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## Risk and benefits in a fracking boom: Evidence from Colorado



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## ABSTRACT

Unconventional oil and gas technology such as hydraulic fracturing (“fracking”) has created a boom in production in the United States. In this paper we add to the growing literature on public perceptions of risk and benefits related to fracking using data from Colorado. We find that trust in the oil and gas industry is powerful predictor of a range of risk and benefit perceptions while other ostensibly important variables—such as the extent of local drilling or the perceived economic significance of the oil and gas industry—have little role in risk and benefit perceptions. The effect of trust is robust across several different types of risk and benefits perceptions and survives the inclusion of an array of control variables. Moving forward, we suggest researchers work to understand the factors which create public trust in the oil and gas industry.

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## 1. Introduction

Hydraulic fracturing (“fracking”) is increasingly coupled with horizontal drilling as a means to extract oil and gas from “tight” shale formations located in previously unreachable underground deposits. The deployment of these technologies has ushered in a new era of onshore, unconventional oil and gas production in the U. S. (Krupnick et al., 2014; Yergin, 2011). By providing an abundant source of readily available natural gas fracking can reduce the overall carbon footprint of the U.S. economy while simultaneously providing jobs and tax revenue to economically marginalized parts of the country (Sovacool, 2014; Munasib and Rickman, 2015; Newell and Raimi, 2015; Lee, 2015). On the other hand, the rapid spread of fracking has also been associated with adverse environmental impacts, negative effects on public health, and strains on public infrastructure (Finkel and Law, 2011; Colborn et al., 2011; Hill, 2014; Holzman, 2011; Graham et al., 2015). States and local governments are still struggling to foment a policy regime for unconventional oil and gas extraction (Rabe, 2014; Warner and Shapiro, 2013; Davis, 2014; Fisk, 2013; Ziogiannis et al., 2016). Thus, it is imperative for social scientists to understand public perceptions of risks and benefits regarding

fracking<sup>1</sup> to inform better policy-making and risk governance strategies.

The purpose of this paper is to understand the complex array of risk and benefit perceptions held by the general public using data from state-wide survey of Colorado residents. Colorado is at the epicenter of the fracking boom with roughly 55,000 active oil and gas wells (COGCC, 2015) yet researchers have given it much less attention than other areas. Pennsylvania, for instance, has been the focus of much social science literature (e.g. Malin, 2013; Malin Stephanie and DeMaster, 2016; Jacquet and Stedman, 2013; Jacquet, 2012; Brasier et al., 2013) while others have national survey data (e.g. Boudet et al., 2013; Davis and Fisk, 2014; Clarke et al., 2015). In this paper we argue that variables like unwanted proximity, trust in regulators and the oil and gas industry, and the perceived importance of the oil and gas industry are important predictors of risk and benefit perceptions. Typically, prior research has aggregated risk and benefit perceptions into additive scales (e.g. Jacquet, 2012; Schafft et al., 2013); here we consider risk and benefit perceptions individually to reveal overlooked nuances into the contribution of different predictors of risk and benefit

<sup>1</sup> The term “fracking” is used throughout this paper to refer to the entire process of unconventional oil and gas development from exploration to drilling to the storage of waste and by-products. While fracking is technically only used for a short time to stimulate an oil or gas well it has become a catch-all term in the public mind for the entire process of unconventional, onshore oil and gas development. We also ask that the reader bear in mind that, as of the writing of this article, onshore oil and gas production in the United States is in decline and the fracking boom may be nearing an end.

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perceptions. In the next section we review the relevant social science literature on fracking, risk and benefit perceptions, and trust.<sup>2</sup>

## 2. Literature review

### 2.1. Public views on fracking risks and benefits

Nationally, a large portion of the public is unaware of or has little information about fracking (Boudet et al., 2013; Clarke et al., 2015). Populations that are more familiar with the issue perceive a number of risks and benefits related to the fracking boom. Many note economic benefits like jobs, increased tax revenue, and improved public services (Theodori, 2009; Silva and Crowe, 2015; Ceresola and Crowe, 2015; Willow, 2015; Jacquet and Stedman, 2013; Jacquet, 2012; Brasier et al., 2013) though these benefit perceptions are far from uniform. Theodori (2009) found inconsistent perceptions of local natural gas development; some informants pointed to economic benefits and others suggested that these benefits are minimal. These findings are echoed in two related studies by Schafft et al. (2013) and Schafft et al. (2014) who reported that many school administrators in the Marcellus Shale region point to economic gains from local drilling while others view the direct economic benefits as rather small and transitory. Residents of areas experiencing intense drilling perceive positive multiplier effects for their local economy, such as increased sales at restaurants, alongside negative economic effects like inflated wages and rents (Schafft et al., 2014; Brasier et al., 2013). Some view the economic windfall of fracking as short-lived while others feel that it will be a motor for long-term economic revitalization (Larson et al., 2014). Other research has shown that fracking is often viewed as environmentally beneficial because it burns cheaper than coal (Ladd, 2013).

