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Will additional federal enforcement improve the performance of pipelines in the U.S.?

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ABSTRACT

This paper provides the first empirical analysis of the effectiveness of regulatory enforcement in increasing the environmental and safety performance of U.S. natural gas and hazardous liquid pipeline operators. The analysis combines data on federal regulatory inspections, enforcement actions, and penalties with data on injuries, fatalities, property damage, and barrels of product lost through pipeline "incidents" for 2006–2011 for the 344 largest pipeline operators in the U.S. The results of the analysis do not provide compelling evidence that either federal inspections or civil penalties are particularly effective in increasing performance; however, the number of federal cases initiated against an operator does have a significant effect on many forms of performance, although not for incidents in general. The results also suggest that some targeting of federal enforcement resources is based on past performance, but there may be room for even more effective targeting. Finally, the analysis reveals interesting patterns between state and federal enforcement efforts.

1. Introduction

Over the past several years, the role that oil and natural gas pipelines might play in increasing the U.S.'s energy independence has gained significant attention. In particular, TransCanada's proposed Keystone XL Pipeline has been the subject of heated debate between those that believe the project is a critical part of the U.S.'s energy security strategy and will have a positive effect on the country's economy and those that believe the project imposes unacceptable risks for the natural environment including devastating sensitive environments and polluting important water sources. A number of relatively recent events have reinforced the arguments that pipelines pose serious threats to human health and the environment: in September of 2010 a natural gas pipeline explosion in San Bruno, California resulted in a massive fire that killed eight people, injured dozens of others, and destroyed over 100 homes and in July of 2011 an Exxon Mobil pipeline rupture spilled over 1000 barrels of oil into the scenic Yellowstone River.

In late 2011, the U.S. Congress approved and President Obama signed the Pipeline Safety, Regulatory Certainty, and Job Creation Act to improve the performance of pipelines. The act was passed during the 112th Congress, one of the least productive – if not the least productive – legislative session in recent history (Terkel, 2012). The act drew unanimous support from both parties in part because of public outcry over the San Bruno explosion and the Yellowstone River spill. However, the act was a compromise and did not include all of the recommended policy changes that were proposed by the National Transportation Safety Board for increasing pipeline safety (Frosch, 2011). The main provisions of the act are an increase in funding for federal inspections of pipelines (the "Job Creation" part of the act) as well as an increase in the fines associated with violations of pipeline regulations. In accordance with the act, the administration's 2013 fiscal year budget increased funding for the Pipeline and Hazardous Safety Materials Administration by 60 percent and added 120 new federal inspectors.

While numerous studies have assessed the effectiveness of federal enforcement in improving compliance with general environmental regulations, to my knowledge there has never been a systematic evaluation of the effect of federal enforcement efforts on pipeline performance. Thus it is not clear whether the Pipeline Safety, Regulatory Certainty, and Job Creation Act will actually accomplish its stated goal of increasing pipeline performance. In particular, because the act was prompted by public pressure to do something about pipeline performance, as Peter (1991) points out, the compromise solution may not fully address the underlying regulatory failure. The goal of this paper is to provide the first empirical analysis of the effect that federal pipeline enforcement on pipeline performance. The results of this analysis should provide insight into whether the changes mandated under the Pipeline Safety, Regulatory Certainty, and Job Creation Act are likely to achieve their goal of improving pipeline safety.

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2. Background on the pipeline industry

Many liquid products are most cost-effectively transported via pipelines. However, many of the products transported by pipeline can pose significant threats to human health and the environment if leaked or released from the pipeline. Although pipelines are designed and constructed to maintain structural integrity since the transported materials have intrinsic value (unlike many effluent substances, such as hazardous wastes or by-products), many factors make it difficult to avoid leaks and other releases during a pipeline's lifetime. Natural disasters, such as flooding, earthquakes, and storms, can result in pipeline failures, as can accidental human, machine, and animal intrusions. Additionally, pipelines may develop leaks or ruptures due to corrosion from the materials being transported or material fatigue from fluctuating temperature and pressure conditions.

In the U.S. over 2.5 million miles of pipelines transport natural gas, petroleum products and other hazardous liquids. Overall, pipelines are a relatively safe mode of transportation compared to alternatives such as tankers and rail cars, and the pipeline transmission safety record has improved significantly over time. However, more than 100 significant pipeline releases occur each year, and deaths from pipeline accidents are, unfortunately, not rare occurrences.

Prior to 1968, pipelines were not subject to safety or environmental regulations. In 1968, Congress established the Office of Pipeline Safety (OPS), a division of the Department of Transportation (DOT), to develop and implement safety regulations for natural gas pipelines. Hazardous liquid pipelines were added to OPS's portfolio in 1979, but until 2002 OPS was generally seen as ineffectual, with weak enforcement and ineffective rules (Parker, 2004). In 2002, Congress passed the Pipeline Safety Improvement Act, which increased penalties and enforcement authority, and limited OPS discretion.

