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Linking pollution toxicity and human exposure to firm idiosyncratic risk

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ABSTRACT

Despite significant academic literature examining the link between pollution and firm performance, the firm risk implications of releasing pollution where humans face exposure has received very little attention from the academic community. In this study we use information processing theory to examine the impact of not only the toxicity level of a firm's emissions, but also the extent of human exposure to those emissions. We consider the extent to which both pollution performance and the pollution dispersion pathway influence idiosyncratic risk for U.S. firms. Our findings suggest that the quantity of pollution alone has no direct impact on a firm's idiosyncratic risk, but that the type of pollution and its degree of human exposure, which we term 'environmental risk', highly influences idiosyncratic risk. Moderators of the relationship between environmental risk and idiosyncratic risk are also examined and discussed.

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1. Introduction

Companies are increasingly concerned with the impact of environmental issues or disasters on their financial performance. To give just three recent examples, consider the BP oil spill in 2010 that led to substantial volatility in the company's stock (Fodor and Stowe, 2012), the West Virginia chemical spill in 2014 that led to bankruptcy (Larson, 2014), and the Volkswagen emissions scandal that has thus far caused reduced stock prices and increased stock volatility (Boston, 2015). While the occurrence of such environmental disasters and scandals can clearly cause financial uncertainty, exposure to the risk of adverse environmental outcomes is also a concern for many companies. In this paper we consider that such risk can exist whether or not a specific disaster has occurred, and that the severity of the risk is related to the toxicity and human exposure of the byproducts of production, i.e. the firm's emissions. Indeed, authors have suggested that environmental concerns may cause volatility in cash flows, thereby creating a need for managing firm environmental impacts as a business risk (Reinhardt, 1999). Financial markets characterize the uncertainty of future cash flows

that can be attributed to firm-specific factors as 'idiosyncratic risk' (as opposed to market-related, or 'systematic risk'). Idiosyncratic risk and uncertain cash flows have been linked to both higher costs of capital financing and lower long-term valuations of the firm (Goyal and Santa-Clara, 2003; Luo and Bhattacharya, 2009; Merton, 1974).

As an illustration of the dynamics investigated in this paper, consider a firm that operates a heavily polluting facility. Although the risks arising from this pollution are difficult to measure, one might suggest that, in general, the future cash flows of this firm are more uncertain than those of a similar company that pollutes less. A firm's uncertainty surrounding future outcomes of environmental issues could include legal liabilities, regulatory compliance costs, consumer boycotts, or even disruptions to ongoing operations. Furthermore, one might imagine that if this company also pollutes in a highly populated area, the resulting human exposure to the pollution would exacerbate the risk faced by this firm.

To capture the context described in the example above, we first consider pollution in terms of a simple toxicity-weighted measure of emissions, which captures the cleanliness of the production process. Next, we consider a measure that includes not only emissions and toxicity, but also location-related considerations such as mode of dispersion and the population density of the impacted area. This second measure, which more directly captures the human side of

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emissions (their impact on the local population), is termed environmental risk.

This study provides unique and important insights by empirically investigating the extent to which firm financial risk is impacted by the firm's environmental risk that results from pollution-related process and location decisions. The existence (or non-existence) of such a link has important implications, as it can help managers better understand the relationship between pollution their emissions and the marketplace's assessment of uncertainty in future firm cash flows.

The rest of this paper is organized as follows. In Section 2 we review the literature relevant to this study and clearly define our dependent variable, idiosyncratic risk. Section 3 presents our main hypotheses while Section 4 presents hypothesized moderating effects. Section 5 provides a discussion of our data and the methodology used for analysis. Next, in Section 6 we present the results from our hypothesis testing. We conclude the study with a discussion of our findings and their managerial implications in Section 7.

2. Related literature

Several papers have linked Corporate Social Responsibility (CSR) activities to lower levels of idiosyncratic risk (Luo and Bhattacharya, 2009; Jo and Na, 2012; Mishra and Modi, 2013; Mason and Simmons, 2014). This paper complements these studies by drilling down to focus solely on the environmental performance dimension of CSR. In the following sub-sections, we review the two major literature bases related to environmental performance and firm idiosyncratic risk.