In addition to opportunities fracking is often simultaneously perceived as a threat on a number of fronts. The classic “boomtown” literature documents adverse social impacts, such as increased crime or strain on infrastructure, resulting from rapid natural resource development (Kohrs 1974; Cortese and Jones, 1977; Albrecht, 1980). Though foundational, this literature suffers from a range of methodological problems (Wilkinson et al., 1984) and Jacquet and Kay (2014) argued that the model presented in the boomtown literature is not fully applicable to the case of hydraulic fracturing. Still, residents of areas experiencing rapid deployment of fracking raise concerns about crime and other unwelcome social changes (Theodori, 2009; Israel et al., 2015). But perhaps the most significant potential risk of fracking is its environmental impacts. These may relate to nuisances like noise, traffic and dust (Jacquet, 2012; Stedman et al., 2013; Willow, 2015) to more grave problems like water contamination or air pollution (Theodori, 2009; Ladd, 2013; Jacquet and Stedman, 2013; Brasier et al., 2013). Public health concerns are also routinely mentioned (Kriesky et al., 2012; Poole and Hudgins, 2014; Jalbert et al., 2014).

As Ladd (2014) noted, public perceptions of fracking are a paradox, or perhaps a double-edge sword (Ladd (2014), p. 296). Residents of communities impacted by fracking welcome potential economic gains in the form of job or tax revenue yet also express concerns about health, the environment and strains on local infrastructure. To varying degrees public perception is corroborated by empirical analyses. For instance, it is likely that fracking does pose some degree of threat to public health (Hill, 2014; Rabinowitz

et al., 2015; Colburn et al., 2011; Kassotis et al., 2014; Kassotis et al., 2016) and the environment (Paulik et al., 2015; Holzman, 2011; Rozell and Reaven, 2012; Ferrar et al., 2013; Howarth et al., 2011) and causes traffic problems (Graham et al., 2015). Alternatively, there is evidence of job growth (Weber, 2012; Munasib and Rickman, 2015; Hastings et al., 2015) and a boost in tax revenue (Newell and Raimi, 2015; Kelsey et al., 2012). The next section describes that factors that drive risk perception.

### 2.2. What causes risk perception?

The literature cited in the last section indicates that, to some degree, public risk and benefit perceptions track the actual risks and benefits generated by the rapid expansion of hydraulic fracturing. Among risk scholars there is a consensus that risk perception is “socially constructed” but there is still some controversy about how much risk perceptions are socially constructed versus the result of real, actual experience with risk. In this regard, Lupton (1999a) explained that risk theory is gradational—some theorists present risks as purely socially constructed while others adopt a more realist perspective in which actual environmental conditions interact with social forces to create risk perceptions. Further, individual risk theorists often drift between a more constructionist and a more realist approach (Lupton, 1999b).

Numerous survey-based studies have connected actual exposure to risk, typically measured as a contextual level variable, to different types of risk perception. These studies have produced extremely mixed results. Zahran et al. (2006) and Brody et al. (2008) found that proximity to a coast has a small *negative* effect on climate change risk perception while Park and Vedlitz (2013) detected no effect. Some studies show that climate change risk perceptions are increased by temperature anomalies (Egan and Mullin, 2012; Hamilton and Keim, 2009; Hamilton and Stampone, 2013; Shao et al., 2014; Zahran et al., 2006; Brooks et al., 2014; Cutler, 2015) while others observed the opposite (Brody et al., 2008; Goebbert et al., 2012; Shum, 2012; Marquart-Pyatt et al., 2014). Perceptions of air quality do not appear to be impacted by actual air quality (Brody et al., 2004; Kirkby, 1981; Dworkin and Pijawka, 1982; Bickerstaff and Walker, 2002). Conversely, Howel et al. (2002) found that pollution-related risk perceptions were higher for individuals who live in close proximity to industrial facilities. Both Marquart-Pyatt et al. (2014) and McCright et al. (2013) pointed out that some of the research on the risk exposure-risk perception interface has not included adequate individual-level controls for known predictors of risk perception, such as political ideology. Overall, the literature on the interface between risk perception and proximity to risk suggests that exposure to actual risk does not consistently impact risk perceptions.

More specific to fracking, Budgen (2014) used nationally representative survey data to show that respondents who lived in a shale play were more supportive of fracking while Boudet et al. (2016) report that local employment in mining is positively associated with fracking support. Schafft et al. (2013) find that, among school administrators in the Marcellus Shale, perceptions of both risks and benefits rise with the proximity of local drilling. Kriesky et al. (2012) compared two Pennsylvania counties—one with very little drilling and another with a great deal of drilling—and observed only small differences in support for fracking between the two areas. Hence, proximity to fracking may be positively associated with both risk and benefit perceptions.

Case study research points to the specific mechanisms by which exposure to a risk become socially constructed into risk perceptions. In particular, media and local leaders can frame an objective risk as more or less harmful, potentially heightening or attenuating risk perceptions (Kasperson et al., 1988; Renn, 1992;

<sup>2</sup> For general reviews on the social, environmental economic and health dimensions of onshore, unconventional oil and gas development we recommend Short et al. (2015), Jacquet (2014), Jacquet and Stedman (2014), Jackson et al. (2014), Kinnaman (2011) and Lave and Lutz (2014).

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