OPS sets the federal standards with which all pipeline operators must comply. As is true with many other regulations, states can and do pass supplemental regulations. Additionally, pipelines in "high consequence" areas are subject to a stricter set of controls due to the increased risk for damage to human health or the environment. Both federal and state regulators enforce OPS regulations. In theory, standard inspections are conducted every couple of years on all pipelines and more often on pipelines with higher potential risks. If a pipeline crosses state borders, enforcement generally falls to OPS, while states inspect most intrastate lines. However, not all states have been certified or approved to conduct intrastate inspections; in unapproved states federal regulators conduct all pipeline inspections. Conversely, OPS has authorized some states to act as its agent and inspect the sections of interstate pipelines that run through the state in addition to intrastate pipelines. To complement formal enforcement, regulated pipelines must also self-inspect and report any violations discovered during the course of required inspections.

OPS is a relatively small agency. In 2011 prior to the passage of the Pipeline Safety, Regulatory Certainty, and Job Creation Act, there were under 120 inspectors working for OPS out of five regional offices (Trenton, NJ; Atlanta, GA; Kansas City, MO; Houston, TX; and Denver, CO) (Frosch & Roberts, 2011). An additional 300 state inspectors carry out the majority of pipeline inspections. Standard inspections are designed to ensure that operation and maintenance procedures, abnormal and emergency operating procedures, damage prevention and public education procedures, and pipeline installation, connection, repair, and operations are in compliance with the relevant regulations. Construction inspections include a review of material and component design specifications, welding procedures and welder qualifications, corrosion protection, and installation as well as post-construction testing. Integrity management inspections are designed to determine whether an operator uses all available information about its pipeline system to assess risks and takes appropriate action to mitigate those risks.

OPS can initiate an enforcement case when an inspection identifies a violation of pipeline regulations or in response to an accident. The type of enforcement action taken depends on the significance of the violation. Minor problems occurring for the first time may only receive a warning letter, while more significant violations may require a compliance order that specifies actions the operator must take to come into compliance (e.g., requiring operators to replace pipeline sections or implement corrosion control and remediation strategies) or a civil penalty. Civil penalties are generally reserved for serious violations leading to deaths, injuries, or significant environmental damage. Regulators may impose civil penalties as severe as $100,000 for each day a violation existed, up to a maximum of $1,000,000. Since 2008, OPS has proposed over $21 million in civil penalties (Quarterman, 2011).

There are currently 2705 regulated pipeline operators in the U.S. Of these, 1921 operate less than 10 miles of pipeline, 440 operate between 10 and 100 miles of pipeline, and 344 operate 100 miles or more of pipeline. In 2010, 22 fatalities and 109 injuries were attributed to pipeline incidents. Of course these numbers are quite variable – over the last 20 years, the number of fatalities has ranged from a low of 7 in 2001 to a high of 53 in 1996. Similarly the number of injuries has ranged from a low of 36 in 2006 to a high of 127 in 1996. Of course injuries and deaths are not the only damages that result from poor pipeline performance. In 2010, pipeline incidents resulted in almost $1.4 billion dollars of property damage and almost 175,000 barrels of spilled hazardous liquids. On the enforcement side, in 2010 federal regulators conducted around 600 pipeline inspections, initiated just over 200 enforcement actions and assessed over $4.5 million dollars in penalties. During the same time period state regulators logged almost 38,000 inspection days, discovered almost 14,000 violations, initiated over 4000 enforcement actions, and assessed over $13 million dollars in penalties.

3. Related literature

The objective of this paper is to better understand the role that federal inspections and enforcement actions play in increasing pipeline performance and compliance. To my knowledge, there are no existing papers that explicitly model compliance with pipeline regulations, either theoretically or empirically.[1] However, there is a large literature examining compliance with environmental regulations more broadly, and I use this as a starting point for the analysis.

The traditional economic view of environmental compliance and performance assumes that a regulated entity's decision to comply with environmental regulations is a rational one based on the objective of profit maximization. The basic framework for these models is Becker's (1968) paper on the economics of crime, which was adapted by Russell, Harrington, and Vaughan (1986) to provide a comprehensive application to environmental regulation. While a number of interesting variations on these models have been developed over the past two decades to allow for various complexities such as imperfect information, self-reporting, principal-agent relationships, and dynamic settings, in all of these deterrence-based models compliance and performance are ultimately improved by increasing the expected cost of noncompliance – either by increasing the likelihood that a violator gets caught or by increasing the level of sanctions associated with violations.

[1] There are a number of papers that analyze pipeline incidents from an engineering perspective to better understand the distribution of pipeline failures (see, for example Sosa and Alvarez-Ramirez (2009)). These papers do not examine regulatory structures or policies.