least were not returned as undeliverable).