2.1. Linking environmental and financial performance

Numerous studies have examined the financial implications of improved environmental performance. We discuss several key papers below, referring the reader to Kroes et al. (2012) for a more extensive review of the body of work in this area. Better environmental performance, as measured by quantity of pollution emissions weighted by toxicity, has been found to be positively associated with financial outcomes such as return on sales (Hart and Ahuja, 1996), Tobin's q (King and Lenox, 2001a), or return on assets (Hart and Ahuja, 1996; Russo and Fouts, 1997). Klassen and McLaughlin (1996) find, using an event study approach, that environmental awards [crises] are related to positive [negative] changes in the stock returns of the firm. Sharfman and Fernando (2008) find a link between environmental management initiatives (but not actual environmental outcomes) and the firm's cost of capital. Additionally, the application of Lean Manufacturing techniques have been widely applied to sustainability efforts in what has been deemed 'Lean is Green.' While several studies have found that Lean production methods have a positive direct or indirect impact on environmental performance measures (Chiarini, 2014; Hajmohammad et al., 2013; King and Lenox, 2001b). Furthermore, Lean production methods have been associated with improved financial or cost measures (King and Lenox, 2001a; Mackelprang and Nair, 2010) or shown to have no impact to financial performance (Zhu and Sarkis, 2004). The current study complements and extends these studies by specifically examining the link between environmental performance and the uncertainty of future firm cash flows, as captured by an objective market-based measure of idiosyncratic risk.

2.2. Idiosyncratic risk

Overall firm financial risk can be decomposed into two portions: systematic risk and unsystematic, or idiosyncratic, risk. Systematic risk is the variability in a firm's stock price due to the overall market returns, while idiosyncratic risk is the residual variability that is not explained by overall market movement (Ang et al., 2006; Campbell et al., 2001). Thus, idiosyncratic risk is considered the variability in a firm's stock price that is firm-specific and uncorrelated with market returns. Idiosyncratic risk has been found to account for over 80% of total financial risk in some cases (Goyal and Santa-Clara, 2003). In general, a higher level of firm financial risk suggests greater uncertainty in future cash flows for the firm (Brown and Kapadia, 2007). This can create a challenging environment in which to plan future operations, capital expenditures, and capital budgeting. Increased uncertainty in future cash flows also implies a potential for higher debt financing costs and lower firm valuation, which would increase the costs associated with equity financing (Brown and Kapadia, 2007; Luo and Bhattacharya, 2009).

Idiosyncratic risk is of particular interest to managers since it is the component of financial risk that can be affected by firm actions rather than overall market conditions (Brown and Kapadia, 2007). Investors also recognize the importance of idiosyncratic risk, and this is reflected in the stock price performance of publicly traded firms in financial markets – portfolios with higher levels of idiosyncratic risk experience lower returns than portfolios with lower levels of idiosyncratic risk (Ang et al., 2006). Clearly, investors and managers alike value increased certainty regarding the availability of future cash flows.

The link between strategic firm decisions and idiosyncratic risk has been studied in several related contexts. Luo and Bhattacharya (2009) examine the link between corporate social responsibility (CSR) and idiosyncratic risk, finding that increased CSR activity lowers idiosyncratic risk and creates an 'insurance-like' protection for the firm. More recently, Jo and Na (2012) and Mason and Simmons (2014) suggest that CSR can lead to lower levels of firm risk. Ortas et al. (2013) found that socially responsible investment had similar, but less-risky returns for investors. While Bansal and Clelland (2004) find that higher levels of environmental legitimacy are associated with lower levels of idiosyncratic risk. However, despite all of the evidence that CSR leads to lower risk levels, Menz (2010) finds no evidence that CSR firms gain any benefit in the corporate bond market, suggesting that these markets do not effectively view these firms as possessing lower risk. Our study builds on these studies by specifically looking at the impact of pollution emissions and dispersion pathways related to human exposure and idiosyncratic risk. As such, we offer a more specific evaluation of firm environmental-related risk than more broadly defined CSR studies.

3. Hypothesis development – main effects

From a theoretical perspective, CSR researchers have often suggested that positive and negative impacts of CSR can be linked to a juxtaposition between neo-classical economics and stakeholder theory (Mishra and Modi, 2013). Neo-classical economists suggest that CSR activities do not inherently align with maximizing shareholder wealth (Friedman, 1970). On the other hand, stakeholder theory suggests that firms that fail (succeed) to effectively manage the interest of all of their stakeholders (customers, suppliers, employees, community) may be subject to negative (positive) performance implications as stakeholders disengage or even become adversarial with the firm (Freeman, 1984).

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